Visual Analysis of Stock Price Crash Risk Research in China and Abroad

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Abstract

In order to provide a comprehensive reference for scholars to further study the risk of stock price crash, this paper uses VOSviewer and CiteSpace visualization software to count the literature of stock price crash risk published in core journals at home and abroad in recent 20 years. The analysis shows that the number of published literature on stock price crash risk in China and abroad has increased significantly in recent years, but the distribution of journals in domestic literature is more concentrated. Domestic and foreign authors co-authored more concentrated, but less ; the research focuses on the influence of information disclosure, corporate governance, investor characteristics, informal institutions and stock price crash risk. The development trend of domestic and foreign research can be divided into four stages. Based on the above research content, this paper analyzes the trend of stock price crash risk at home and abroad. In the future, more attention should be paid to interdisciplinary research and multi-level capital market development.

Keywords

VOSviewer; Citespace; Stock Price Crash Risk; Bibliometrics.

1. Introduction

Stock price crash refers to the situation where the stock market price continues to fall and a large number of securities are sold off. The research on stock price crash risk began in the 1970s. At present, it is generally accepted that the risk of stock price crash stems from the management 's concealment of bad news. Based on personal interests, management tends to disclose good news to the outside world and hide bad news. Once the accumulation of bad news exceeds the critical value, it will cause stock price crash[1].

In recent years, stock price crash risk has become a hot research topic in capital market. Many scholars try to find possible factors that affect stock price crash from multiple perspectives. Foreign scholars have conducted research from the perspectives of corporate social responsibility[2], earnings smoothing[3], international financial reporting standards and the " Big Four " audit[4]. Domestic scholars have discussed the relationship between goodwill[5], disclosure of key audit matters[6], executive compensation structure[7], investor sentiment and stock price crash risk[8]. With the development of science and technology, the methods and tools of literature research are constantly enriched, which provides a reliable support for the visualization analysis of research data. As a new bibliometric method, knowledge map has been widely used in many disciplines due to its intuitive visualization results, fast and efficient literature processing, and various analytical perspectives[9], such as library[10], automation technology[11], economic management[12] and so on. Based on the current environment, this paper uses scientific visualization analysis tools to analyze the research hotspots, current stage progress and possible future research directions of stock price crash risk at home and abroad.

This paper selects the literature on stock price crash risk published in core journals in China and abroad in the past 20 years, and uses visual analysis software to systematically analyze it.

Scholars have mainly focused on the causes and influencing factors of stock price crash risk, and this paper uses visual analysis software VOSviewer and CiteSpace to analyze the research hotspots and development trends of relevant literature at home and abroad. This paper not only enriches the research methods of stock price crash risk from the perspective of scientific measurement, but also provides some reference for grasping the research hotspots of stock price crash risk at home and abroad as a whole, so as to provide reference for China 's research.

2. Methodology and Data Sources

2.1. Research Methods

The main research methods used in this paper are bibliometric methods (publication statistics, journal statistics, author statistics, keyword statistics) and co-word analysis methods (co-word network, hot spot evolution trend), in order to intuitively show the overall research hotspots of stock price crash risk at home and abroad and analyze the research trend.

2.2. Data Source

The foreign periodicals selected in this paper are from the core collection of Web of Science, and the Chinese periodicals are from CSSCI and CSCD sources of CNKI, which ensures the authority and reliability of data sources in this paper. First of all, in the core of Web of Science, the search term ' stock price crash risk ' was input, and the search time was 2000-2020. A revised literature was excluded from the initial search results, and 369 foreign literatures were refined. Secondly, in CSSCI and CSCD journals of China National Knowledge Infrastructure (CNKI), the ' stock price crash risk ' is used for thematic retrieval. The retrieval time is still set from 2000 to 2020, and the initial retrieval results are 298. The introduction of columns, the summary of academic annual meetings, the citation of papers, the catalogue of journals and brief introductions are excluded. Finally, 290 Chinese-related documents are obtained, and the format of exported documents is transformed by EndNote X9.

