An overview of behavioral finance research in China and abroad — Bibliometric analysis based on Gephi and Cite Space

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Abstract: *The purpose of this study is to use Gephi and Cite Space visualization software to conduct bibliometric analysis on the scientific field of behavioral finance at home and abroad, and to explore the research situation, research hotspots and gaps of behavioral finance in China and abroad. The literature comes from CSSCI journals included in CNKI and Sci journals included in Web of Science from 2001 to October 31,2022, including 493 CSSCI and 475 Sci. The analysis includes keyword co-occurrence, authors, institutions, burst words and time lines. The study found that: (1) the study of behavioral finance, domestic from the beginning of the rise gradually began to study widely but from 2009 gradually no longer popular, while the number of foreign research is still on the rise; (2) foreign research authors and institutions usually form a wide range of cooperation, while the domestic authors and institutions are relatively independent; (3) The theoretical basis of domestic and foreign research is prospect theory, but abroad has generally entered the stage of theoretical application. In addition, the contribution of this paper is to analyze the development of research topics covered by behavioral finance, and provide reference suggestions for the development of behavioral finance.*

Keywords: behavioral finance; Gephi; Cite Space; bibliometric method; prospect theory.

1. Introduction

Behavioral economics is the discipline that relates human behavior to demand, consumption, investment, management decisions and the role played by heuristics and cognitive biases in the decision making process. With the development of behavioral economics, the academic community has also started new branches of research, among which it is possible to find behavioral finance (Tomer, 2007). Tversky and Kahneman (1974) introduced the concept of behavioral finance, arguing that individuals usually make decisions through simplified decision-making processes and are vulnerable to cognitive biases. Behavioral finance is a new approach to the study of financial markets that reflects the difficulties encountered with traditional theories, as some financial phenomena can be better understood by using models of imperfect rationality, and the growth of research trends in behavioral finance is due to the inability of traditional models to explain many empirical trends in fundamental topics such as financial behavior, money management, corporate investment, and stock market bubbles (Ritter, 2003).

Behavioral finance is one of the byproducts of behavioral economics and is a concretization of behavioral economics and therefore a more specific area of study than behavioral economics (Costa et al., 2019). According to the foundations of behavioral economics, behavioral finance aims to incorporate psychological factors into the decision-making process, although focusing on financial decisions and financial markets (Shefrin, 2009), and is more concerned with the study of judgment errors and decision characteristics in financial investments, focusing on people's emotions, cognition, decision-making behavior, and needs in the financial field, among others.

Most previous studies have analyzed the development of this research area of behavioral economics in China, but for this interdisciplinary discipline that combines psychology and economics, it is necessary to explore its specific research directions in depth. Moreover, a search on the Internet reveals that the research on behavioral finance in China is scattered, while there is a special journal of behavioral finance in foreign countries - Journal of Behavioral Finance, which indicates that the attention to behavioral finance in China still needs to be strengthened.

Therefore, in order to understand the current development overview and research hotspots of behavioral finance, the study conducts a bibliometric analysis of relevant domestic and foreign literature through Gephi and Cite Space. Specifically, the purpose of this study is to analyze the number of literature, authors, institutions, keywords, timelines, and other characteristics in order to analyze the research overview and hotspots in this field, identify the research gaps at home and abroad, and make relevant suggestions for the development of behavioral finance.

2. Data sources and research methods

2.1 Data Sources

In order to conduct a comparative analysis of international and domestic research in the field of behavioral finance and to understand the differences between domestic and international research, this paper selected literature data in the field of behavioral finance from Sci and CSSCI source journals, which were published from January 1, 2001 to October 31, 2022, and finally analyzed 493 articles from CSSCI after screening the literature and reports that did not fit the topic. SCI 475 articles.

2.2 Research methods

The study mainly used Gephi, Cite Space bibliometric analysis software mapping and statistical information with the help of Excel tools to draw international and domestic behavioral finance research mapping and statistical charts through author distribution, institutional distribution, and keyword co-occurrence and clustering, timeline, and emergent word analysis in order to analyze the current status, hot spots, and development similarities and differences of international and domestic behavioral economics research. After using Cite Space analysis, we found that there are many nodes and the cooperation between domestic authors and institutions is fragmented, and most of them are independent research, so we use Gephi to visualize this analysis to make the results more intuitive, and Gephi can analyze the degree of connection between the literature more clearly.

