Bibliometrics and Visual Analysis of the Event Study in Business Finance

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Abstract. Since the early 1980s, Event Study has been widely used in Business Finance. To explore the research overview and hot spots of Event Study in this field, 3524 articles related to Event Study of Business Finance in the Web of Science Core Collection database are taken as the research object, and the bibliometric analysis was carried out by using Web of Science analysis tool, the analysis of subject bases was carried out by using Histcite, and the knowledge map such as keyword clustering and timeline was drawn by using CiteSpace for visual analysis. The results show that the number of papers published generally indicates an increasing trend; compared with the United States, Britain, and other countries, China still has a certain gap in the application and exploration of Event Study. The classical literature is a bridge in the history of the development of the discipline, which has made a great contribution to the research progress of the discipline. The application of Event Study to measure stock market returns and evaluate the economic effects of corporate investment activities is a research hotspot in this field, and the analysis of the impact of policies and economic news is a more cutting-edge direction.

Keywords: Event Study, CiteSpace, bibliometrics, visual analysis.

1 INTRODUCTION

Event Study is a statistical analysis method used to research the impact of specific events before and after. Event Study was originally used primarily in the financial field, and its earliest proposer Dolley (1933)[1] used this method to study the price effect of stock segmentation. Subsequently, Ball & Brown (1968)[2] studied the informativeness of earnings. Fama et al. (1969)[3] studied the effect of stock dividends and refined the Event Study by embodying the method as a study of the change in the price of a sample stock before and after an event, which in turn explains the effect of a particular event on the change in the price of a sample stock relative to its yield. The method has attracted the attention of more and more researchers and gradually spread to other fields, and is now widely used in economics[4-6], management[7-9], and other related disciplines. The application of Event Study to Business Finance was first seen in 1983, Halpern P[10] applied Event Study to analyze the stock market data in corporate acquisitions to reflect the performance of participants during the acquisi-

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tion. In China, the Event Study was first applied to Business Finance in 2000, and the volatility spillover effect of the stock market was investigated[11].

The turbulence in the global capital markets has intensified due to the increasingly challenging global political and economic situation and the diversification of the economic environment. The research in Business Finance is gradually showing more complex and interdisciplinary characteristics. To enhance the comprehensiveness of the research in this field, the research should fully consider the time dimension and establish long-term and dynamic research. Event Study processes time series data by selecting the event period[12, 13], which can deal well with the heterogeneous processing effect on the time dimension[14], and conducts short-term and long-term effects on specific events[15, 16]. The effect of the event is tested from the perspective of the integrity of the event[17], the economic effect is quantified[18, 19], and valuable information about the impact of the event is provided[20, 21]. Due to the advantages of clear logic and clear analysis process, Event Study has received more and more attention and has been widely concerned and applied by many researchers[22-24]. However, there is no article on the bibliometric and visualization analysis of the application of Event Study in the field of Business Finance. Based on this, this paper conducts the bibliometric and visualization analysis of the relevant literature on the application of Event Study in Business Finance to comprehensively present its research overview and hotspots, to provide a more in-depth perspective for understanding and predicting market behavior. Meanwhile, it also provides useful reference and inspiration for future scientific research.

2 DATA SOURCES AND RESEARCH METHODS

2.1 Data Sources

The data in this paper are from the Web of Science Core Collection database (WoSCCd). The WoS is currently the world's largest citation database platform. The articles included in the database usually represent a higher level in the field, and the literature included in the Core Collection database is also more authoritative[25]. In the WoSCCd, the search conditions are set as Topic search, the search term is Event Study, and Business Finance is selected according to the Web of Science Category. In the search results, the earliest relevant literature was published in 1983, so the time span was set from 1983 to 2023, and a total of 3524 articles were retrieved.

2.2 Research Methods

Under the background of bibliometrics and visual analysis, a series of visualization software of bibliometrics has been developed. CiteSpace software, developed by Professor Chen, is applied for literature classification research, data mining, and visualization of international bibliographic databases[26]. The software can visually analyze the literature and intuitively show the knowledge structure, research hotspots, and evolution process in the form of maps. In this paper, the WoS statistical analysis function is used to make a preliminary quantitative analysis of the retrieved literature.

