Bibliometric Analysis of Behavioural Finance Using Biblioshiny
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Abstract: Behavioral Finance is based on the belief that markets are inefficient, investors do not make rational decisions always and there are various anomalies and emotional biases that guide the decision-making process of investors. The bibliometric research was conducted to determine the development of research on Behavioral finance during the period 1994 to 2021 using Biblioshiny. To perform the bibliometric performance and science mapping analysis, the publications regarding Behavioral Finance have been collected from Scopus. Of the 2072 documents used in this study, it shows that research with the theme of Behavioral finance has increased every year, though it picked up more significantly since 2011 onwards. Themes related to the Stock market have been found to be closely related to Behavioral finance. There is a good collaboration among countries for research in the field. The author's keywords that have been used recently include 'covid 19', 'google trends', 'financial literacy'. 'Behavioural biases', and 'cognitive biases' are the other two important authors' keywords that have been used frequently in the published documents. Overall, the development of research with the theme of Behavioral finance is growing and research in the field is becoming prominent as the role of psychology is now well established in financial decision-making.

Keywords: Behavioural Finance, Scopus, Bibliometric, Biblioshiny, Science Mapping.

1.Introduction

Traditional or Standard Finance theories such as expected utility theory and efficient market hypothesis are based on the premise that investors are perfectly rational. The forefather of Traditional Finance, Eugene Fama (1970) asserted that markets are completely efficient and it is impossible to beat the market even with insider trading. For a long period of time, these traditional theories predominated in financial and economic theories. Many financial-economic crises such as real estate bubble of 2006 followed by European Sovereign Debt Crisis which began in 2009 raised questions on the validity of traditional finance theories. As a result, new research area in finance emerged which revolutionized the financial theory known as Behavioral Finance. This new theory is based on the belief that markets are inefficient and there are anomalies and emotional bias that guide the decision-making process of investors.

The roots of Behavioral finance date old back, Adam Smith published the Theory of Moral Sentiments and in renowned Wealth of Nations (1776), he emphasized the role of individual psychology in building wealth in the markets. The concept of behavioral finance gained importance from the studies of various researchers. Herbert Simon (1955) wherein, he introduced the concept of 'Models of Bounded Rationality'. Tversky and Kahneman (1974) showed that individuals often make decisions on the basis of heuristics, and are prone to cognitive biases. In 1979, Kahneman and Tversky introduced loss aversion bias, known as Prospect Theory and in 1981, they introduced new concept known as Framing Bias and Advances in Prospect Theory was published by Tversky, A., & Kahneman, D. in 1992. Another, Nobel laureate in the field is Richard Thaler who introduced mental accounting bias in 1985. Similarly, Robert J. Shiller got Nobel laureate in 2013 for his study on Analysis of Asset Prices wherein he challenged efficient market theory. Richard Thaler got Nobel prize in 2017 on his notable work known as Nudge Theory (2008) that defy economic theory. There are many another prominent names that contributed to the development of Behavioral finance. Shiller, 2003 defined behavioural finance in relation to other social sciences, including both psychology and sociology. Pompian (2006) defined the discipline of behavioural finance as the 'application of psychology to finance'. Shefrin and Statman (1985) described Disposition Effect as a tendency of investors to sell "winning" shares or assets and holding on to "losing" stocks or assets. Barberis and Thaler (2003) who stated that the discipline of behavioral finance can be better understood by analyzing models where agents are not completely rational. In general, Behavioral Finance defends that 'irrational expectations or non-standard preferences affect asset prices' (Campbell, 2000, p. 1551). Ofek, Richardson, & Whitelaw, 2004 mentioned that 'investors' psychological motivations' cause difference between assets real value and its prices.

Behavioral Finance is a growing discipline and to understand its evolution, the research issues in the past and current state of Behavioral finance theory, a bibliometric analysis has been conducted in the current study. Data for the purpose has been collected from Scopus. We found other bibliometric analyses of Behavioral Finance, such as Fonseca, de Melo, de Melo, & Willer, 2017; Fonseca, de Melo, & de Melo, 2019; Paule-Vianez, Jessica, Raul Gomez Martinez, and Camilo Prado-Román,2020. The current bibliometric analysis is different because of time period (1998 - 2021) and its methodology. This article is structured in five sections, the first section being the introduction. The next section discusses the methodology for bibliometric analysis and the methods used. The third section discusses the analysis of results. The last section highlights the conclusions of the research.

2.Method

In this work, a bibliometric analysis on behavioural finance has been done in this publication is based on science mapping approaches (Börner et al; 2003) Various tools such as average citation per year, most relevant sources, top authors production, authors impact by H index, tree map, trend topics and other visualization techniques such as Three fields Plot, Conceptual Structure, Thematic Map etc. has been used. Biblioshiny has been used which is web-based graphical interface and powered by Bibliometrix (Aria; Cuccurullo, 2017). Bibliometrix was programmed in the R language and it has interconnection with other R packages. Different mapping techniques has been used (Boyack et al., 2005; Taqi, M. et al., 2021) using Biblioshiny. The tool incorporates analytics tools and graphs for three-level metrics (source, author and document) and also three structures of knowledge (conceptual, intellectual and social). Analysis is done to determine the most cited

publications. Co-word analysis is also performed using the simple centres algorithm techniques (Callon et al. 1983). Two specialized tools which are a) strategic diagram and, b) thematic network has been used to visualize the research themes on the basis of centrality (Relevance Degree) and density rank (Development Degree) values (Callon, Courtial, and Laville 1991).

Data To perform the bibliometric performance and science mapping analysis, the publications regarding Behavioral Finance have been collected from Scopus using the following Advanced query: TITLE-ABS-KEY ('Behavioral Finance' or 'Behavioural Finance'). In this way, this query was limited to Articles, Proceedings, Books, conference proceeding and Reviews in English, and retrieved a total of 2072 publications for the year from 1994 to 2021. Furthermore, the citation of these publications was recorded on 11 Ooctober,2021. This research also has limitations because of its qualitative nature and choice of methodology and researcher's preferences. Nevertheless, this research provides an opportunity to explore how behavioural finance is related to other research themes and it will promote further research on the theme.

3. Findings and Discussions

Source

The Table 1 showing a collection of documents used in research with the theme of 'Behavioural

Finance/ Behavioral Finance'. The number of documents used is 2072 which are divided into 5 types of documents, including journal articles (1625 documents), book chapters (118 documents), conference proceedings (189 documents), book reviews (90 documents) and books (50 document).