3. Research overview

3.1 Volume of publications

In terms of time, the bar chart in Figure 1 shows the number of publications in Sci and CSSCI in each year from 2001 to 2022. The number of publications in CSSCI reached the highest point in 2005, indicating that behavioral finance has become a hot spot for research in China in recent years, with a slight decrease in attention after 2017; the number of publications in Sci is generally on an increasing trend The number of Sci literature is generally increasing, and will remain a hot topic until 2021. In contrast, it seems that in 2001, China quickly seized the research hotspot to explore behavioral finance, with the highest number of 56 articles published in a year, but after that, the attention of foreign countries to behavioral finance

gradually increased, and continued to study new areas of behavioral finance, while the domestic research in the field of behavioral finance still needs to be explored in depth.

Figure 1: Temporal distribution of behavioral finance research literature in China and abroad

3.2 Distribution of authors in the literature

The CSSCI literature was visually analyzed by Gephi, and the layout of the Fruchterman Reingold algorithm was used. After modularizing the authors, the Modularity value was 0.986, and the authors were color-coded according to "degree", i.e., the frequency of collaboration was used as the color classification criterion. The degree of cooperation of each author can be analyzed from the figure, as shown in Figure 2. For example, Ding Zhiguo's node is the largest, which means that he has published the most articles, followed by Larsheng Li, Wei Zhang, and George Su, etc., and a number of scholars are connected with him to form a small range of author cooperation, such as Zhang Wei, Xiong Xiong, Xueying Wang, and Gen Li, and most of the scholars are in the form of two-two cooperation (purple) or three-person cooperation (blue). It can be seen that the larger the node the more authors it collaborates with relatively.
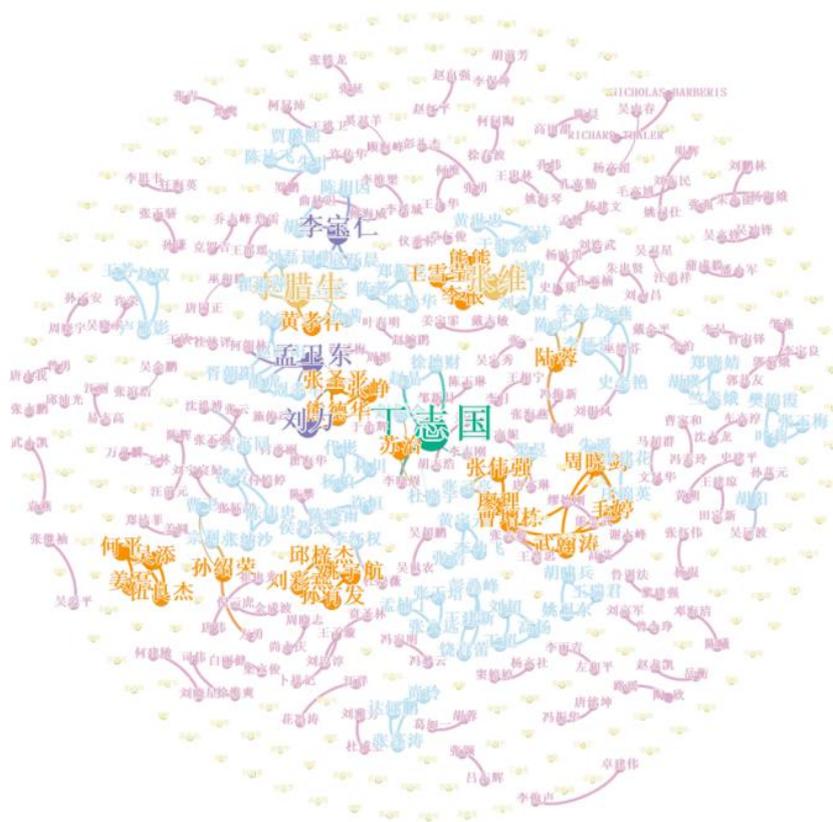