Histcite software is used to analyze the literature of basic knowledge of the subject by citation score. CiteSpace6.2.R4 (64-bit) Advanced software is used to draw a scientific knowledge map of the retrieved literature, and cluster analysis and timeline analysis are carried out to obtain research hotspots and development trends in this field.

3 RESULTS AND ANALYSIS

3.1 Analysis of Overall Issuance

The development trend of papers on Event Study can be seen in Figure 1, from 1983 to 2023, the number of published papers is generally on the rise, the number of published papers from 1983 to 1991 was only in single digits, and the number of papers published in 2013 was 101 papers, which exceeded one hundred, and in 2023 of the year, the number of publications has reached 390, and it is expected that the number of publications will continue to increase in 2024, reflecting the research fervor of Event Study in the field of Business Finance. Analyzing the index of citation volume can measure the academic influence of scientific research results, according to the WoS statistical results and citation report, between 1983 and 2023, the cumulative number of citations of the literature number of 3,524 articles reached 74,684, the number of citations after removing the self-citation was 70,025, and the average citation frequency of each piece of literature was 21.19, and the h-index (the h-index, also known as the h-factor or the number of high citations, refers to the fact that up to h papers have been cited at least h times, respectively) reached 117. It shows that Event Study has a certain influence on the scientific output in the field of Business Finance.

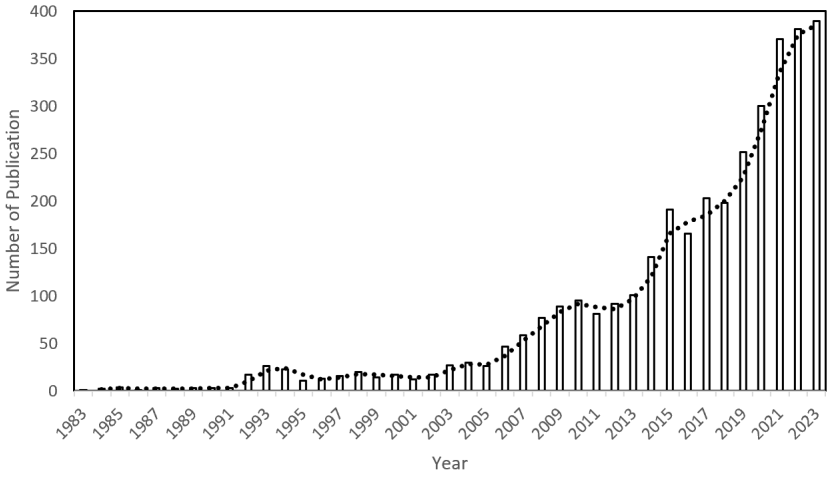

Fig. 1. Total number of papers published per year from 1983 to 2023

3.2 Analysis of Country (Region)

A search of the number of national publications provides a practical understanding of the application of Event Study in the field of Business Finance in each country. According to the statistical analysis function that comes with WoS, the countries/regions are searched, and the counting results of the search results, as shown in Table 1, the top 10 countries in terms of the number of articles published are the USA, China, UK, Australia, Germany, Canada, Italy, France, China Taiwan, and India in the following order. According to the search results, the counting results of the papers published by the USA are 1167, accounting for 33.12 % of all statistical literature, leading other countries in the number of papers. At the same time, the average number of citations and h-index of single articles in the USA are higher, which indicates that the papers of the USA in the application of the event-based approach in Business Finance have a world-leading level. China ranks second in terms of the number of papers published, with a search result count of 489. However, compared with other countries, China's average number of citations per paper is lower than that of the other seven countries, and the h-index is lower than that of the UK, which is ranked third, suggesting that there is still room for further improvement in the quality of China's papers.

Table 1. Table captions should be placed above the tables.