3. Basic Research on Stock Price Crash Risk at Home and Abroad

3.1. Literature Quantity and Annual Analysis

From the number and annual distribution of literature, as shown in Figure 1, foreign scholars ' research on the risk of stock price crash began in 2008, and domestic scholars ' research is relatively late, starting in 2012. On the whole, the number of domestic and foreign stock price crash risk literature shows an upward trend, and the number of foreign literature is higher than that of domestic literature, which has increased greatly after 2015. In recent years, stock price crash risk has been widely concerned at home and abroad, domestic and foreign scholars in the field of research work in depth. In 2000-2014, the number of publications at home and abroad was basically below 20 per year and the growth rate was relatively slow. This shows that this stage is the initial stage of the development of stock price crash risk research in China and abroad. Scholars have insufficient understanding of stock price crash risk, and have relatively little attention and research in this field. Before 2008 domestic and foreign scholars related research is relatively small, until the outbreak of the financial crisis in 2008 scholars focus on the risk of stock price crash. From 2015 to 2020, the number of publications at home and abroad increased significantly, even more than 70 in 2019 and 2020, indicating that the risk of stock price crash at home and abroad has entered the stage of medium and high speed development. The domestic scholars ' research on the risk of stock price crash from 2017 to 2018 is slightly more than that of foreign literature, which is related to the fact that China ' s stock market experienced another plunge in 2015. Domestic scholars have devoted themselves to the study of stock price crash risk.
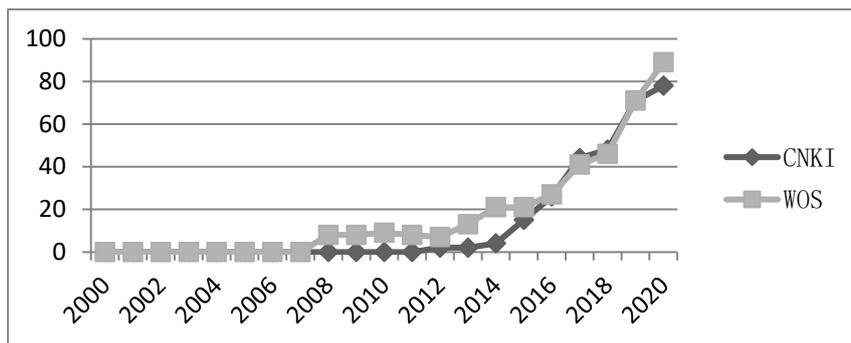
Figure 1. Number and annual distribution of domestic and foreign literature from 2000 to 2020

3.2. Analysis of Periodical Distribution

From the distribution of journals, such as Table 1. There are 14 journals with more than 7 papers published in China and 14 journals with more than 6 papers published abroad, among which domestic ' accounting research ' and foreign ' Journal of corporate finance ' rank first. In addition, foreign literature is mainly distributed in 128 academic journals, and each academic journal publishes about 2.8 articles. Domestic literature is mainly distributed in 90 academic journals, and each journal publishes about 3.2 articles, indicating that the distribution of domestic literature journals is more concentrated than that of foreign journals. In addition, 96 papers were published in the top 10 journals in China, accounting for 33.1 %, and 108 papers were published in the top 10 journals in foreign countries, accounting for about 29.3 %. That is, only 18.9 % of the total journals published more than half of the domestic and foreign journals related to stock price crash risk, indicating that these 20 journals are influential journals in the field of stock price crash risk research at home and abroad.