Figure 2: Author distribution of domestic behavioral finance research

Sci literature was visualized and analyzed by Cite Space, Node Types was set to Author, threshold was set to filter the author nodes with small frequency, and Cite Space software was run to obtain the author cooperation network map. The size of the node represents the frequency of the author, i.e., the number of articles published; the thicker the line between the nodes, the closer the cooperation between the authors; the more lines around the node, the greater the centrality of the author, indicating that the author plays a "mediating role" in the research of behavioral economics. From Figure 3, N=966, E=995, which means that there are 966 nodes with 996 links, and each node is more closely connected, and the nodes of

DAVID HIRSHLEIFER, ALOK KUMAR, ANN MARIE HIBBERT, WOLFGANG BREUER and other authors are larger, which means they have more publications. Meanwhile, it can be seen from the figure that most of the authors have collaborative relationships, and the nodes of several scholars such as DAVID HIRSHLEIFER, ALOK KUMAR, and DANLING JIANG link many scholars together to form a certain range of author collaborations. In comparison, foreign scholars of behavioral finance focus more on collaborative authorship, while domestic scholars of behavioral finance tend to be solo authors or collaborators of two or three individuals.

Figure 3: Distribution of authors of foreign behavioral finance studies

3.3 Distribution of literature institutions

CSSCI issuing institutions are analyzed by Gephi, and after filtering the institutions with low frequency, the degree (i.e. degree of cooperation) is used as the color classification basis, and the larger the node indicates the closer connection with other institutions, such as Antai College of Economics and Management of Shanghai Jiao Tong University, Shanghai Normal University School of Business, and Shanghai University of Finance and Economics School of Public Economics and Management are in the same category (institutions with smaller issuing volume are not shown).

Business School of Nanjing University, School of Economics and Management of Tsinghua University, and Tianjin University of Finance and Economics are in the same category, but the centrality of domestic institutions are all smaller, indicating that there are fewer connections and cooperation among domestic institutions in behavioral finance research. The graph in the institutions shows that those who issue more articles are mostly colleges related to behavioral finance, such as the School of Economics and Management, the Center for Economic Research, the School of Business, and the School of Finance, which have played a leading role in the development of behavioral finance.

Figure 4: Institutional distribution of behavioral finance research in China

In terms of Sci, where "N=570, E=578" indicates that the cooperation among institutions is very close, and the thicker the connecting line indicates the higher the frequency of cooperation among institutions, the highest frequency and centrality of universities such as Hong Kong Polytechnic University, University of Zurich, Erasmus University

Rotterdam and Florida State University. This indicates that they play a leading role in the field of behavioral finance. It is also clear from the figure that compared to the mostly fragmented state of CSSCI, the overall state of Sci's publishing institutions is connected, indicating closer cooperation among schools.
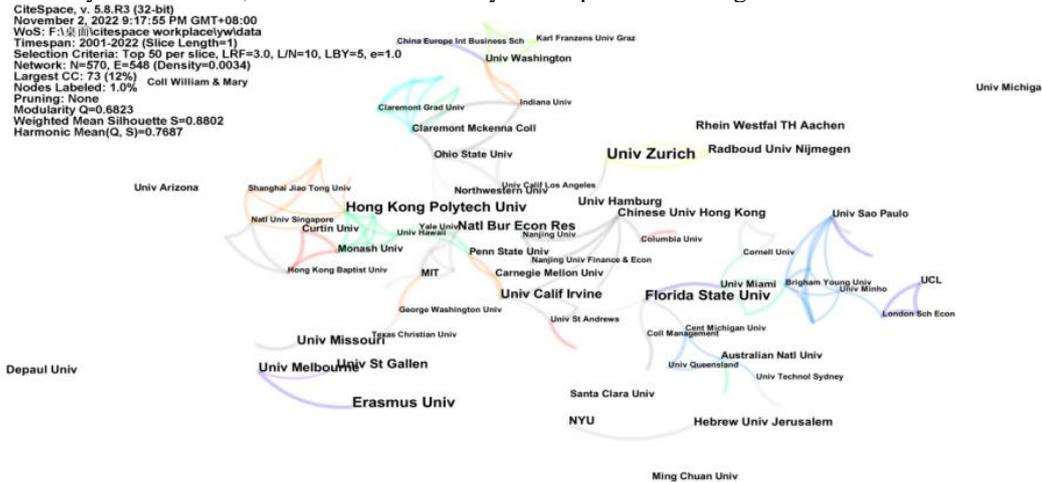
Figure 5: Institutional distribution of foreign behavioral finance research