Table 1: Document Types

Document	No Of Documents
Journal Articles	1625
Book Chapters	118
Conference Proceedings	189
Book Reviews	90
Book	50
Total	2072

YEAR WISE ANALYSIS The data collected from Scopus shows research from 1994 and peak of research was seen from 2011 onwards. In 2010, there was 79 publications and then in 2011, it increased to 115(approx. 46% increase). Since then, research has been above 100 except 2013 in which exactly 100 documents in the research theme were recorded. During 2020 and 2021, no of documents were 246 and 197 respectively (above 200). Out of documents, one journal article has been accepted to be published in 2022 which was excluded while doing year wise analysis. During 1994-2000, there was 12 documents, during 2001-2006, there was 123 documents and from 2007 onwards, research picked up. If we take period from 2007-2010, 262 research documents was found

almost double of what was from 2001-2006. From 2011-2016 and 2017-2021, there was 741 and 933 documents respectively (See Figure 1)

Figure 1
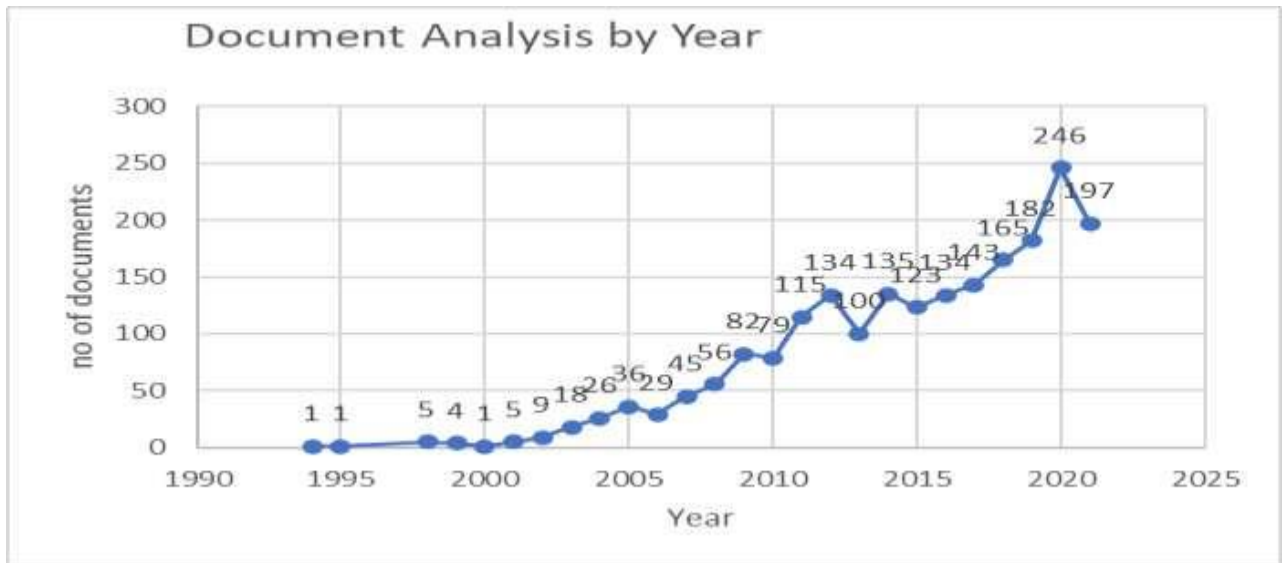
SUBJECT WISE ANALYSIS The main subjects have been in the field of Economics, econometrics, finance (approx. 41%) followed by Business, Management and Accounting to the extent of 23.5%. The other subject areas have been computer science (6.5%), social sciences (6%), psychology (5.1%), mathematics (4.5%) and decision making (4.5%). (See Figure 2).

Figure 2: Subject Wise Analysis
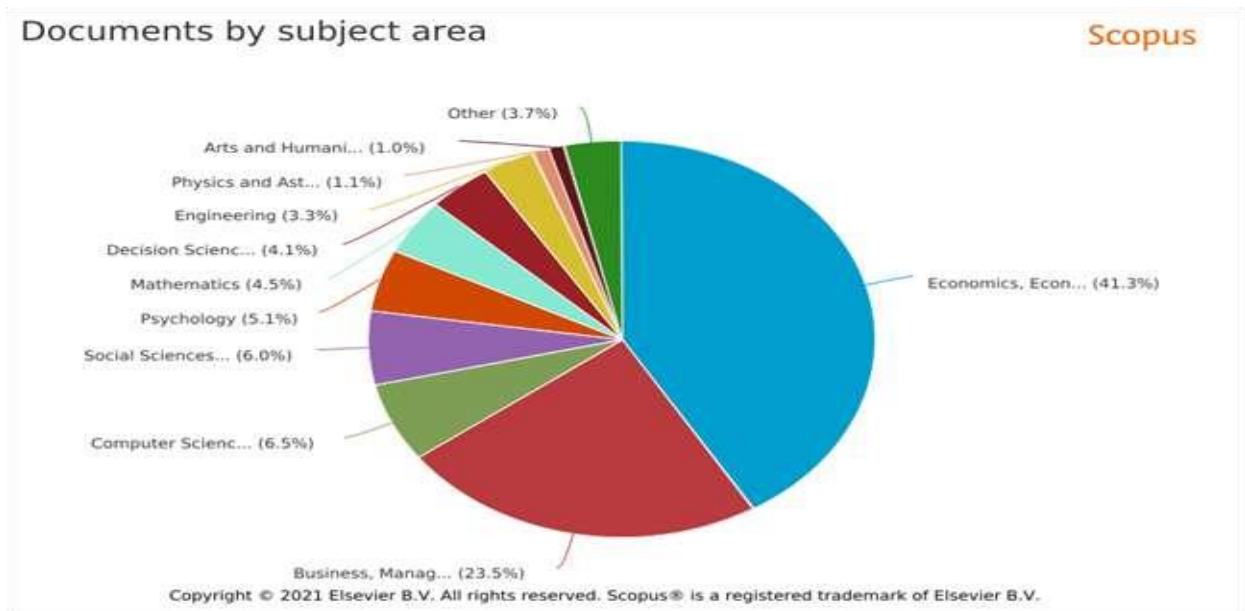
AVERAGE CITATIONS PER YEAR The research was also carried out based on the average citations/citations in the paper related to the theme of Behavioral Finance' or 'Behavioural Finance', both in average per year and per article. The time span of research carried out under this theme was published from 1994 to 2021. From the Table 2, it is known that the most published papers related to the behavioural finance were published in 2020 with a total of 246 documents.

Then, based on the average total citation for each article, the highest occurred in 1998 with an average of 296 citations and for the average annual citation, the research with the highest citation occurred in 1998 at 19.72. This shows that papers published in 1998 are cited more than publications of any other year.

Table 2: Average Citations Per Year

Year	N	MeanTCperArt	MeanTCperYear	CitableYears
2022	1	0	0	-1
2021	197	0.54822335		0
2020	246	1.943089431	1.943089431	1
2019	182	3.956043956	1.978021978	2
2018	165	4.993939394	1.664646465	3
2017	143	6.972027972	1.743006993	4
2016	134	7.880597015	1.576119403	5
2015	123	10	1.666666667	6
2014	135	14.05185185	2.007407407	7
2013	100	14.97	1.87125	8
2012	134	14.35074627	1.594527363	9
2011	115	16.48695652	1.648695652	10
2010	79	19.41772152	1.765247411	11
2009	82	21.69512195	1.807926829	12
2008	56	22.80357143	1.754120879	13
2007	45	30.04444444	2.146031746	14
2006	29	36.37931034	2.425287356	15
2005	36	38.94444444	2.434027778	16
2004	26	41.42307692	2.436651584	17
2003	18	154.4444444	8.580246914	18
2002	9	72.55555556	3.81871345	19
2001	5	36	1.8	20
2000	1	269	12.80952381	21
1999	4	107.5	4.886363636	22
1998	5	453.6	19.72173913	23
1997	0	0	0	0
1996	0	0	0	0
1995	1	296	11.38461538	26
1994	1	0	0	27

THREE FIELDS PLOT

The Three Fields Plot in Figure 3 is a picture consisting of 3 elements in it, namely, journals list, authors' names and the themes/titles used. The three elements are connected by a gray plot which is related to one another. Starting from Journal name, then each journal shows the author who often contributes to its publication, then each writer shows the themes/titles they often use for research conducted with the theme of behavioural finance. The size of the rectangle shows the quantity of publications associated with each of these elements.