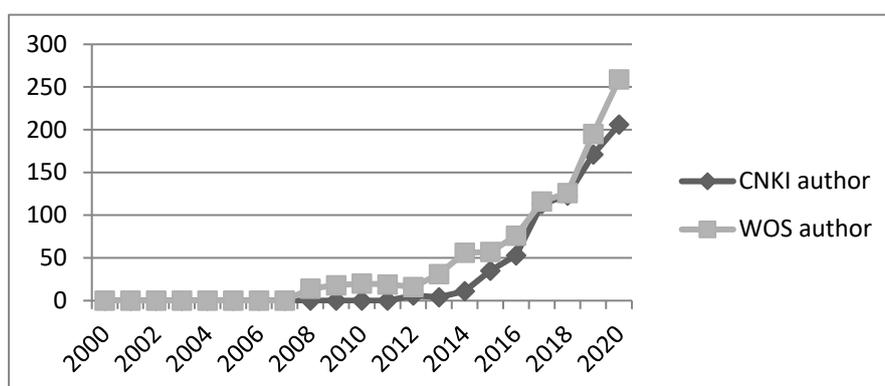**Table 1.** Distribution of domestic and foreign journals from 2000 to 2020

number	domestic periodicals	quantity	foreign journals	quantity
1	Accounting study	16	Journal of corporate finance	19
2	Journal of suee	14	Journal of banking finance	15
3	Managerial world	11	Pacific basin finance journal	15
4	Economic management	10	Journal of financial economics	11
5	Investment study	8	Emerging markets finance and trade	9
6	Economics	8	Accounting and finance	8
7	Journal of Tianjin University of Finance and Economics	8	Finance research letters	8
8	Journal of finance and Economics	7	Journal of futures markets	8
9	Finance theory and Practice	7	Physica a statistical mechanics and its applicationa	8
10	Commercial research	7	Asia pacific journal of accounting economics	7
11	Economic research	7	Contemporary accounting research	7
12	Chinese industrial Economy	7	International review of economics finance	7
13	Economic Theory and Economic Management	7	Review of financial studies	7
14	Financial research	7	International review of financial analysis	6

3.3. Authors and Cooperation Networks

3.3.1. Author Distribution

From the perspective of the distribution of domestic and foreign literature authors, as shown in Figure 2, the number of literature authors has increased rapidly in recent years. In 2020, the number of domestic and foreign literature authors has exceeded 200. This is also consistent with the above analysis conclusion, that is, the risk of stock price crash has been widely concerned by scholars at home and abroad, and more and more scholars have joined the research camp. On the whole, the number of authors studying stock price crash risk in foreign countries is slightly more than that in China, which is closely related to the late start of domestic scholars ' research time. In addition, the number of authors in foreign literature is about 4, and the number of authors in domestic literature is about 3, which is an important reason why the number of authors in domestic literature is less than that in foreign literature.

In terms of the number of papers published by authors, there are 11 foreign authors with the largest number of papers, and only 7 domestic authors with the largest number of papers. Among them, there are 7 authors who have published more than 5 papers at home and abroad, accounting for 1.3 % and 0.8 % of the total number of authors, respectively. It shows that whether domestic or foreign, there is a lack of strong core authors in the study of stock price crash risk, and it is necessary to expand the research team in related fields. There are 447 and 747 authors published only one paper at home and abroad, accounting for 81.1 % and 88.4 %, respectively. It shows that most scholars ' research on the risk of stock price crash only stays in the superficial stage, and does not continue to deepen the research.

Figure 2. The number distribution of domestic and foreign literature authors from 2000 to 2020

3.3.2. Author Cooperation Network

The authors ' network views of the literature on stock price crash risk at home and abroad from 2000 to 2020 are drawn, as shown in Figures 3. The circles with the same color in the figure indicate that the authors belong to a cooperative network of clustering (automatic classification of the system), and the connection indicates the cooperative connection between different authors. The authors with the largest number of literatures in this field in CNKI are Yangmianzhihe Linchuan, who published 7 related literatures. Among the authors, Song Guanghui, Dong Yongqi and Xu Lin had high contact intensity, and the contact intensity was 8. Combined with the number of papers published by the authors, it can be seen that the authors with more research results and more cooperative links are in the center of the network diagram and occupy the dominant position. The largest number of published papers abroad is Kim, during which 11 papers were published, followed by Zhang, Cao and Chan, 7, 6 and 6 respectively ; cao and Sun have higher contact strength, contact strength are 7, followed by the contact strength of 6 Yuan. On the whole, the authors ' contact strength of foreign literature is