4. Research Overview and Hotspots

After describing the publication information of behavioral finance in terms of volume, authors, and institutions, we would like to analyze the keywords, emergent words, and timeline to study the research hotspots and trends at home and abroad.

4.1 Keyword co-occurrence

In order to get a clearer network feature, we use Gephi to analyze keywords, set the layout of Fruchterman Reingold algorithm, and analyze the data modularly, set the node size as 15-45, the larger the node means the more frequent the keyword, and the thickness of the connection line indicates

the closeness of the relationship. From Figure 6, we can get that there are 440 nodes and 691 connecting lines in the co-occurrence graph of behavioral finance research keywords in CSSCI literature, with graph density of 0.007 and modularity of 0.835. From the graph, we can get that the frequency of keywords such as behavioral finance, finance, investor, limited rationality, and herd effect is higher. The herd effect is the most common behavioral bias in the financial market, and the continuous maturation of the stock market operation mechanism leads to the herd effect becoming more and more obvious: the irrational behavior of investors is reflected in the true herd effect; the non-fully rational behavior caused by limited information and external payment is the pseudo herd effect (Jin & Xiao, 2022).
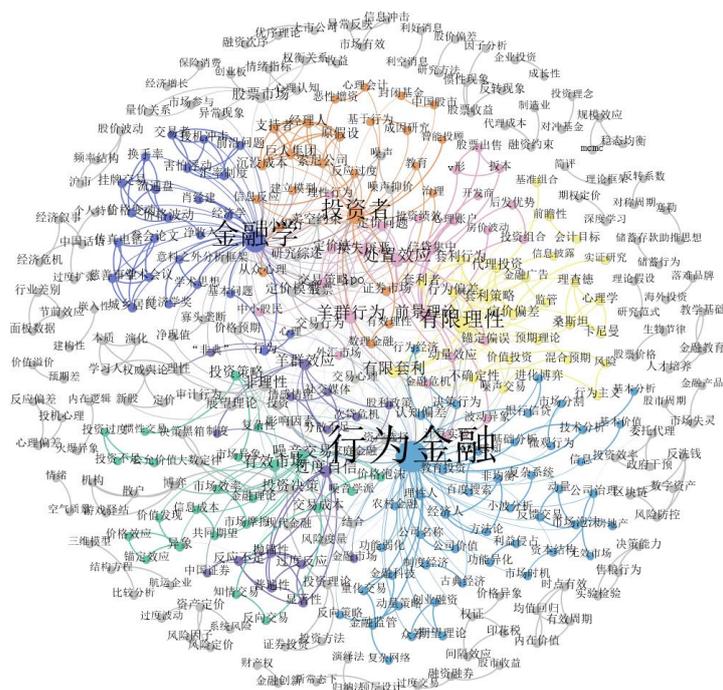

Figure 6: Domestic keyword co-occurrence graph for behavioral finance

In SCI literature, there are 476 nodes and 2558 lines in the keyword graph of behavioral finance research, with a graph density of 0.023 and a modularity of 0.589. Due to the large number of foreign keyword characters, the keyword co-occurrence graph is shown in Figure 7 after filtering the nodes with frequency less than 5 in order to make the features obvious. behavioral finance, market, risk, prospect theory, etc. are the keywords with large frequency. The keywords with higher frequencies are behavioral finance, market, risk, and prospect theory, etc.

Figure 7: International behavioral finance keyword co-occurrence map

4.2 Timeline analysis

To further grasp the hotspot distribution and trend evolution of behavioral finance, we need to further study the keywords of a large amount of literature. Timeline graph analysis can explore the concentration point of different topics and facilitate the macroscopic grasp of the evolution of behavioral finance research.