FIGURE 3: THREE FILEDS PLOT
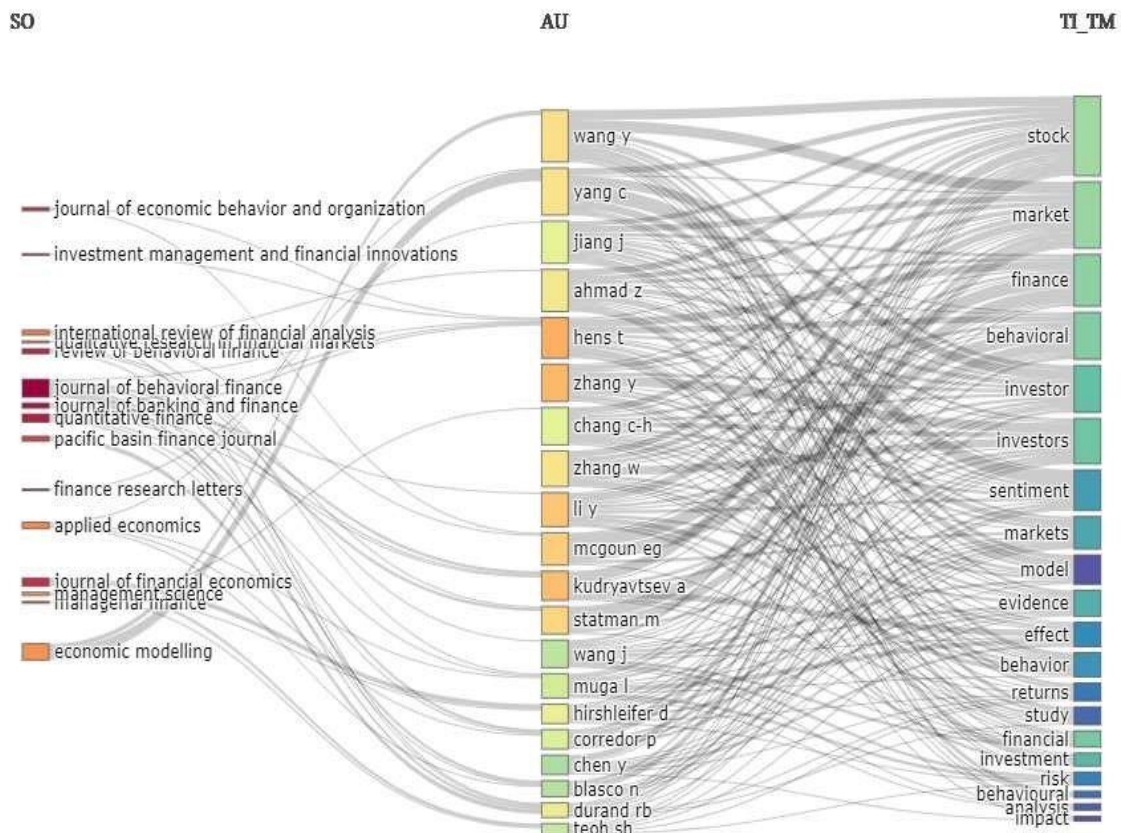
From the picture above, it is known that in the first element, there are 15 journals indexed in the Three Fields Plot which publish the paper on the theme of behavioural finance/Behavioral finance. The top journals that publish the greatest number of papers with the theme are Journal of Behavioural Finance, Economic Modelling, Quantitative Finance and Journal of Financial Economics, Applied Economics and Journal of Banking and Finance depicted with rectangle connected to several authors. The second element in the middle of the image, which shows the author's name. Where there are several authors who are linked to the journal. In addition, the author is associated with themes on the right side of the image. In this study, there were 20 top researchers enrolled in this plot. The size of the rectangle indicates the respective quantity of research publications from each author. The most prominent authors according to the three fields

plot are Wang Y. and Yang C. Finally, the third element that describes the research titles/themes which is on the right side of the picture. Each topic is connected with writers who write a lot on related titles. From the results of the image, there are 20 titles/themes listed. Of all the titles/themes that appear, the word stock is the most frequent word marked with a green rectangle. The word market in the second position which is often used by almost all authors is marked with a rectangle in green colour. This shows that behavioural/Behavioral finance research is closely related to stock market. Then, the Figure 4 shows the number of research documents published by each journal related to the behavioural finance. The data shows a list of the names of the top journals published and the interval for the number of documents published with a blue bar chart at the bottom. The darker the blue colour, the more is the quantity, consistency in terms of time and relevance to the research theme.

Figure 4: Most Relevant Sources
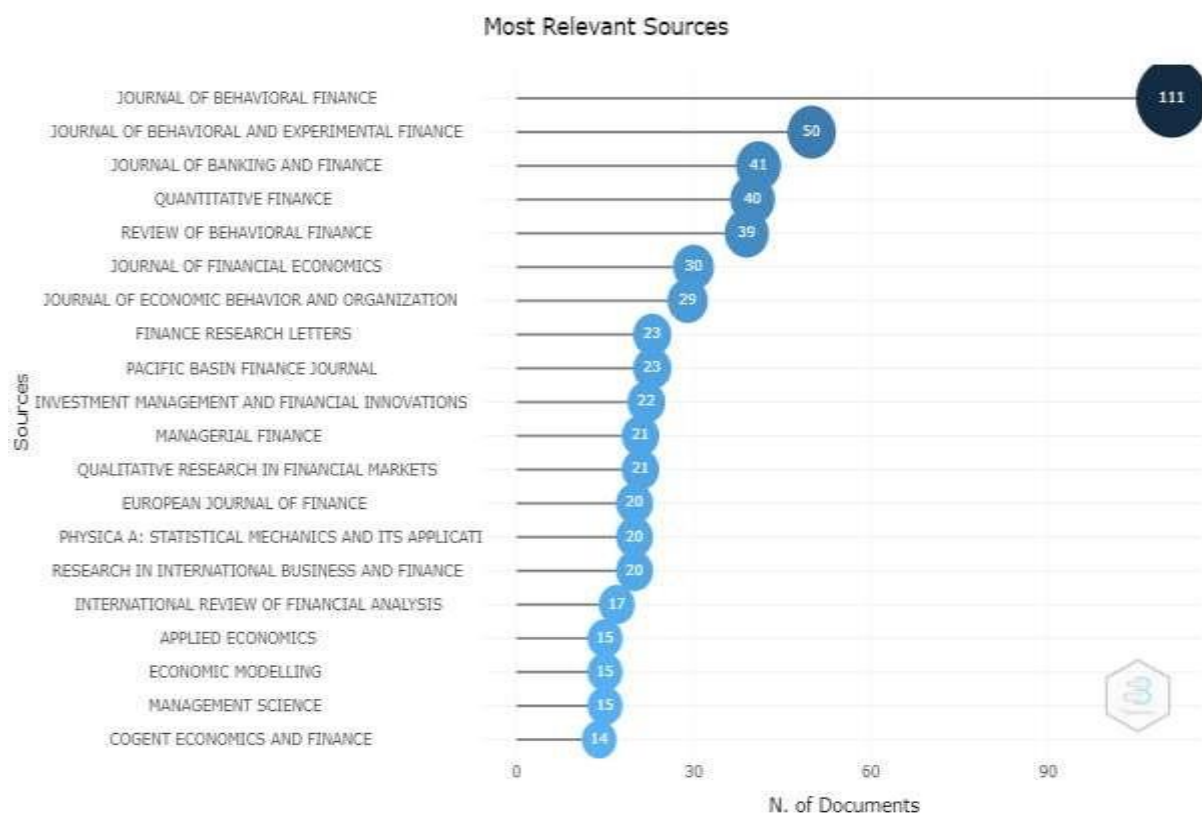
Journal of Behavioral Finance is a journal that is in the top position with the number of published documents of 111 documents shown in a dark blue bar chart followed by Journal of Behavioral and Experimental Finance with 50 documents compared to the bars of other journals. This is because the journal is relevant to the Behavioural finance theme. This study also discusses the journals local impact by H Index that become sources in research on behavioural finance themes. The Figure 5 shows the Journal of Banking and Finance and Journal of Financial Economics had the highest local impact by H index followed by Journal of Behavioral Finance