No.	County	Records	Proportions%	h-index	Citations per paper	Total cites	Other citation
1	USA	1167	33.12	103	41.03	47884	46839
2	China	489	13.88	37	14.14	6913	6817
3	UK	330	9.36	42	22.95	7573	7494
4	Australia	238	6.75	29	14.26	3395	3332
5	Germany	203	5.76	31	17.33	3519	3445
6	Canada	180	5.11	29	24.72	4450	4408
7	Italy	148	4.20	25	15.92	2356	2323
8	France	133	3.77	27	53.54	7121	7090
9	China Taiwan	97	2.75	13	9.27	899	892
10	India	93	2.64	20	15.76	1466	1414

Further analysis of the number of published papers in China shows that China started to publish papers related to Event Study in 2000, which is a late start in the use of Event Study compared to the international level. The number of published papers gradually increased from 2019, with 18 publications in 2019, increasing to 35 in 2020, 52 in 2021, and 80 in 2023. Chinese authors have published a high number of articles in the following journals: *Finance Research Letters* (54 articles), *International Review of Economics & Finance* (18 articles), *International Review of Financial Analysis* (16 articles), *Pacific-Basin Finance Journal* (15 articles), *China Finance Review International* (14 articles), *Journal of Banking Finance* (14 articles), and *Journal of Corporate Finance* (14 articles), all of which are among the top journals in the CAS (Chinese Academy of Sciences) Journal Division. The top five institutions that published more articles in China were: CAS (23 articles), Central University of

Finance and Economics (18 articles), City University of Hong Kong (17 articles), Southwest University of Finance and Economics (16 articles), Renmin University of China (15 articles). All institutions have strong scientific research strength in this field, and the Chinese Academy of Sciences has the largest number of articles.

3.3 Analysis of Publishing Journals

According to the search results, the top 10 journals in terms of number of publications (Table 2), the top 10 journals accounted for 24% of the total number of publications, the h-index was 78, and the average number of citations of a single paper was 35.04. Among the top 10 journals in terms of publication volume, there are three journals listed as top journals in zone 1 by SCI Journal Division of CAS, namely, International Review of Financial Analysis, Journal of Corporate Finance, and Journal of Financial Economics, in addition to Journal of Banking Finance, Finance Research Letters, Journal of International Money and Finance, and International Review of Economics Finance are classified as zone II journals, while Accounting Review, International Journal of Finance Economics are listed as zone III journals. This indicates that Event Study has had some academic impact on articles in the field of Business Finance.

Table 2. Top ten institutions with the largest number of publications.

No.	Journal name	Records	Proportions%	IF in 2023
1	Journal of Banking Finance	163	4.63	3.7
2	Finance Research Letters	162	4.60	10.4
3	Managerial Finance	112	3.18	1.6
4	International Review of Financial Analysis	89	2.53	8.2
5	Journal of International Money and Finance	61	1.73	2.5
6	Accounting Review	56	1.59	4.1
7	Journal of Corporate Finance	54	1.53	6.1
8	International Journal of Finance Economics	52	1.48	2.9
8	International Review of Economics Finance	52	1.48	4.5
8	Journal of Financial Economics	52	1.48	8.9

3.4 Analysis of Authors of Publications

The top 10 authors in terms of number of papers published were from 6 countries (Table 3). Among the top 10 publishing authors, Goodell JW from the USA and Ramiah V from Australia published the highest number of papers, both with 10 papers. Kolari JW from the USA ranked fifth in the number of papers published with 6. Although the number of publications is not the highest, his paper has been cited 461 times, which is the highest number of citations for his paper among the 10 scholars. Among the developing countries, Kumari V from India, with a number of 7 publications, has a relatively high number of citations to his papers. In addition, it was found in the search that these authors have different collaborations with each other, Pandey DK and Kumari V from India have a very close collaboration on their papers and their

total number of citations is also relatively close to each other. Finally, it can be seen that among the top 10 authors, authors from the USA have the highest number of publications as well as the highest citation frequency in this field using Event Study.

Table 3. Top ten institutions with the largest number of publications.