Figure 8: Domestic behavioral finance timeline graph

In this paper, the keywords of foreign and domestic literature in the field of behavioral finance are clustered and analyzed by log-likelihood rate algorithm (LLR), and the time range is selected from 2001 to 2022, and presented in the form of a timeline on this basis, so as to analyze the emergence time and current research hotspots of the research content in this field. The timeline view of domestic behavioral finance is shown in Figure 8, with the maximum clustering set to 10, and the line representing two keywords appearing in the same article at the same time, with the keyword clustering shown on the right side of the figure. The keyword "behavioral finance" appeared for the first time in 2001 in the analyzed data, and has received wide attention since then. The initial focus was on financial aspects such as stocks, gaming, and investment, and psychology also began to enter the field of finance in this period; around 2004, the issue of rationality and irrationality

began to be explored, and scholars found that the mere idea that "people are not completely rational" did not stand up to challenge traditional economics, because traditional economics Although people are not completely rational, they are rational most of the time and irrationality is only accidental and can be eliminated through economic mechanisms (Hu et al., 2022); from 2010 to 2022, mathematical methods and computational experiments were used to explore the field of behavioral finance, which is still in the process of adjustment and change, and the focus on various emotional indicators has increased.

The international behavioral finance research timeline diagram is shown in Figure 9, set to show a maximum of 8 clusters, and the right side of the diagram shows keyword clusters, from the keywords of each era can be seen in the continued international attention to behavioral finance. Prospect theory was first mentioned in 2004 and continued to be applied to the later research of behavioral finance, and psychological knowledge such as overconfidence, loss aversion, and emotion was introduced to gradually improve behavioral finance, mainly studying the anomalies of market

movements, decision biases of traders, and perverse actions of company managers. Compared with the domestic research on behavioral finance, the international research direction is more specific and in-depth. In terms of theory application, some domestic behavioral finance scholars have introduced relevant foreign theories into the country to solve problems in related fields, including public finance, health care (Wei et al., 2019).

4.3 Analysis of emergent words

Burstness analysis can grasp the trend and frontier of future behavioral finance research to a certain extent, and provide theoretical reference for the next behavioral finance research. Based on the keyword analysis, click Burstness and then click View to get the keyword emergence map of behavioral finance research at home and abroad. This paper detects the bursting words by Cite Space and screens out the 20 bursting keywords with the highest frequency between 2001 and 2022 to explore the research hotspots of behavioral economics at different stages and grasp the trends and frontiers of future development, as shown in Figure 10.
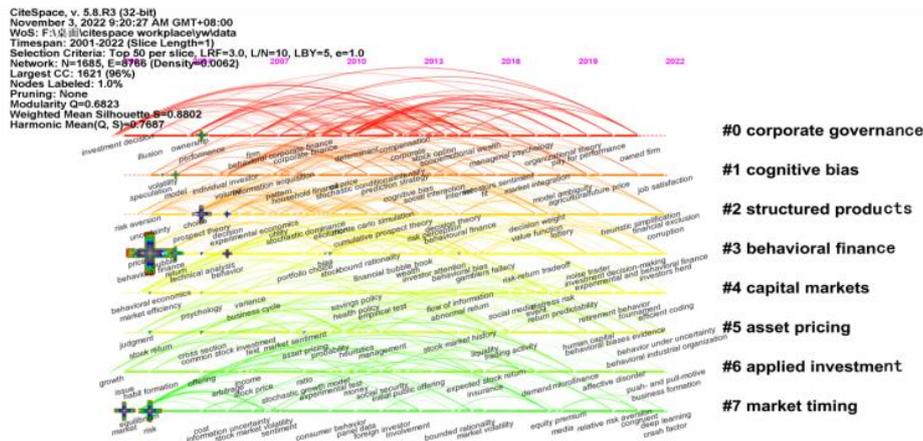