Where in the Figure 6 shows the productivity of some of the top authors during the study period, namely from 1999 to 2021. This productivity is shown by a red line from the time the author published his research until the last year the author published his research. In addition, the circle in red line shows the quantity of papers issued in the concerned year. The picture above presents an

overview of authors who have written research related to Behavioural finance for a long time or have recently written. The author who has long published research is Hens T., who has done research consistently from 2004 to 2020 and research increased every year. In addition to that, the author ZHANG Y has a long track record from 2003 to 2021
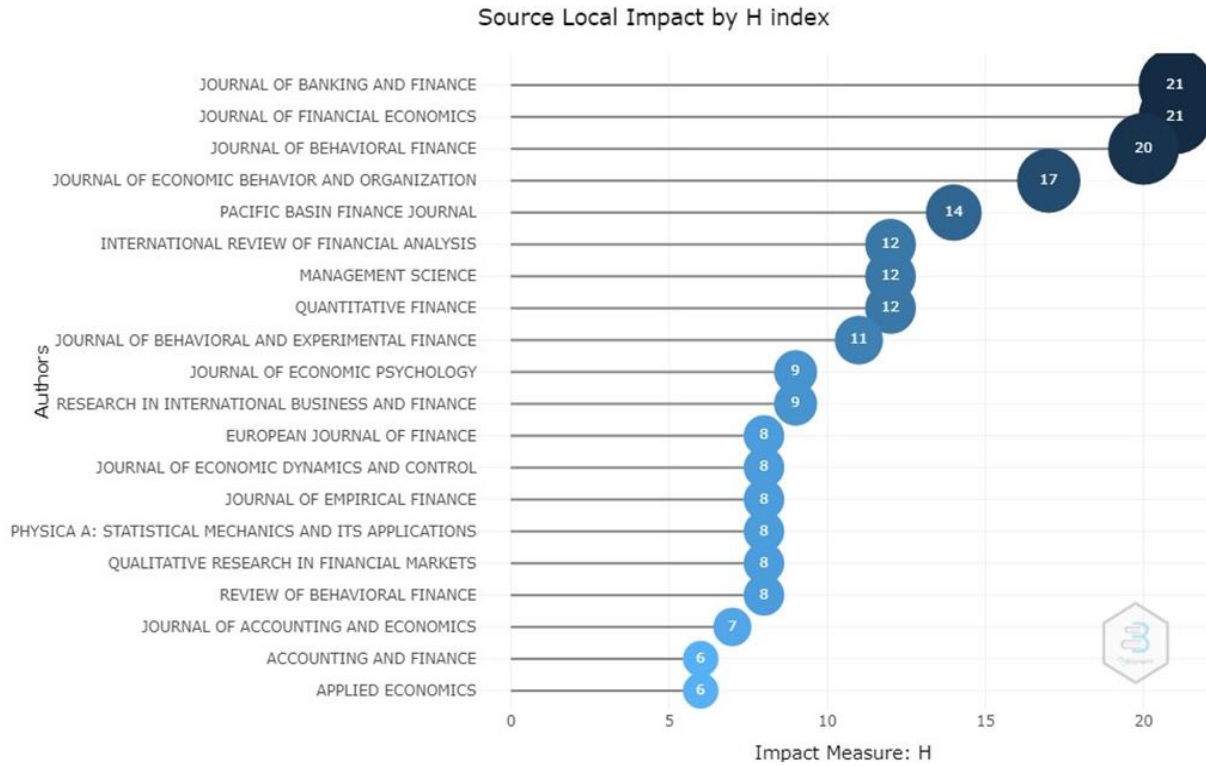
Figure 5: Source Local Impact by H Index

FIGURE 6: Top Authors Production Over the Time
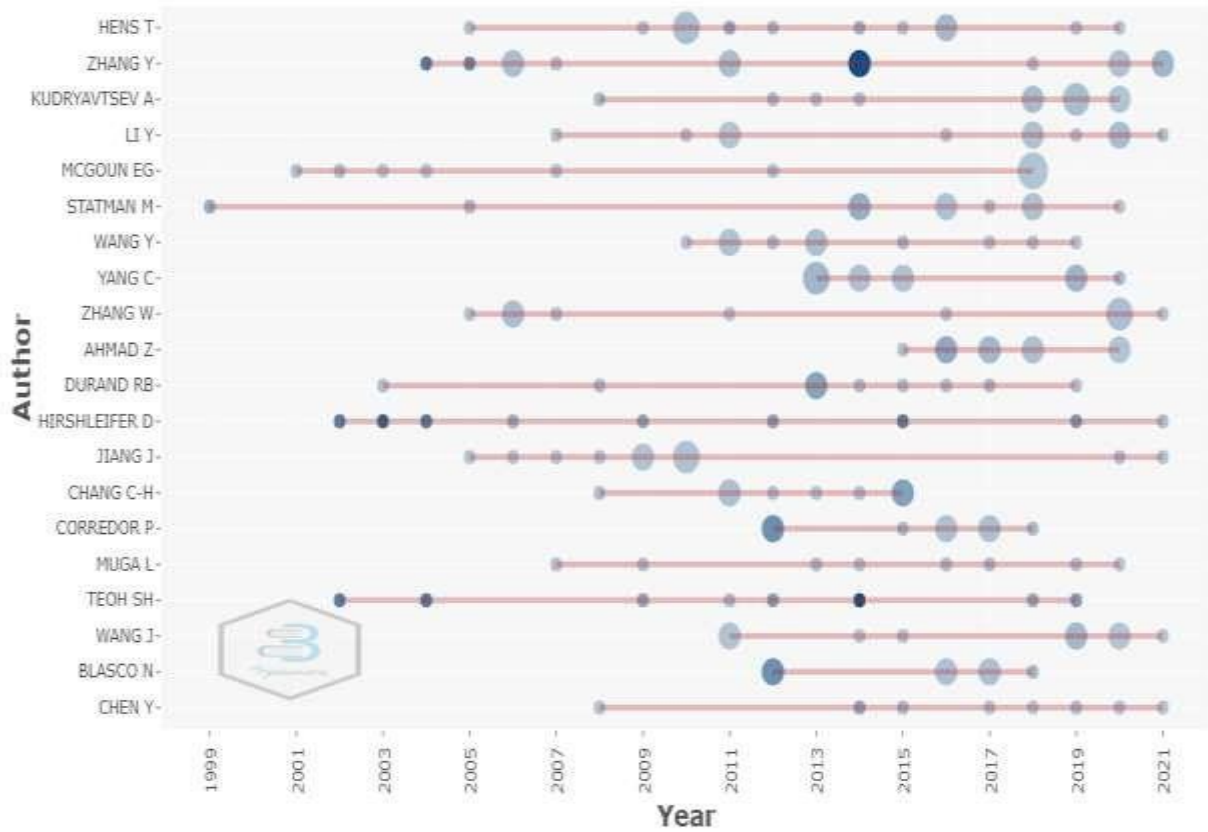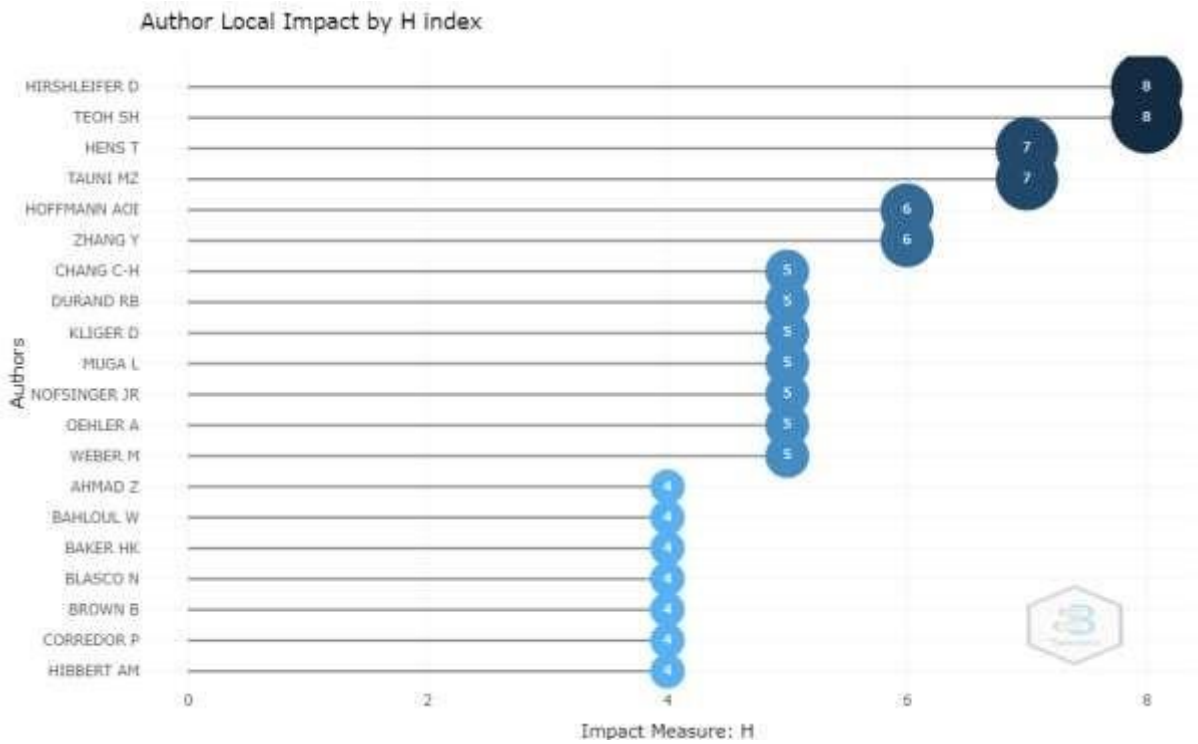
Top-Authors' Production over the Time