lower than that of domestic literature, which can be seen from the total contact strength of domestic literature is 65, while foreign literature is only 41. However, no matter at home or abroad, the cooperation between two and three authors is common, and there are also very few four authors who cooperate to publish articles, with the majority of authors who publish articles alone. Therefore, the authors who study the risk of stock price crash should further strengthen cooperation and exchanges to jointly promote the healthy development of the capital market.
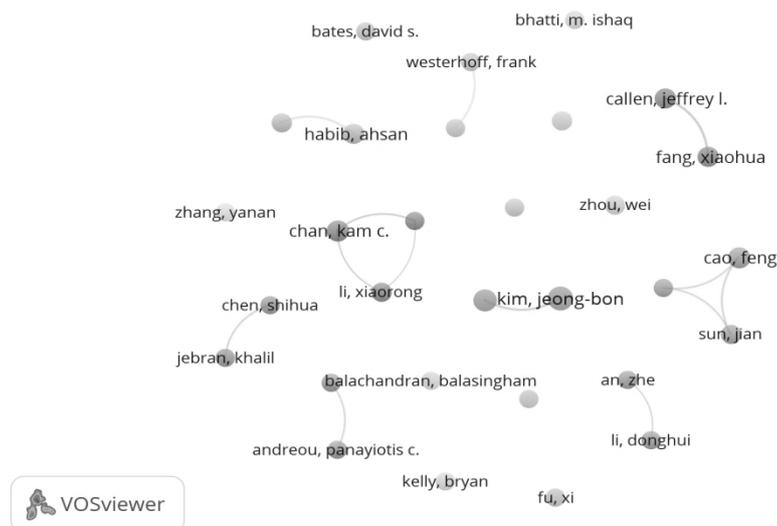

Figure 3. WOS Author Co-occurrence Figure 2000-2020

4. Research Hotspots of Stock Price Crash Risk

4.1. Determination of Hot Spots

Keywords are not only highly concise topics of research achievements in a certain discipline, but also reflect the potential relationship between research contents[13]. Usually, there are 3-5 keywords in a literature, and it is a high summary of the research content. Therefore, the higher the frequency of keywords, the more scholars ' research results in related fields, and relatively more can reflect the research hotspots in this field in a certain period.

This paper uses VOSviewer software to analyze the high frequency keywords of domestic and foreign stock price crash risk literature. After data processing, a total of 881 keywords in foreign literature and 593 keywords in Chinese literature were finally obtained. Then the keywords with keywords frequency more than 5 times in domestic and foreign relevant research literature were selected to draw a table, of which 18 and 17 keywords were higher in domestic and foreign literature, respectively, as shown in table 2. It can be seen that scholars at home and abroad take ' stock price crash risk ' as the most keywords in the literature, 156 times and 280 times respectively, but the proportion is different, 17.8 % and 47.2 % respectively. In addition, it can be seen that there are also " corporate governance ", " China " and " information asymmetry " with high frequency in foreign countries. Among them, many foreign articles focus on the current situation of China ' s capital market. The frequency of " information asymmetry " and " institutional investors " in China is 21. These keywords have attracted wide attention of scholars in China and abroad. Overall, however, these keywords are relatively low frequency, stock price crash risk research needs to be further deepened.