No.	Author	County of institution	Records	Cited frequency
1	Goodell JW	USA	10	291
1	Ramiah V	Australia	10	175
2	Schiereck D	Germany	9	69
2	Moosa I	Australia	9	177
3	Pandey DK	India	8	344
4	Kutan AM	USA	7	79
4	Yousaf I	China	7	106
4	Yarovaya L	UK	7	374
4	Kumari V	India	7	347
5	Kolari JW	USA	6	416

3.5 Analysis of Highly Cited Papers

Highly cited papers have a more important role in promoting the development of the discipline and also highlight the research hotspots in the field from the side[27]. As shown in Table 4, of the top 10 highly cited papers, five were published in *Journal of Financial Economics*, three were published in *Journal of Finance*, and both journals are listed as Top journals by the CAS Journal Division. The main research themes can be seen from the specific content of the highly cited papers. The second and third papers mainly investigate the application of Event Study and measure stock market returns based on changes in stock prices. The fourth and fifth papers mainly investigate the key indicators used in Event Study: AR (Abnormal Returns), CAR (Cumulative Abnormal Returns), and BHAR (Buy-and-Hold Abnormal Returns). The sixth article mainly explains that Event Study can be used to measure the company's business performance, which provides investors and analysts with a new perspective to measure the value of the company. In addition, the research results of using Event Study to examine the degree of price reaction to disclosure information, the application of Event Study in the acquisition process, and the application of Event Study under different conditions are also cited with high frequency.

Table 4. Top 10 highly cited papers.

Author	Journal name	Title	Citations
Artzner P	Mathematical Finance	Coherent measures of risk	4465
BROWN SJ	Journal of Financial Economics	Using daily stock returns-the cast of event studies	2741
Morck R	Journal of Financial Economics	The information content of stock markets: why do emerging markets have synchronous stock price movements?	1427

Barber BM	Journal of Financial Economics	Detecting long-run abnormal stock returns: The empirical power and specification of test statistics	1140
Lyon JD	Journal of Finance	Improved methods for tests of long-run abnormal stock returns	841
Barber BM	Journal of Financial Economics	Detecting abnormal operating performance: The empirical power and specification of test statistics	791
Fuller K	Journal of Finance	What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions	773
BOEHMER E	Journal of Financial Economics	Event-Study Methodology under conditions of event-Induced variance	708
Hirshleifer D	Journal of Finance	Driven to distraction: extraneous events and underreaction to earnings news	620
Khan M	Journal of Accounting Economics	Estimation and empirical properties of a firm-year measure of accounting conservatism	597

3.6 Analysis of Basic Subject Knowledge

The citation relationship knowledge network links the research literature to reflect the progress of research in the discipline. Based on the literature records retrieved by WoS, LCS (Local Citation Score) and GCS (Global Citation Score) were evaluated using Histcite software developed by Thomson Reuters[28]. LCS is the number of times the paper is cited by the local data set, that is, 3524 articles retrieved. The higher LCS indicates that the paper has a higher academic influence in this research field. GCS represents the total number of citations in the WoS database, but these citations may come from literature in different fields. In this paper, we statistically analyze the citation relationship of the papers by Histcite to get the top ten papers based on the LCS scores and sort them by time series, as shown in Table 5.

According to the scores, the paper with the highest local citation score of 314 also has the highest global citation score, indicating that there is some correlation between LCS and GCS. However, several papers with high GCS scores do not have high LCS scores. For example, papers with GCS scores of 1140 and 841 have LCS scores of only 97 and 76, indicating that global citation scores do not prove that the papers are representative of the field, and therefore literature with high global citation scores may not belong to the foundational literature in the field. In addition, the two papers with the first and second LCS scores were published in the Journal of Financial Economics, which is classified as a Zone 1 Top Journal, indicating that the papers have a high scholarly impact in the field.

Based on the time series, in 1984, DYCKMAN T studied Event Study in comparison with other research methods. BROWN SJ discussed the relevant factors affecting Event Study in his 1985 article. In 1989, CORRADO CJ evaluated a new parametric test about Event Study. CORRADO CJ and Barber B further standardized the metrics in Event Study including normal versus Abnormal Returns in 1992 and 1997, respectively. Lyon JD improved the test for long-term abnormal stock returns in his 1999 article. Fuller K extended Event Study to multiple acquisitions and since then Event

Study has been widely applied to analyze the impact of mergers and acquisitions on firms. In 2010, Kolari JW proposed a new econometric statistical method to test cumulative daily returns.

