

# Business Risk and Corporate Debt During COVID-19: A Bibliometric Analysis

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**Abstract:** The COVID-19 pandemic created unprecedented disruptions in global economic activity, exposing firms with high levels of leverage to heightened financial vulnerability and operational uncertainty. Understanding how corporate debt levels interact with business risk under such crisis conditions has therefore become an important topic in business and management research. This study applies bibliometric analysis to systematically examine the evolving relationship between corporate debt levels and business risk in the context of the COVID-19 pandemic. Using 2,488 relevant publications indexed in the Web of Science database and following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, the research identifies core authors, influential journals, and major thematic clusters within this rapidly expanding body of literature. Co-citation analysis and keyword co-occurrence analysis are employed to map the intellectual structure and developmental trajectory of the field. The findings show that the pandemic significantly intensified financial instability among highly leveraged firms, particularly in capital-intensive industries such as real estate and manufacturing. At the same time, the literature increasingly highlights the importance of effective debt management and risk mitigation strategies in strengthening organisational resilience during periods of large-scale economic shocks. From a theoretical perspective, the results indicate that the relationship between leverage and business risk is closely connected to discussions on organisational resilience and crisis management in strategic management research. Methodologically, this study contributes to business and management research by demonstrating how bibliometric mapping can be used to analyse complex and rapidly evolving research topics during global crisis events. By visualising knowledge structures, identifying influential research clusters, and tracing the evolution of key themes, the approach provides a systematic framework for synthesising fragmented academic debates. The results also offer practical insights for managers and policymakers. For example, the findings suggest that firms operating in capital-intensive sectors should adopt more flexible debt structures and strengthen liquidity management during crisis periods to reduce operational vulnerability. Overall, the study provides a comprehensive overview of the research landscape on corporate debt and business risk during the COVID-19 pandemic and highlights promising directions for future research in corporate finance, risk management, and crisis-related business studies.

**Keywords:** Bibliometric mapping, Bibliometric analysis, COVID-19, Corporate debt level, Business risk, Keyword co-occurrence

## 1. Introduction

Debt is essential for corporate operations and growth, yet excessive debt can trigger financial distress and bankruptcy. The COVID-19 pandemic, a major global economic shock, has reshaped the business environment. Analyzing the link between high debt levels and operational risk is crucial for understanding the current economic situation and guiding companies in formulating rational financial strategies (Huang & Ye, 2021; Liao et al., 2023). Debt ratio and structure are key metrics reflecting a firm's financial health and risk. A debt ratio above the industry average signals repayment pressure, potentially undermining operational stability (Friend & Lang, 1988). During COVID-19, many businesses endured revenue slumps and cash flow shortages (Sevim, 2021). Maintaining standard debt ratios could heighten risks. Although some advocate for debt increases to sustain operations, debt ratio management during this period must consider company status, market conditions, and industry trends, balancing short-term liquidity with long-term stability (Lin & Wang, 2016; Schuknecht, 2022). This study aims to systematically map the intellectual structure and research evolution of studies examining the relationship between corporate debt levels and business risk during the COVID-19 pandemic through bibliometric analysis. By analysing core authors, key journals, and thematic clusters, the paper seeks to reveal major research trends and identify emerging research opportunities in this field.

Financial theorists and practitioners have shown great interest in the correlation between corporate operational risk and excessive indebtedness. Debt is crucial for business expansion, but when debt exceeds a firm's repayment capacity, it raises financial and operational risks, potentially leading to cash flow problems and higher

insolvency risks (Wang & Hsu, 2013; Liao et al., 2023). The impact of high debt on operational risk varies by industry: in capital intensive sectors like real estate and manufacturing, which typically have high debt levels (Kumar & Sujit, 2017), excessive debt directly and significantly increases operational risk; in industries with fewer physical assets, such as technology and cultural sectors, the impact is relatively smaller but still significant (Hasman, 2021). From a theoretical perspective, the relationship between corporate debt and business risk has been widely discussed in corporate finance literature. According to trade-off theory, firms balance the tax advantages of debt financing with the increasing probability of financial distress, suggesting that excessive leverage may significantly increase firm vulnerability during economic shocks (Friend & Lang, 1988). Agency theory provides another explanation, arguing that moderate levels of debt may discipline managerial behaviour and reduce agency costs. However, when leverage becomes excessively high, conflicts between shareholders and creditors may intensify, thereby increasing operational and financial risk. The COVID-19 pandemic offers a unique context in which these theoretical predictions can be reassessed, as sudden revenue shocks and liquidity constraints placed unprecedented pressure on highly leveraged firms (Huang & Ye, 2021).