Table 2. High frequency keywords of WOS and CNKI from 2000 to 2020

number	Keywords in WOS Literature	frequency	number	Keywords in CNKI literature	frequency
1	stock price crash risk	156	1	stock price crash risk	280
2	corporate governance	21	2	information asymmetry	21
3	China	17	3	institutional investor	21
4	information asymmetry	13	4	corporate governance	19
5	bad news hoarding	12	5	investor sentiment	11
6	asset pricing	12	6	internal control	10
7	agency cost	10	7	institutional environment	10
8	Bubbles	8	8	accounting conservatism	7
9	earnings management	7	9	mesomeric effect	7
10	political connections	6	10	stock price synchronicity	6
11	information environment	6	11	information disclosure quality	6
12	return predictability	6	12	external director	6
13	tail risk	6	13	financing constraints	6
14	Contagion	5	14	equity pledge	6
15	option pricing	5	15	information transparency	5
16	implied volatility	5	16	control of earnings	5
17	Liquidity	5	17	auditing quality	5
18	market efficiency	5			

4.2. Hot Topics

In order to further understand the research of stock price crash risk at home and abroad, we use the keyword ' co-occurrence ' function in VOSviewer to analyze. If all keywords are displayed, the nodes are complicated and the visualization effect is not intuitive enough, so this paper still chooses the threshold of 3. There are 56 keywords with frequency not less than 3 times in WOS, and the total connection strength is 258. There are 53 keywords with frequency more than 3 times in CNKI, and the total connection strength is 382. The keywords are classified according to the clustering function of VOSviewer software, that is, the same cluster represents the same research topic, foreign literature is divided into 10 categories, Chinese literature is divided into 15 categories, different clusters are distinguished by different colors, and the automatic clustering of stock price crash risk research at home and abroad is further subdivided (see table 3), mainly including information disclosure, investors, corporate governance and informal institutions and stock price crash risk. Domestic and foreign stock price crash risk keywords appear in Figure 4, combined with table 3 can be seen, relative to foreign literature, domestic literature related keywords are more concentrated.

4.2.1. Information Disclosure and Stock Price Crash Risk

Domestic keywords include information asymmetry, accounting conservatism, information transparency and so on. Foreign keywords include information asymmetry, bad news hoarding and so on. Academic circles have reached a consensus on the causes of stock price crash, namely ' bad news hiding hypothesis '[1]. Many scholars have discussed the positive relationship between information asymmetry between management and shareholders and stock price crash risk[14]. The higher the transparency of information is, the more help stakeholders outside the management understand the real situation of the company, thereby reducing the possibility of stock price crash. Management actively disclose the company ' s relevant information, alleviate the reaction time of investors for bad news, can increase the transparency of information to a certain extent, so as to reduce the occurrence of stock price crash.

4.2.2. Investors and Stock Price Crash Risk

Domestic keywords include institutional investors, investor sentiment, etc., foreign including institutional investors. Investors are easily disturbed by external environment due to information asymmetry and herding effect. Zhao et al. (2019) discussed in detail the psychological behavior of investors from the perspectives of investor sentiment and institutional investors ' heterogeneity[8]. They believed that institutional investors increased the risk of stock price crash as a whole, and investor sentiment could also positively affect stock price crash. Foreign scholars also had similar conclusions. But at present, whether domestic scholars or foreign scholars, for investors and stock price crash risk related research is relatively less, still need further exploration and research.

4.2.3. Corporate Governance and Stock Price Crash Risk

Domestic topics include corporate governance, internal control, independent directors, etc. Foreign topics include corporate governance, return predictability, etc. Corporate governance has become an important research object for scholars on how to alleviate the risk of stock price crash. Ye et al. (2015) believed that the level of internal control determines the impact of corporate governance on the risk of stock price crash[15]. As an important member of corporate internal supervision, the existence of independent directors is closely related to the risk of stock price crash. Scholars in China and abroad have conducted a series of studies on their personal characteristics. Although scholars ' research results on corporate governance are different, the overall theory of corporate governance affecting information disclosure and thus affecting stock price crash is basically consistent.