According to the content, literature with high LCS scores tends to occupy a central position in the citation relationship knowledge network, which is the key literature reflecting the research progress and development history of the discipline, and it usually belongs to the highly cited literature, which demonstrates its significant influence in the academic community through its highly cited characteristics. It was found that the literature that occupies a central position in the citation-relationships knowledge network tends to propose innovative methodological improvements or theoretical extensions, focusing on the study of such methodological improvements as the Event Study.

Table 5. Key papers in the top 10 citation relation knowledge networks.

First author	Publication	Title	LCS	GCS
DYCKMAN T	1984	A comparison of event study methodologies using daily stock returns – a simulation approach	39	141
BROWN SJ	1985	Using daily stock returns -the case of event studies	364	2741
CORRADO CJ	1989	A nonparametric test for abnormal security-price performance in event studies	105	428
BOEHMER E	1991	Event-Study Methodology under conditions of event-induced variance	158	708
CORRADO CJ	1992	The Specification and power of the sign test in event study hypothesis tests using daily stock returns	67	198
Barber BM	1997	Detecting long-run abnormal stock returns: The empirical power and specification of test statistics	97	1140
Lyon JD	1999	Improved methods for tests of long-run abnormal stock returns	76	841
Fuller K	2002	What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions	47	773
Norden L	2004	Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements	44	280
Kolari JW	2010	Event Study Testing with Cross-sectional Correlation of Abnormal Returns	86	272

3.7 Research Hotspots and Trend Analysis

In this paper, we analyzed the current situation and hotspots of the Event Study by constructing the co-word network analysis and drawing scientific knowledge maps. The time period is from 1983 to 2023, the time segmentation is set to be once a year, the node type is selected as "keyword", and under the keyword node type, a total of 536 keywords and 2416 lines are identified after visualization analysis, with a network density of 0.0169. The network structure and clustering results of the knowledge map are evaluated by Modularity Q and Mean Silhouette. Modularity $Q > 0.3$ is considered as a more significant network structure, and Mean Silhouette ≥ 0.7, which indicates that the clustering results are credible[29].Modularity Q and Mean Silhouette are 0.4694 and 0.7628, indicating that the network structure of the map is more significant and reasonable, and the confidence level of clustering is high and meaningful.

By analyzing the keyword knowledge map of the literature, the hot vocabulary of the relevant literature can be captured, which helps to mine the research hotspots and development directions of the subject area[30]. In this paper, the LSI algorithm is used to optimize and name the clusters (Fig. 2), and the noun terms are extracted from the Keywords of the retrieved literature (Table 6), and the keyword timeline mapping of the application of Event Study in Business Finance is also plotted (Fig. 3) to react to the temporal evolution characteristics of the research. The clusters are named with #0-#8, and the smaller the ordinal number, the larger the cluster size, and the more keywords are included in the clusters. According to the results in Fig. 2, Fig. 3 and Table 6, a total of nine distinct clusters are obtained.

Cluster 0 is mainly concerned with the fact that Event Study is beginning to be widely used in the field of Business Finance in relation to events such as financial regulation as well as accounting reforms. One of the hot areas of Event Study analysis is to test whether the market's response to a particular event is appropriate and effective, and its testing can help regulators and policymakers better understand market dynamics, so as to formulate more effective policies and measures. Cluster 1 focuses on reputational risk, which involves events such as banking crises, and the average time for the emergence of this type of research is 2008, mainly because since the financial crisis in 2008, academics have shown a sustained concern for the stability and reputation management of financial institutions. Cluster 2 is related to the application of Event Study to measure stock market returns, especially the impact of high economic policy uncertainty on stock market returns, and this type of research began to appear gradually in 2008 and continues to this day. Cluster 3, which focuses on the market's reaction to events, and Cluster 4, which focuses on changes in the stock market environment and is more concerned with bank analysts' assessment of corporate earnings and key earnings forecasts for investors in this changing environment, both appeared on average in 2011. Cluster 5 focuses on corporate investment activities, and there have been related studies since 1994 and continue to this day, focusing on the efficiency of corporate investment activities in the market under information asymmetry and the economic effects generated by investment activities. Rahim[31] believes that information has an essential role in decision-making for investors who