The relationship between corporate leverage and operational risk therefore varies across industries and organisational conditions. In capital-intensive sectors such as real estate and manufacturing, excessive debt may significantly increase operational vulnerability due to high financing needs and fixed investment commitments (Katsaliaki, Galetsi & Kumar, 2022). In contrast, industries characterised by lighter asset structures, such as technology and cultural sectors, may experience a relatively weaker but still meaningful relationship between leverage and operational risk (Gopalakrishnan, Jacob & Mohapatra, 2022).

Building on these theoretical perspectives, it becomes important to understand how the academic community has studied the relationship between corporate leverage and business risk during the COVID-19 crisis. Although many empirical studies have examined specific aspects of this relationship, the overall intellectual structure of the research field remains fragmented. Bibliometric analysis provides a systematic method for mapping the evolution of research themes, identifying influential scholars, and revealing major knowledge clusters within the literature. By integrating theoretical insights from corporate finance with bibliometric mapping techniques, this study provides a comprehensive overview of how the debt–risk relationship has been explored during the pandemic period. This approach helps clarify the development trajectory of the research field and identifies promising directions for future research.

## **2. Research Methodology**

This article uses bibliometric analysis to explore the relationship between asset structure and operational risk in different types of enterprises during significant social events like the COVID-19 pandemic. Our researchers ensured the thoroughness and scientific validity of our research by utilising the authoritative academic database Web of Science to conduct a comprehensive literature search relevant to our research topic. The search covers primary literature collections from the Science Citation Index Expanded (SCI-EXPANDED) and the Social Sciences Citation Index (SSCI).

We rigorously followed PRISMA standards in literature analysis for transparency and reliability. Guided by the globally recognized PRISMA guideline (Shamseer et al., 2015), we conducted a systematic literature review (Page et al., 2021) to explore how corporate asset structure changes affect operational risk in specific social contexts and analyze enterprise performance differences. Figure 1 shows our research process and methodology. PRISMA guidelines standardize reporting to enhance clarity of research methods and results.