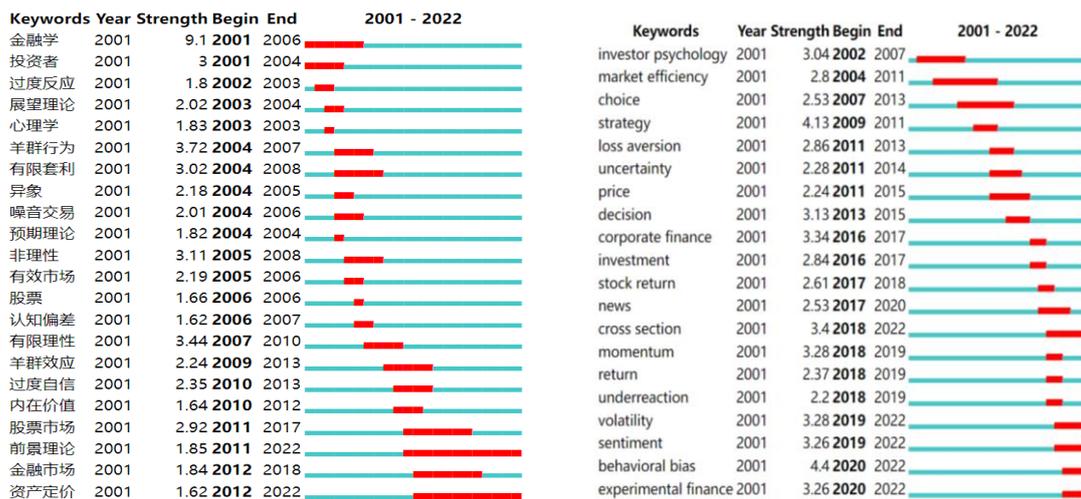**Figure 9:** Timeline diagram of international behavioral finance

Figure 10: Details of the emergent words at home and abroad

For the development of domestic behavioral finance, the emergence intensity of herd behavior, limited rationality, and stock market is high, 3.72, 3.44, and 2.92 respectively. domestic scholars began to focus on investors and their investment behavior when finance emerged in 2001, and combined psychology into the study of finance for the first

time in 2003; the key words of prospect theory and asset pricing have continued to emerge in recent years. The keywords of prospect theory and asset pricing have continued to emerge in recent years, and may still be the hotspots of domestic behavioral finance research in the coming period. For the Sci literature, most of the keywords such as investor

psychology, sentiment and strategy are above 3.0. In the last three years, the focus on sentiment, behavioral bias, and experimental finance has been increasing. In general, the intensity of the emergent keywords in foreign research is generally greater than that in China, and the hotspots of research in recent years are also more concentrated; for such emergent words as investment, psychology and behavioral bias are reflected both at home and abroad, but slightly later than abroad.

4.4 Comparison of Research Hotspots at Home and Abroad

In summary, the hotspots of international and domestic behavioral economics research are both interrelated and different from each other. In order to better grasp the respective characteristics of international and domestic behavioral finance research, this paper provides a comparative analysis of international and domestic research hotspots in terms of similarities and differences.

First, the theoretical basis of both is prospect theory, and the "prospect theory" proposed by Kahneman and Tversky is also the "metatheory" of behavioral economics. It describes how individuals choose among alternatives involving risk, where the probability of the outcome is uncertain and heuristics and biases are considered (Valcanover et al., 2020), while "uncertainty" is also a sub-component of prospect theory, which is the counterpart of the term "risk". Secondly, the common keywords include "investment", "decision", and "psychology", indicating that the analysis of human psychology to influence individual decision-making behavior is the main topic of discussion at home and abroad. Psychological research has identified various biases that may affect financial decisions, and psychological biases are a unique factor in the behavioral finance paradigm. Indeed, the investigation of imperfect rationality and its effects, such as noise trading or emotions, is nothing more than an examination of human psychology, which reveals a meaningful contribution of psychology to finance (Kuma et al., 2022).