4.2.4. Informal Institution and Stock Price Crash Risk

Domestic keywords include institutional environment, financing constraints, political connections and so on. Foreign keywords include market efficiency, political connections, information environment and so on. Domestic scholars have found that different corporate political connections have different effects on reducing the risk of stock price crash[16], but Jin et al., (2016) found that corporate managers with political connections will increase the risk of stock price crash[17]. For the institutional environment, domestic and foreign views are basically the same, that is, the stricter the institutional environment supervision, the smaller the possibility of stock price crash of listed companies. External supervision can significantly inhibit the risk of stock price crash, so it is necessary to further strengthen the institutional environment management of capital market.
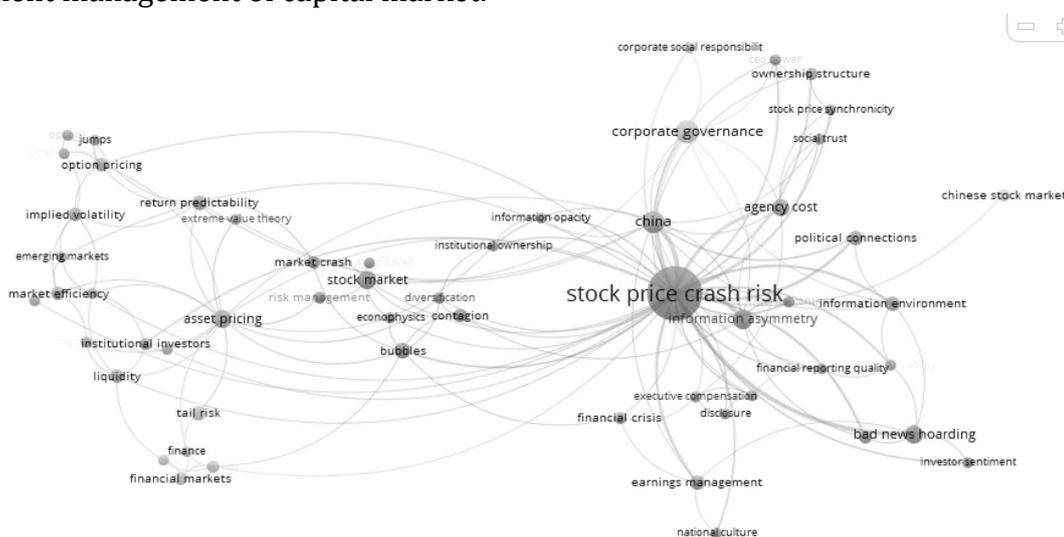

Figure 4. Keywords co-occurrence map of WOS stock price crash risk 2000-2020

Table 3. Keywords classification and frequency of CNKI and WOS from 2000 to 2020

classification	Keywords CNKI	WOS keywords
disclosure of information	information asymmetry(21), accounting conservatism(7),information transparency(5),control of earnings(5)	information asymmetry(13),bad news hoarding(12),agency cost (10),earnings management(7)
investor	institutional investor(21),investor sentiment(11)	institutional investors(4),ownership investors(4)
corporate governance	corporate governance(19),internal control(10),external director(6),equity pledge(6)	corporate governance(21),return predictability(6)
informal institution	institutional environment(11),financing constraints(6),auditing quality(5),political connection(4)	market efficiency(5),political connections(6),information environment(6),tail risk(6),contagion(5),external monitoring(4)
miscellaneous	mesomeric effect(7),cost of equity capital(4)	bubbles(8),asset pricing(12),option pricing(5)

4.3. Evolution Trend

4.3.1. Evolution Trend of Research Hotspots on Stock Price Crash Risk in China

In order to further sort out and analyze the research progress of domestic stock price crash risk, this paper imports the above data into CiteSpace software for time zone analysis of its various stages of development. Chinese scholars in 2012 - 2020 on the stock price crash risk research hot spot changes, it is divided into four stages :

In the exploratory stage (2013 and before), the research of Chinese scholars on the risk of stock price crash started later than that of foreign countries, and only in 2012 began to pay attention to this issue. At this stage, the hot keywords are ' corporate governance ', ' institutional investors ', ' female CEO ' and ' listed companies '. The research mainly focuses on the possible impact of internal governance of listed companies on stock price crash risk, and there is little research on external environmental constraints.