Figure 7: Author's Impact by H Index

Author Local Impact by H index

Authors who have published their papers can also be sorted based on the resulting impact based on the h-Index. The authors' h-Index values range from 0 to 15. The magnitude of h impact is marked in dark blue in the bar chart above. Where from the Figure 7 shows that the authors with the highest h-Index obtained HIRSHLEIFER D and TEOH SH with an achievement of number 8 marked with a dark blue bar chart colour that describes the maximum impact. Then followed by two other authors with a value of h-Index 7 with good impact, namely HENS T, TAUNI MZ. The other two authors with a value of h-index 6 having reasonably good impact include HOFFMANN AOI and ZHANG Y.

The Figure 8 shows the authors' correspondence countries contained in each article with the total form of collaboration between SCP (single country collaboration) that is one country collaboration, and MCP (multiple country collaboration) or collaboration between various countries. There are 20 top countries included in this data. The results obtained are that USA is in the first rank as a country with the highest quantity of author correspondence with more than 300 published papers. Furthermore, the second rank is China with more than 200 published papers and United Kingdom with more than 100 published papers. Germany, India and Australia have good collaboration networks with the number of published papers approximately close to 100. These data indicate there are good collaborations among countries on the theme of behavioural finance.

Figure 8: Author's Correspondence Country
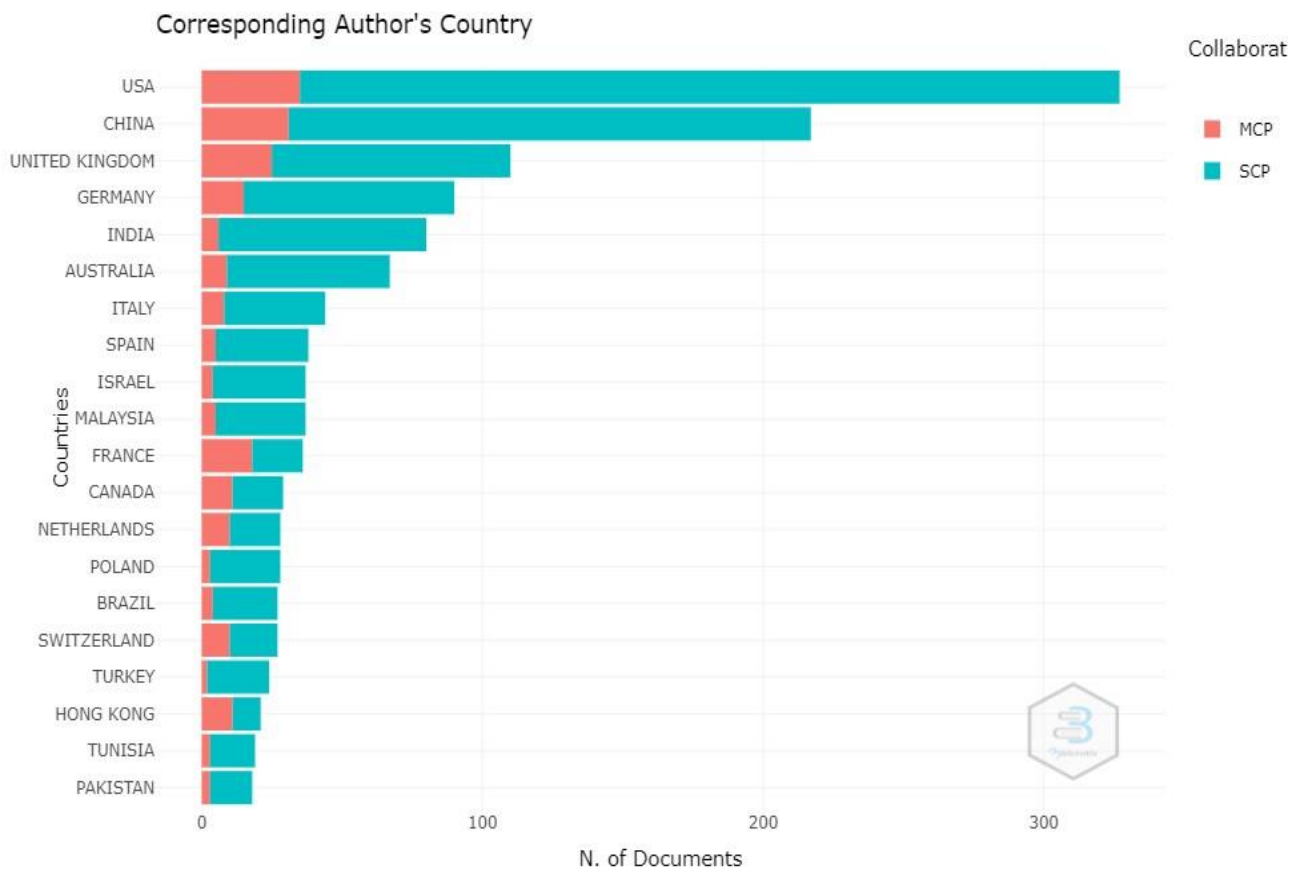
This study also counts the words that are relevant in the collection of documents in the study. In the present study, there are several words used in the titles of the documents with a number of occurrences between 42 and 426 times. The top 50 listed words marked with the diagram in blue show the comparison of the number of occurrences of usage of each word and their relevance to the

behavioural finance theme. The top word with the highest number of occurrences in title of the documents and the most relevant to the research theme is the word 'stock' with a total usage of 426 times indicated in blue followed by 'market' with a total usage of 388

(Marked in orange) and followed by 'finance' (green) with an appearance of 321 times. This illustrates that the behavioural finance research documents have used most of the titles as stock, market and finance. Furthermore,

other important words include behavioural (314 times), followed by financial (284) and investor with an appearance quantity of 228 times. The Word Tree Map in Figure 9 displays words that often appear in boxes as regions on the map, the larger the square area, the higher the appearance of the words.