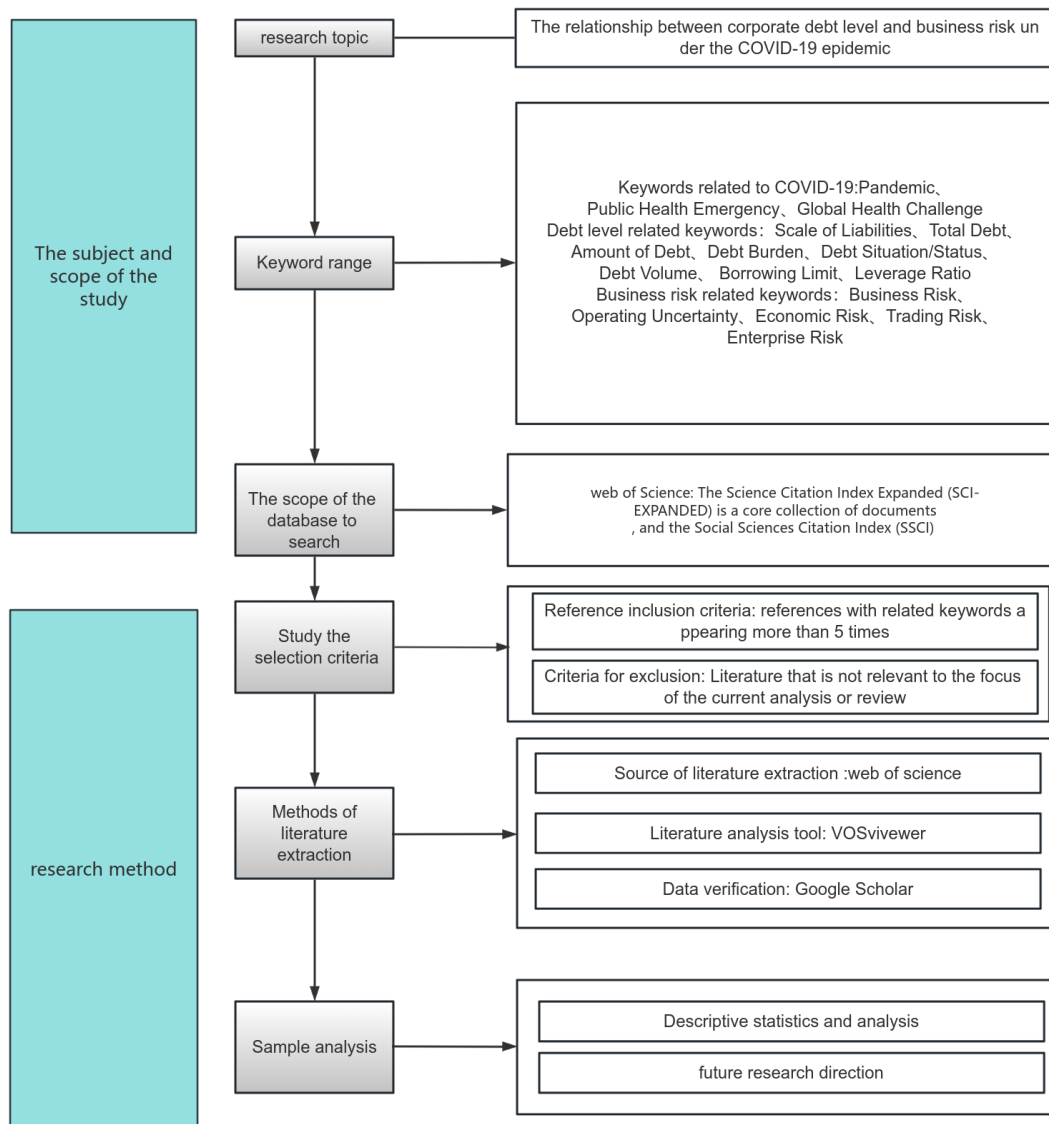


Figure 1: Literature research framework diagram

### 2.1 Selection of Keywords for Literature Review Search

This review examines the relationship between high corporate debt and operational risk across industries during the COVID-19 pandemic. An initial systematic literature search using keywords such as “COVID-19,” “business operational risk,” and “excessive indebtedness” identified relatively few relevant studies, which limited the initial scope of the review. To reduce bias and improve coverage, the search strategy was expanded by incorporating broader terms related to the pandemic, including “pandemic” and “outbreak,” as well as debt-related terms such as “scale of liabilities” and “debt burden.” Operational risk was also explored using keywords such as “business risk” and “operating uncertainty.” This expanded keyword framework improved the comprehensiveness of the literature search in accordance with PRISMA guidelines, strengthened the theoretical basis of the study, and enabled a more systematic understanding of how high corporate debt interacts with operational risk during major economic disruptions.

### 2.2 Choice of Literature Databases

Several publication databases, such as Web of Science, PubMed, IEEE Xplore, SpringerLink, JSTOR, and Scopus, offer extensive academic resources (AlRyalat, Malkawi & Momani, 2019). Since this study focuses on economics, database selection requires a balance between specificity and comprehensiveness (Rathnayaka, 2022). Although concentrating on economics may introduce some bias, it helps identify research gaps more accurately. Thus, databases like PubMed, IEEE Xplore, SpringerLink, and JSTOR were excluded due to their limited relevance to

economic research (Amelia et al., 2023; Huang & Ye, 2021). To avoid national-level research limitations, Chinese domestic databases were not included. For research on COVID-19's economic impact, Web of Science was chosen over Scopus, as it provides abundant resources and advanced tools better suited for economic studies (Donthu et al., 2021).

## 2.3 Methods of Literature Analysis

### 2.3.1 Methods of citation analysis

This article aims to explore the inherent connections among the cited references using co-citation analysis. This method focuses on analysing the connection between citations, especially in articles with common themes or keywords. When two articles both reference the same literature, it suggests a strong thematic link between the documents (Ladd, 2021; Rossini, 2024). Due to the abundance of synonyms in the literature examined in this study, co-citation analysis provides a more accurate insight into the knowledge dissemination and disciplinary framework present in the literature (Trujillo & Long, 2018), thus improving comprehension of the research material.

Since its introduction in 1973, co-citation analysis has played a pivotal role in shaping methodologies within bibliometrics and scientometrics (Small, 1973). This method is crucial for evaluating the impact of academic papers and is widely utilised to pinpoint research hotspots, trends, and the intersection of various research fields in academic disciplines (Mao, Wang & Ho, 2010). We can use different bibliographic databases and retrieval tools during the implementation process to systematically gather citation data and determine the co-citation strength between documents. This will establish a strong data foundation for further co-citation analysis (Borodins et al., 2023).