First, in terms of research hotspots, after the concept of "behavioral finance" emerged in 1974, both domestic and foreign researchers seized the hotspots in time, but the focus of domestic research was slightly later than foreign; second, in terms of theoretical applications, international research expanded from the initial focus on finance to health policy, insurance and other fields, and conducted a variety of experimental methods in behavioral finance, and most studies use the theoretical foundations of behavioral theory and prospect theory. Methodologically, most studies are empirical, based mainly on quantitative research designs, archival data, and regression analysis. The domestic ones are still at the stage of theoretical exploration, and the application direction is basically in the financial field. Third, in terms of focus, domestic focus on individual investor behavior or public opinion and social views can influence institutional investors, such as herding behavior, while foreign will be more specific about investor sentiment, as well as will implement more research to determine the relationship between explaining investor sentiment and trading.

5. Conclusion

In this study, a comparative scientometric visualization analysis of the literature on behavioral finance research from 2001-2022 in Sci source journals of Web of Science and CSSCI source journals of China Knowledge Network was done at different levels through Cite Space and Gephi software, and the study concluded the following:

(1) The analysis of the volume of publications shows that the current international research attention on behavioral finance is much higher than that of domestic, and most of them are published by universities.

(2) The distribution of authors and institutions in the literature shows that: compared with international, the connection between domestic authors and institutions is weak, and no effective communication channel has been formed, which is not conducive to the collision of theoretical ideas in behavioral economics.

(3) The co-occurrence of keywords indicates that the hotspots of behavioral economics research at home and abroad are both similar and heterogeneous. The similarity lies in the fact that most of the domestic and foreign research is based on prospect theory and focuses on human psychology to influence individual decision-making behavior; the difference lies in the sensitivity of research hotspots, the maturity of theory application and the focus of attention.

(4) Timeline diagram and emergent word analysis show that the frontiers of behavioral finance research are asset pricing, emotions, behavioral biases and various experimental methods, and prospect theory is still the basis of research in this field.

With regard to the above findings, this paper would like to make the following suggestions: firstly, domestic needs to further strengthen the attention to behavioral finance-related research and increase the importance of it, and establish relevant policies to attract foreign outstanding behavioral finance scholars; secondly, play the leading role of economic-related professional institutions, such as the Quantitative Economics Research Center of Jilin University; finally, do a good job in localizing behavioral finance research, and vigorously Finally, we should promote the cooperation between domestic scholars and institutions to improve the academic influence of China in the field of behavioral finance through the above measures.

References

[1] Tomer, J. F.. (2007). What is behavioral economics?. The Journal of Socio-Economics, 36(3), 463-479.

[2] Tversky, A., & Kahneman, D.. (1978). Judgment under uncertainty: heuristics and biases. Ence, 185(4157), 17-34.

[3] Ritter, J. R.. (2003). Behavioral finance. Pac.-Basin Finance, 11 (4), 429-437.

[4] Costa, D. F., Carvalho, F., & Moreira, B.. (2019). Behavioral economics and behavioral finance: a bibliometric analysis of the scientific fields. Journal of Economic Surveys, 33.

[5] Shefrin, & Hersh. (2009). Behavioralizing finance. Social Science Electronic Publishing, 4(1-2), 1-184.

[6] Jin, C.J., Xiao, M.. (2022). The Herding Effect of Block Trading on the Stock Price Volatility. The Theory and Practice of Finance and Economics,43(05):49-55.

[7] Hu, J., Yu, J., Zhao, G., & Zhang, H.. (2022). Survey, Hotspot and Trend of Behavioral Economics Research-Based on International and Domestic Comparative Studies. Modernization of Management, 42(05): 141-151.

[8] Wei, L. F., Teng, B.J.,&Jiao, B. L..(2019).Chinese Health Economics .Review and Prospect of the Application of Behavioral Economics in Health Field. Chinese Health Economics, 38(11): 8-14.

[9] Shefrin, Hersh. (2009). Behavioralizing Finance. Social Science Electronic Publishing, 4(1-2): 1-184.

[10] Valcanover, V. M., Sonza, I. B., & Silva, W.. (2020). Behavioral finance experiments: a recent systematic literature review. SAGE Open, 10.

[11] Kuma, S., Rao, S., MGoyal, K, Goyal, N.. (2022). Journal of Behavioral and Experimental Finance: A bibliometric overview. Journal of Behavioral and Experimental Finance, 34.