will invest in financial markets, using a sample of companies listed on the Indonesian Stock Exchange in March 2020 as a case study to determine the market's response to information and the economic effects of investment activities. The studies in this cluster reveal how corporations adjust their investment strategies in response to market information, and currently, this cluster is one of the hot areas analyzed in Event Study. Cluster 6 and Cluster 8 have an average year of occurrence in 2015, and the study focuses on how policy changes and economic news affect financial markets in the context of global change. Researchers have analyzed the impact of policy changes and economic news events on the stock market, bond market, etc. through the Event Study, for example, after the financial crisis, countries introduced a series of macroeconomic policies, and the implementation of financial crisis policies causes volatility and positively affects the stock market. This provides a new perspective for understanding the global financial market, and this type of literature has been gradually increasing in recent years, which is currently a more cutting-edge research direction. The average time of cluster 7 is also earlier in 2007, focusing on the measurement indicators used in Event Study, mainly AR (Abnormal Return) and CAR (Cumulative Abnormal Return). Researchers evaluate the impact on stock prices through index calculation. This clustering research provides methodological support for improving the accuracy and reliability of Event Study and ensures the accuracy of the research results.

Combining the above cluster analyses, the application of Event Study relies on the occurrence of the sample events and uses the calculation of indicators to verify the event effects, thus reacting to the market changes before and after the events and ensuring the accuracy and reliability of the research results. In terms of research hotspots, the application of Event Study to measure stock market returns and assess the economic effects of corporate investment activities is a research hotspot that has been the focus of attention in this field, while the application of Event Study to analyze policies and economic news is a more cutting-edge research direction.

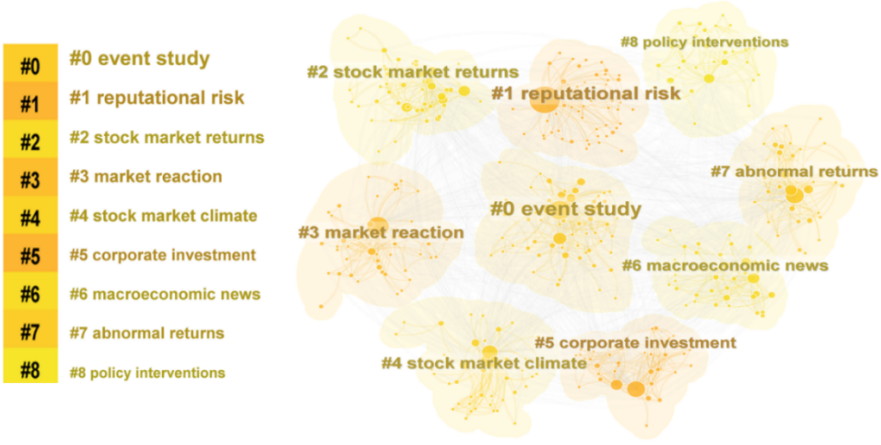

Fig. 2. Keyword clustering knowledge map.

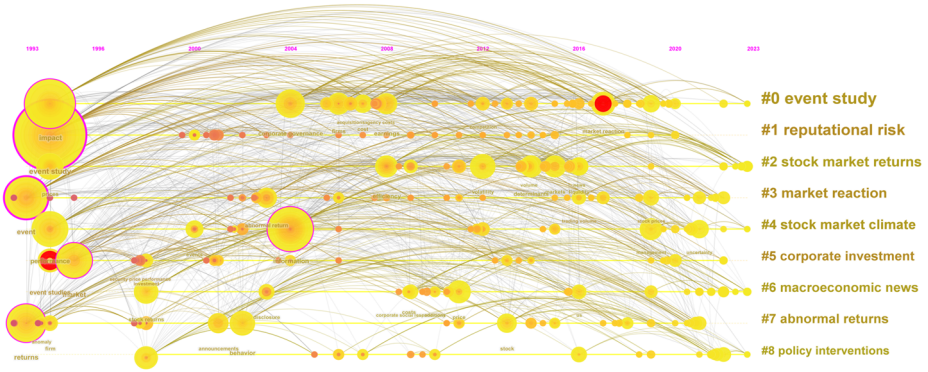

Fig. 3. Keyword timeline knowledge map

Table 6. Cluster labels of keywords.