### 2.3.2 Keyword co-occurrence analysis

This review utilises the co-occurrence analysis method to systematically analyse selected keywords in the field of economics. This analytical method allows for a more scientific representation of the connections and levels of proximity between keywords in past literature (Liu & Mei, 2016). It also helps enhance our comprehension of the positions and functions these keywords have within the economic knowledge system. The aim is to discover potential connections between keywords that have not been thoroughly investigated in current economic research by conducting detailed data analysis and comparisons. This will provide new perspectives and ideas for future studies (Sharma et al., 2018).

## 3. Results

### 3.1 Basic Quantitative Information

According to the above literature search scheme, conduct a literature search in the Web of Science database using the keywords selected in this article. A literature search strategy yielded 2,574 relevant articles authored by 7,113 individuals from 119 countries, associated with 3,062 institutions. The authors referenced a total of 110,779 sources, originating from 40,740 institutions.

### 3.2 Analysis of Literature Journals

A total of 2,574 articles were collected, including 86 articles before 2015 and 2,488 articles from 2015 to 2024. As shown in Figure 2, statistical data indicate a significant increase in the number of published papers on business risks and high-leverage research during global public health emergencies from 2015 to 2024. From 2010 to 2017, research primarily concentrated on public health emergencies in particular regions, such as influenza A (Influenza A virus subtype H1N1) and Ebola haemorrhagic fever. Since the onset of the COVID-19 pandemic in 2019, there has been a significant rise in the number of published papers on the topic. This increase demonstrates the ongoing enhancement of research methodologies and underscores the growing global interest in these subjects. Despite the diminishing impact of the COVID-19 epidemic in 2022, the number of research publications related to it is expected to continue increasing, with academic research increasingly focusing on corporate over-indebtedness and operating risks.

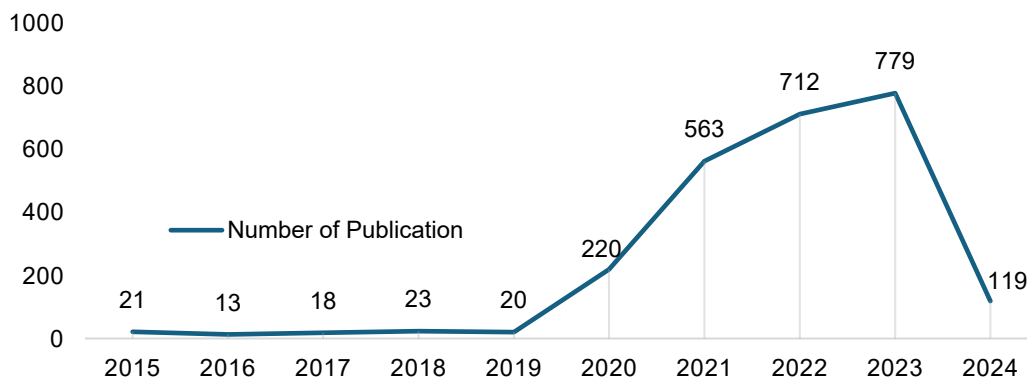


Figure 2: Publication trajectory

Derek John de Solla Price, a pioneer in scientometrics, introduced the concept of core authors in literature through Price's Law (Egghe & Rousseau, 1986). In a well-established research field, Price (1970) found that over 50% of the publications are authored by a select group of highly engaged researchers known as core authors (Vinkler, 2019). Price's Law can be depicted using the following formula:

$$\sum_{m+1}^i n(x) = \sqrt{N}$$

In this equation, *i* represents the publication count of the most prolific author, where *i* = *n*<sub>max</sub> as determined through VOSviewer's co-authorship analysis, resulting *i* = *n*<sub>max</sub> is 7 articles. *m* denotes the minimum number of publications by core authors within this theme. *N* signifies the number of authors who have published *x* articles, and *N* represents the total number of authors. Based on the Lotka's Law, Derek John de Solla Price deduced an important corollary of Price's Law (Allison et al., 1976; Egghe, 1987):

$$m = 0.749 \times \sqrt{n_{max}}$$

Following Schorr (1975) formula, where the minimum publication count for core authors in a theme is 0.749 times the square root of the most prolific author's publications, we calculated the threshold \*m\* as approximately 2.48, rounding it down to 2. Thus, authors with 2 or more publications were considered core authors. Using the VOSviewer (Visualization of Similarities Viewer) tool based on these criteria, we filtered and analyzed the data, identifying 84 core authors out of 7,113 total authors.