Topic trends are also part of this research, where the Figure 10 shows an overview of the development of the topic from time to time with the division per year on the basis of authors keywords. It shows authors keywords that have been used for a long time and authors keywords which have been used recently. The appearance of the authors keywords is also adjusted to the frequency of the quantity of the word in the research on Behavioural finance. Based on the description of the data above, the authors keywords that has been used since 2003 is 'limits to arbitrage' till 2021, Then in 2008 the word 'biases' began to appear and has been used till 2020. The topics that are widely used since 2018 include 'covid 19', 'google trends', 'financial literacy' with varying magnitude.

Figure 9: Tree Map on The Basis of Titles of the Documents
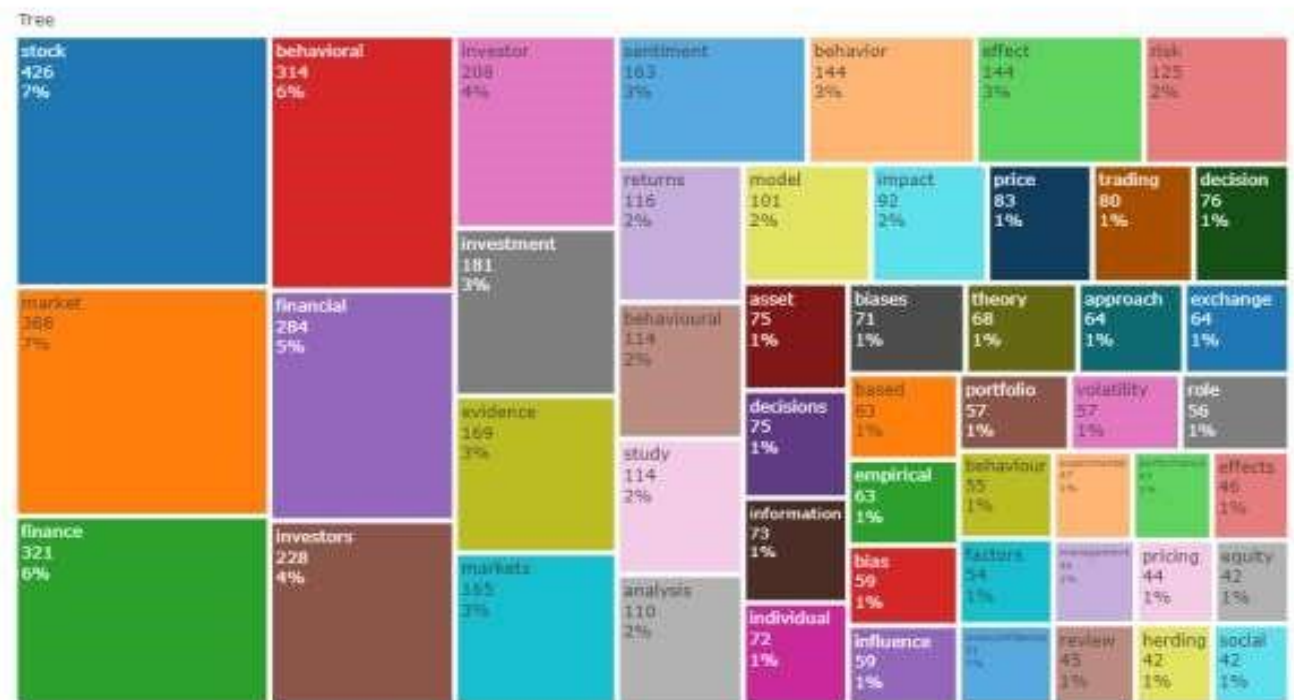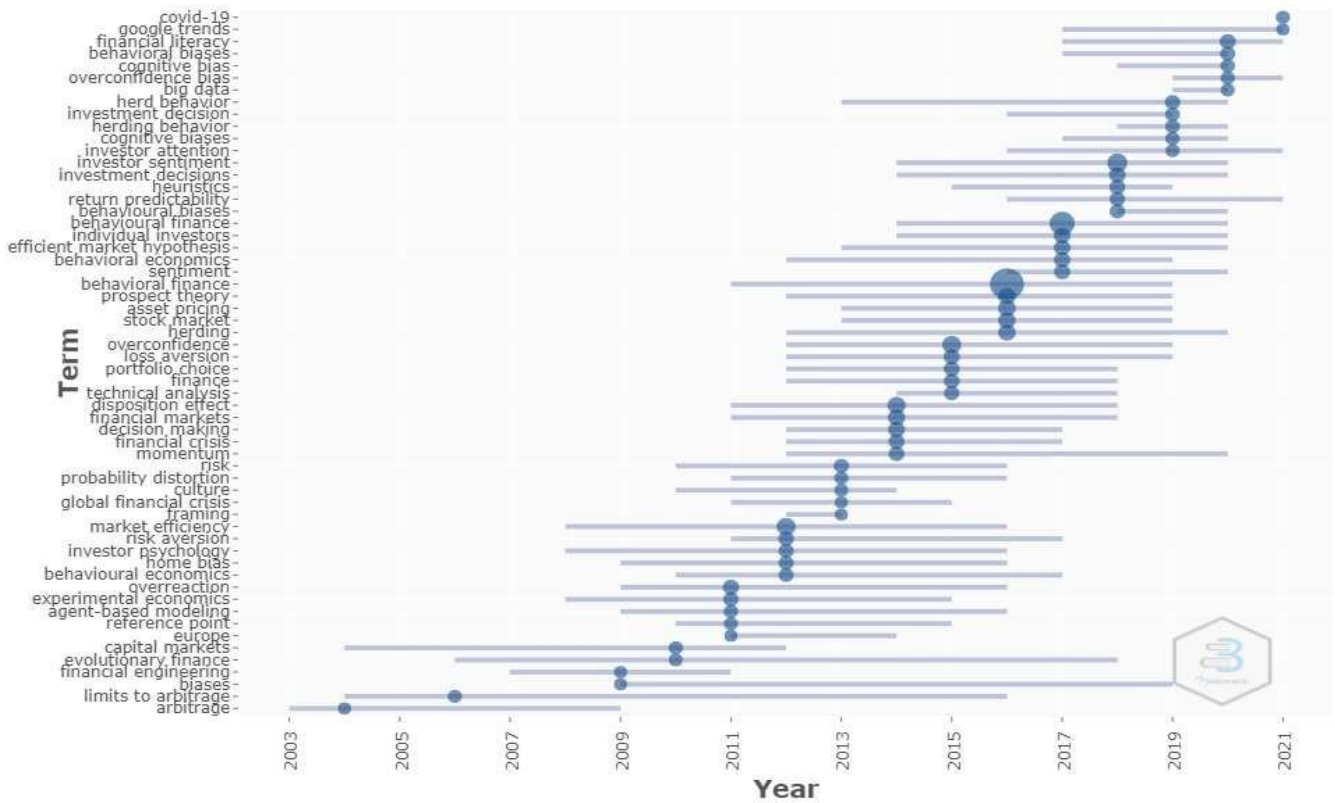