The growth phase (2014-2015) has seriously affected the healthy and stable development of the capital market with the volatility of the stock market, and other scholars have begun to pay attention to this topic. In this stage, the research hotspots are ' institutional environment ', ' political connection ', ' media ', ' earnings management ', ' external governance ' and other words. The research content is gradually rich. In addition to the internal factors of the company, more scholars pay attention to the possible impact of external informal institutional supervision on the risk of stock price crash. This stage has more in-depth research than before, for how to promote the development of financial markets from internal and external has made further progress.

In the development stage (2016-2017), a series of black swan events such as ' meltdown disaster ' occurred frequently in the stock market in 2016, which attracted many scholars ' research on the stock market and naturally led to a surge in research literature on the risk of stock price crash. Hot keywords at this stage include ' information asymmetry ', ' economic consequences ', ' internal control ', ' audit supervision ' and so on. Scholars have begun to focus on the possible economic consequences of stock price crash risk in addition to possible influencing factors [18]. This stage of research reached an outbreak point, research content is very rich.

The continuous enrichment of research in the first three phases of the deepening phase (2018-present) lays the foundation for the development of this phase. The research hotspots in this stage are ' GEM ', ' investor sentiment ', ' negative mood ', ' information environment ' and so on. The research scope is not only limited to A-share listed companies, but also some scholars have begun to study the possible impact of GEM listed companies[19]. At the same time, the research content has a certain interdisciplinary with psychology, and makes a certain contribution to the healthy development of the capital market by studying the relationship between investor sentiment and stock price crash risk[20]. Moreover, the future study of stock price crash risk from the perspective of psychology and other disciplines is likely to become a new research hotspot.

4.3.2. Evolution Trend of Foreign Research Hotspots on Stock Price Crash Risk

It can be seen from Figure 5 that foreign scholars divided the changes in the research hotspots of stock price crash risk from 2012 to 2020 into four stages :

The starting point of foreign stock price crash risk research in the exploratory stage (2010 and before) is relatively earlier than that in China. The hot keywords of this stage are ' asset pricing ', ' option pricing ', ' volatility smile ' and so on. Scholars have not paid enough attention to it, and the literature is relatively small. They mainly focus on exploring the causes of stock price crash risk, and rarely mention internal and external governance.

Growth stage (2011-2013) With the deepening of research, more scholars began to pay attention to this topic. At this stage, the hot keywords include " corporate governance " and " agency theory ". The research content is gradually enriched, and the influence of corporate internal governance on stock price crash risk is studied. In addition, agency theory has laid a theoretical foundation for later scholars' research.

The development phase (2014-2016) of the 2015 U. S. stock crash triggered a new wave of research into the risk of stock price crashes. The research hotspots in this stage include ' bad news hoarding ', ' financial market ', ' conditional extreme value theory ', ' jump diffusion ' and so on. It mainly studies the causes of stock price crash in financial markets, among which ' information hiding hypothesis ' has become a possible cause agreed by scholars[1], and the research theory in this stage is relatively mature.
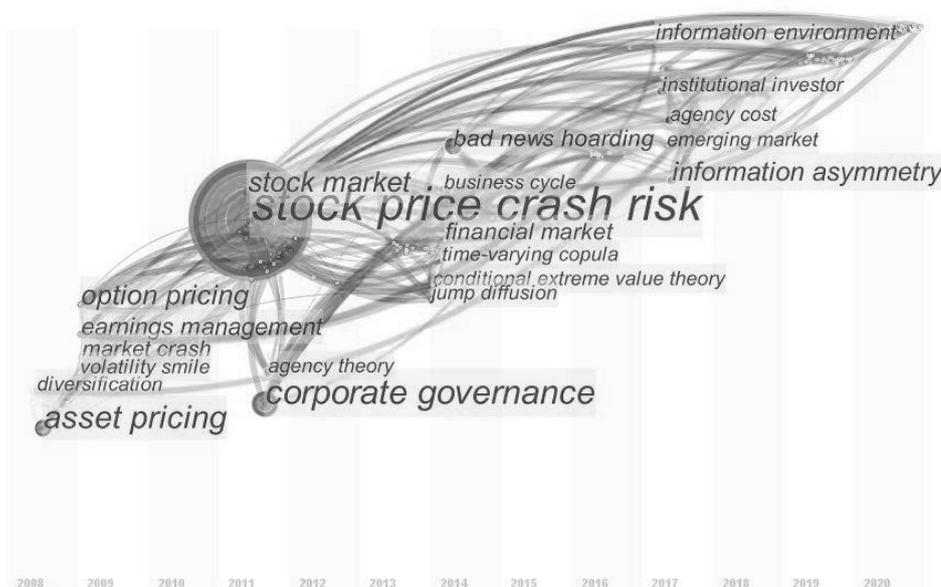