Cluster	Size	Silhouette	Mean (Year)	Label (LSI)
0	61	0.705	2014	event study; border carbon policy; financial regulation; UK financial institutions; credit default; market reaction; accounting reforms; non-life insurance; European insurance companies
1	55	0.664	2008	reputational risk; event study; banking crisis; capital purchase; financial companies; operational losses; contagion effect; energy industry
2	47	0.720	2016	stock market returns; event study; Russia-UKraine crisis; financial sustainability; revolution; economic policy uncertainty; European banks; bank stability; health crisis; geopolitical risk
3	47	0.768	2011	market reaction; event study; product recall; stock valuation; environmental sustainability; abnormal return; short selling; cumulative abnormal return; China securities regulation committee; event study methodology
4	43	0.688	2011	event study; stock market climate change; cop26 green economy; analysts earnings forecast; feedback trading; operational risk; banking analyst; career concerns; forecast revision; analyst competition
5	41	0.823	2007	Event Study; corporate investment; capital expenditures; anti-money laundering; cryptocurrency regulation; asymmetric information; asset pricing; market efficiency; transaction activity
6	40	0.726	2015	macroeconomic news; bond market; event study; high frequency data; management forecasts; investor sentiment; market efficiency; extended trading; social media; labor market
7	39	0.859	2007	Abnormal returns; stock prices; cumulative abnormal returns; information incorporation; Event Study; efficient markets; price manipulation; emerging markets

8	31	0.744	2015	policy interventions; financial market stress; financial contagion; event study analysis; non-parametric bootstrap; probabilistic scenario analysis; empirical network model; probabilistic classification; credit risk; transmission

4 CONCLUSIONS

Based on the WoSCCd, we retrieved the literature related to Event Study in the field of Business Finance, and applies CiteSpace, which is a more popular literature visualization and analysis tool, as well as WoS and HistCite to conduct bibliometric and visual analysis of the 3524 articles retrieved to explore the research overview, hotspots and development trends of Event Study in this field. The following conclusions are drawn from the analysis of the research results.

In terms of research characteristics, the number of published articles on Event Study in the field of Business Finance has generally shown a growing trend, and its research heat has continued. Moreover, most of the journals in which the articles were published belonged to high-quality journals, indicating that articles on Event Study in this field tend to have a high academic impact. In addition, it is found that USA has stronger academic research power on Event Study in this field, while there is still a big gap between China and other countries in the quality of the paper, the reason is, on the one hand, because of China's late start for the research on Event Study, the growth of the economy and the development of the financial market is relatively slow, resulting in the lack of accumulation of relevant data, On the other hand, scholars have mostly followed the theories and design methods proposed by foreign countries for the application of Event Study, and contributed less to the innovation of theory and technical improvement of the method.

The analysis of highly-cited papers and the analysis of disciplinary foundations reflect the fact that the classic literature has contributed more to the progress of research in the discipline, and that the classic literature also serves as a bridge in the course of the development of the discipline, as shown by the analysis of disciplinary foundations and the mapping of scientific knowledge. The mapping of scientific knowledge shows that the Event Study is a powerful tool for understanding and predicting market behavior, from financial regulation to global political change, and from corporate investment decisions to market reaction analysis. Among them, the application of Event Study to measure stock market returns and assess the economic impact of corporate investment activities has been a hot research topic in the field, and the application of Event Study to analyze the impact of policy and economic news in the context of global changes is a more recent research direction in the field, and also provides a new perspective on global financial markets that deserves further attention from scholars.

To summarize the above analysis, Event Study, as a statistical analysis method born very early, has demonstrated its wide applicability in the application of Business Finance. Since its application to this field in 1983, Event Study has been applied by more and more scholars to stock market research, providing practical analysis and

forecasting for this purpose, and has become an important research method. At the same time, it has also been widely used in other disciplines, providing a powerful tool for academic research and practical operation. Under the current trend of cross-border cooperation in scientific research, researchers should also maintain an open attitude and learn from the experience of other disciplines in applying Event Study, so as to expand the research scope of this method.

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