Figure 10: Trend Topics on The Basis of Authors Keywords

Trend Topics

In this study, an analysis of thematic maps was also carried out based on density and centrality which were divided into 4 theme quadrants as in the Figure 11. This result is obtained from a semi-automatic algorithm by reviewing the titles of all references to the behavioural finance with the addition of relevant keywords other than the author's keywords, so as to get meaningful insights. The upper right quadrant is a driving theme(motor) characterized by high density and centrality, so it still needs to be promoted and is relevant from the perspective of future research. On the border, there are themes of financial data processing, electronic trading and behavioural finances that shows they are motor as well as niche themes. Furthermore, the upper left quadrant shows a specific and unique theme (niche) but has a high development possibility and it is indicated by high density but low centrality. The themes in this quadrant include decision making, economics and human. Furthermore, in the lower left quadrant are themes that have been used for a long time but have experienced a downward trend in the recent studies with low centrality, but in this quadrant no such themes are there. On the border of upper and lower left quadrant, there are three themes as investment, stock market and financial market. In the lower right quadrant, we have base themes such as finance, risk assessment, decision theory, behavioural finance, investments, commerce.

The evolution of the theme is shown in the Figure 12. Although the theme of this study is behavioural finance these data indicate several sub-themes that are widely used. The left side shows some of the titles that are widely used till 2000, there are 3 titles as 'Asset', 'Funds' and 'Behavioral' and have been used at different levels. The second or middle part shows some of the themes that are widely used from 2001 to 2011. Some of the themes that have emerged during this period are an evolution of the previously used themes such as 'finance', 'asset', 'model', 'risk', 'market', 'exchange' and 'investors. The third or right section shows the most recently used themes in the period between 2012 and 2022. There are 4 listed titles such as 'stock', 'investors', 'financial' and 'analysis'.

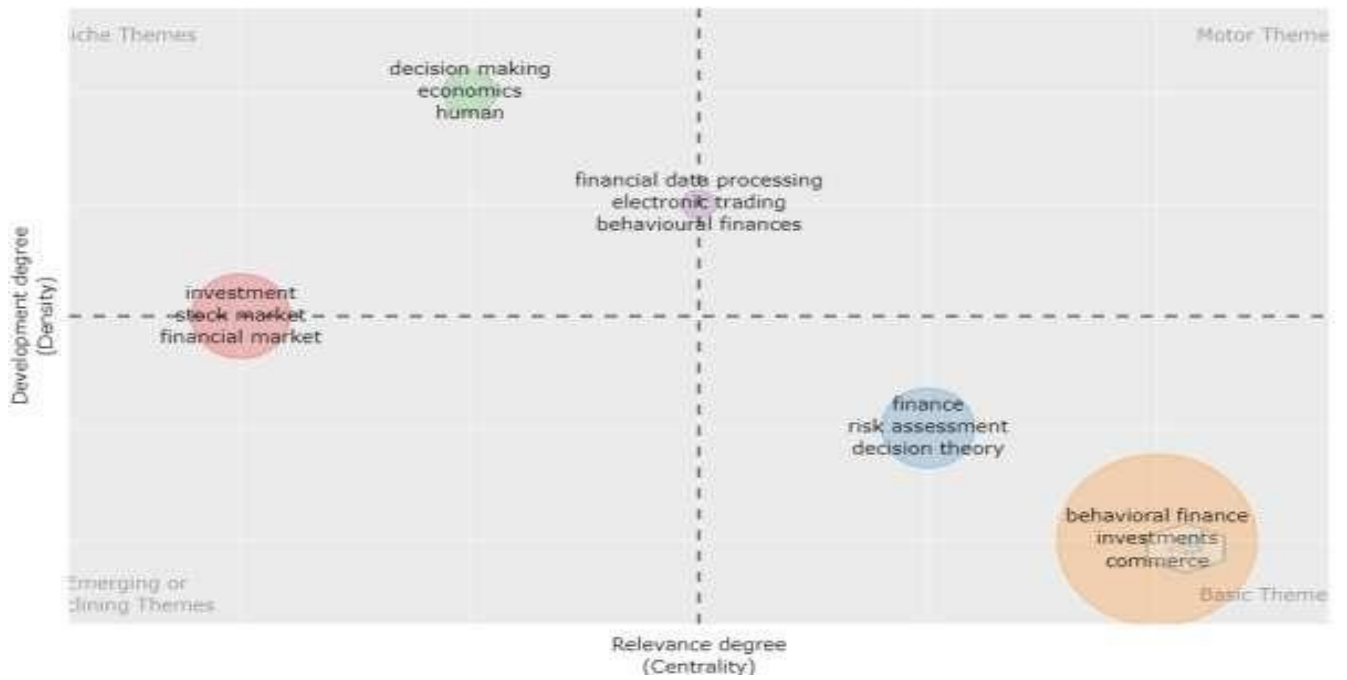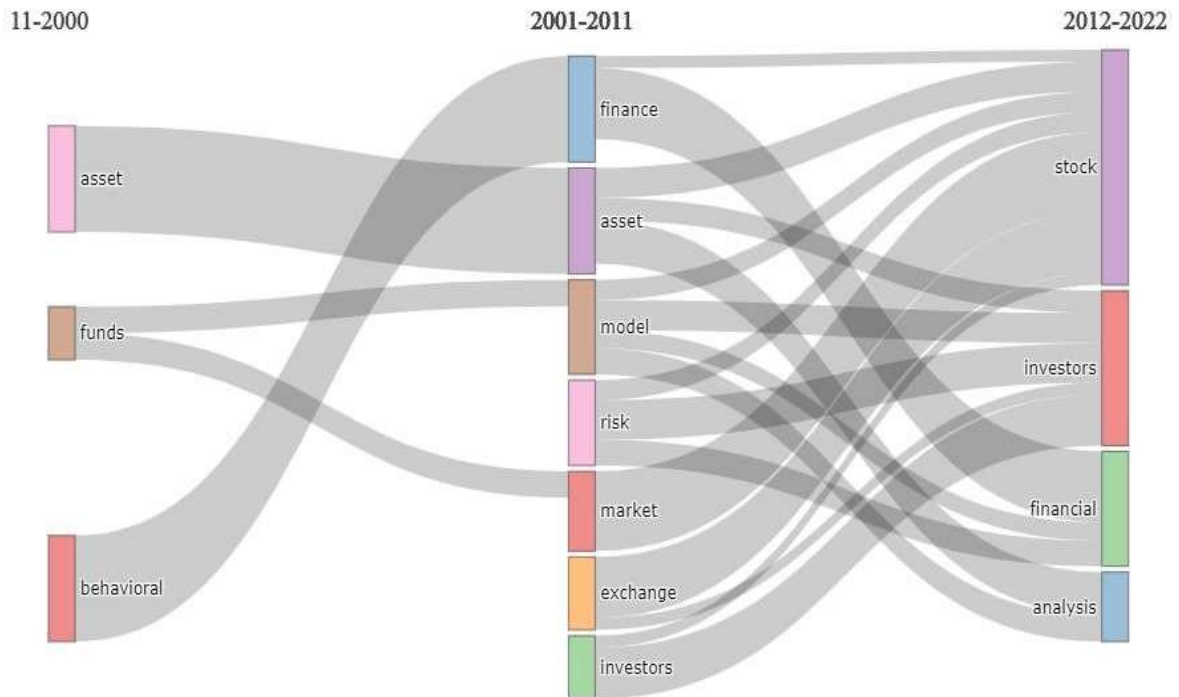**Figure 11: Thematic Map on The Basis of Keywords (Plus)**

Figure 12: Thematic Evolution on the Basis of Titles

This study also describes a conceptual structure map or map of the contextual structure of each word that often appears in research papers on the theme of behavioural finance by dividing it based on mapping the relationship between one word and another word through area mapping. In this data, there are 2 parts of the area according to the values of Dim 1 and Dim 2 which are divided, namely the red area and the blue area, each area contains words that are related to each other. Based on the Figure 13, the red area/blue area shows more and more various words included in it, this shows that there are many research papers that shows the link between the words listed in this area.