Figure 5. Evolution map of WOS stock price crash risk hot spots from 2000 to 2020

The development of the first three stages of the deepening stage (2017-present) has laid a solid theoretical foundation for the study of stock price crash risk in this stage. The hot keywords of

this stage are ' institutional investors ', ' information environment ', ' agency costs ' and so on. The research content includes not only the impact of internal governance on it, but also scholars began to look for external factors. In addition, it is also highly concerned about how to alleviate agency costs and information asymmetry, thereby reducing the occurrence of stock price crash. Moreover, the impact of institutional investors and external supervision on them may be further strengthened in the future.

5. Research Conclusions and Prospects

5.1. Research Conclusion

In this paper, VOSviewer and CiteSpace software are used to visualize the literature on stock price crash risk of core journals at home and abroad in the past 20 years. The research hotspots in this field are summarized, and the possible research trends in the future are analyzed.

From the number of domestic and foreign literatures, the number of domestic and foreign literatures on the risk of stock price crash is still growing significantly, with more than 70 articles published in 2020. Although domestic research started four years later than foreign research, but also once slightly ahead of the number of foreign literature.

From the perspective of annual authors, the number of domestic and foreign authors has increased rapidly in recent years, and the number of domestic and foreign authors has exceeded 200 in 2020. But the number of papers per author is small, indicating that domestic and foreign stock price crash risk research is still a lack of strong core authors. In addition, on the whole, the intensity of domestic author cooperation is higher than foreign.

From the distribution of journals, by calculating the average number of journals published, it is concluded that the distribution of domestic literature journals is more concentrated and the distribution of foreign literature journals is more dispersed.

From the perspective of research hotspots, in addition to ' stock price crash risk ', domestic research in this field is mainly from the aspects of corporate governance, information asymmetry, institutional investors, etc. In foreign literature, the research focus is mainly ' corporate governance ', ' agency cost ', ' asset pricing ' and so on. Overall, domestic and foreign stock price crash risk research can be divided into four stages.

5.2. Shortcomings and Prospects

At present, the research on stock price crash risk at home and abroad is still in the rising period, and the research trend of predicting the future stock price crash risk will still be studied in depth in terms of influencing factors and research objects.

In terms of influencing factors, due to the domestic and foreign research mainly from the company level, the future will not only be limited to the company ' s point of view, but also will focus on the company ' s external factors, interdisciplinary research will also be the future research hotspot.

In terms of research objects, at present, domestic scholars mainly study A-share listed companies, and few study GEM listed companies, which should be studied in the multi-level capital market environment. In addition, there is little comparison of stock price crash risk differences and their unique influencing factors in different industries and regions.

At present, there are few literatures about the economic consequences of stock price crash risk at home and abroad, and there is no literature to compare the crash risk with the actual crash events, or to warn the probability of the company ' s crash. These aspects are promising research areas in the future.

In short, scholars should actively explore deeper factors that may affect the risk of stock price crash, and promote the healthy, stable and high-quality development of China ' s capital market.

Acknowledgments

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