Figure 13: Conceptual Structure Map
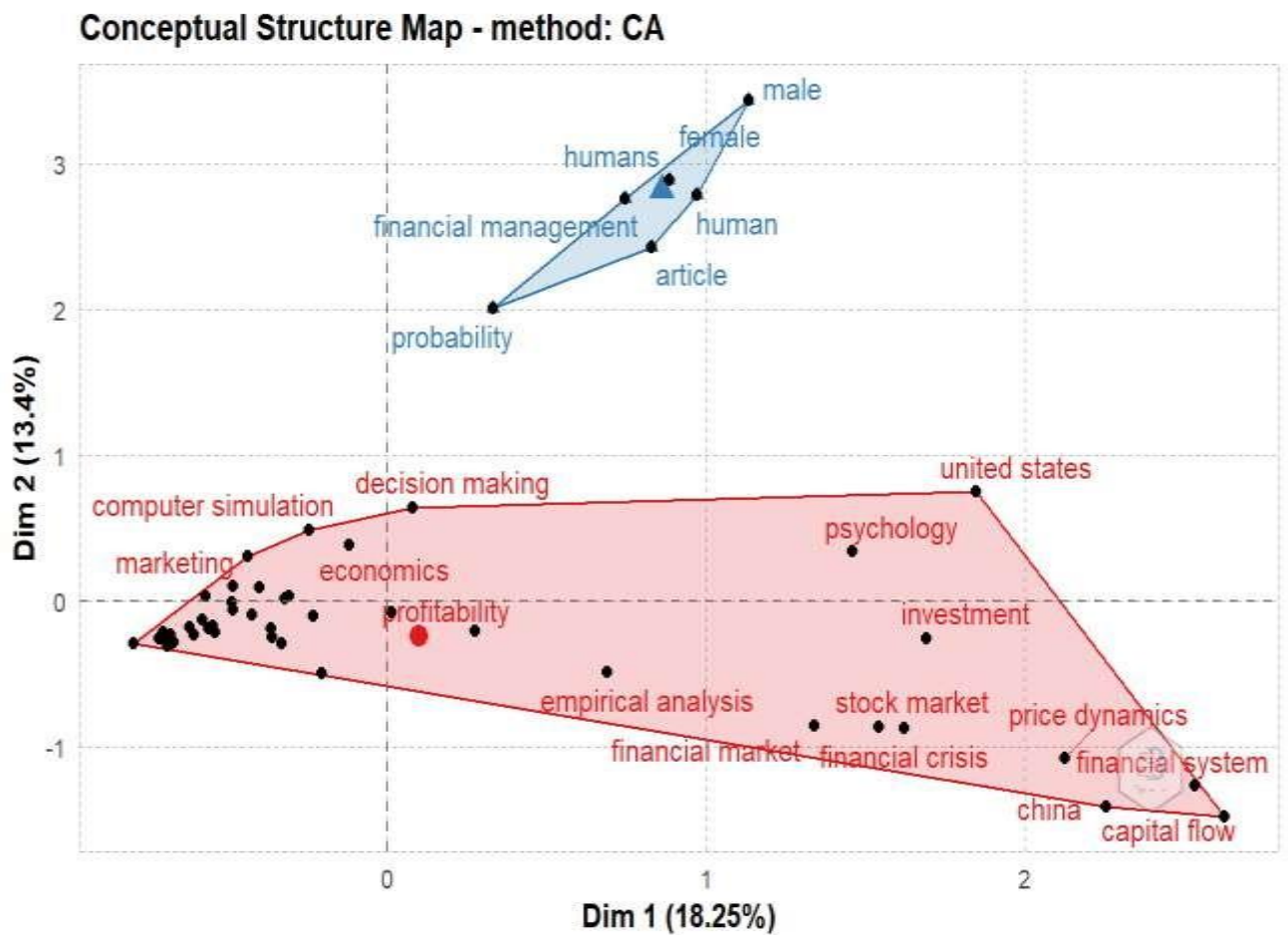
4. Conclusions

The research was conducted to determine the development of research on Behavioral finance during the period 1994 to 2021. Of the 2072 documents used in this study, it shows that research with the theme of Behavioral finance has increased every year. Research in the field picked up significantly from 2011 onwards. Papers published in 1998 have been cited more than publications of any other year on the basis of average citations per year. The top journals that have published the greatest number of papers with the theme are Journal of Behavioural Finance, Economic Modelling, Quantitative Finance and Journal of Financial Economics, Applied Economics and Journal of Banking and Finance. The most prominent authors according to the three fields plot are Wang Y. and Yang C.

Themes related to Stock market have been found to be closely related with the Behavioral finance. Journal of Behavioral Finance is in top position with the highest numbers of documents whereas Journal of Banking and Finance and Journal of Financial Economics have the highest local impact by H index followed by Journal of Behavioral Finance. The authors who have long published research are Hens T and ZHANG Y. Data also indicate that there have been good collaborations among countries on the theme of behavioural finance. And the top most countries are United States, China and United Kingdom that are doing collaborative research. On the basis of Tree Map, the top most words used in title of the documents are stock, market and finance. Furthermore, other important words that have been used in the title include behavioural, financial and investor. On the basis of author's keywords, 'limits to arbitrage' has been consistently used from 2003 till 2021, Then in 2008 the word 'biases' began to appear and has been used till 2020. The keywords which have been used recently include 'covid 19',

'Google trends', 'financial literacy'. 'Behavioural biases', and 'cognitive biases' are the other two important authors keyword that have been used frequently in the published documents.

An analysis of thematic maps on the basis of keywords also revealed that the themes of financial data processing, electronic trading and behavioural finances are motor as well as niche themes. Whereas, themes such as decision making, economics and human are niche themes for research in the behavioural finance. Then there are several sub-themes which have been widely used include 'Asset', 'Funds' and 'Behavioral' (more prominently till 2000). Themes used from 2001 to 2011 have been an evolution of the previously used themes such as 'finance', 'asset', 'model', 'risk', 'market', 'exchange' and 'investors. The themes used most recently in the period from 2012 till 2022 are 'stock', 'investors', 'financial' and 'Analysis'. On the basis of conceptual structure map, the words frequently used together are humans, male, female, financial management, probability indicated by blue area. And the other words which have been used more frequently have been psychology, decision making, computer simulation, market, united states, profitability, economics, investment, etc. Overall, the development of research with the theme of behavioural finance is growing and research in the field is becoming prominent as the role of psychology is now well established in financial decision-making and there is lot of potential for future research in the behavioural finance.

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