$$\sum_3^{11} n(x) \approx \sqrt{7113}$$

The analysis revealed that 84 authors have published 3 or more articles on the topic, which closely aligns with the patterns anticipated by Price's Law. This observation indicates the presence of a stable and cooperative academic community in this research field, providing a solid foundation for future in-depth studies. As shown in Table 1, the leading authors in terms of publication volume have each published 10 or more articles, further highlighting the emergence of a core group of high-yield contributors in this area.

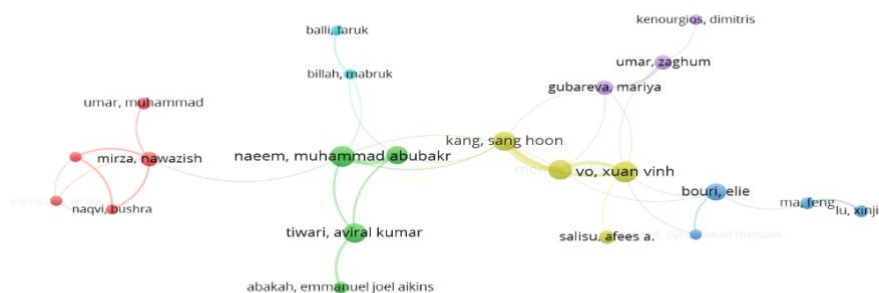
Table 1: Top 5 authors by publication volume

Author	Documents	Citations	Average Number of Citations
Kang Sang Hoon	10	185	19
Mensi Walid	11	152	14
Naeem Muhammad Abubakr	12	348	29
Tiwari Aviral Kumar	10	260	26
Vo Xuan Vinh	12	81	7

There are five authors who have more than 10 publications. Naeem Muhammad Abubakr and Vo Xuan Vinh have the most publications, with 12 each (Naeem et al., 2023). Naeem Muhammad Abubakr is the most cited author with an average citation count of 29. Naeem Muhammad Abubakr's articles mainly discuss research in financial markets, with a focus on topics like market connectivity, ethics and religious finance, ESG market

efficiency, systemic risk and information transmission, and the interdependence of sustainable investments. He points out that the pandemic has exacerbated the interconnectedness of global financial markets, leading to increased asset prices and sensitivity to risks. Moreover, during the pandemic, different regions' Environmental, Social, and Governance (ESG) markets have exhibited asymmetric price efficiency, reflecting variations in market reactions to sustainable investments, and during the pandemic, the tail risk spillover effect in commodity markets has been comparatively studied during crisis periods, highlighting the market's vulnerability when facing extreme events(Nicholls, 1988; Qiao & Han, 2023).

A systematic aggregation analysis was conducted on the core author group (i.e., authors who published 3 or more articles). In order to more accurately explore the cooperative relationship between authors, we have carefully screened and distinguished those authors who have not yet formed a cooperative relationship (see Figure 3).



**Figure 3: Author Relationship Chart**

In bibliometric studies, prominent clusters in visualisation charts are groups with close connections, often sharing similar colour coding. The current chart for this topic shows colour variations and scattered distributions, indicating a lack of large, closely collaborating groups. The main group of authors forms six cohesive clusters, suggesting strong collaborative ties within each. Naeem Muhammad Abubakr is centrally positioned in the graph, highlighting his key role in the network and extensive links with other researchers. Although there's no unified large group in the network, Abubakr's centrality can be crucial for future collaborative expansion.

**Cluster Red Green and Purple: Appropriate Portfolio Investment Reduces Operational Risks during COVID-19**  
 Mirza Nawazish, Umar Muhammad, and Naeem Muhammad Abubakr collaborate on finance research, focusing on the impact of COVID-19 on sustainable investments. Using network analyses, they prove the interconnectedness of global investment markets and find that Islamic equity funds and sustainable development bonds became more resilient during COVID-19 (Mirza et al., 2022; Naeem et al., 2023). Health crises such as the Swine Flu, Ebola, and COVID-19 pandemics have strengthened the interconnectedness between crude oil and stock markets, with spillover effects extending to green energy stocks (Umar et al., 2024). During COVID-19, many firms experienced declining debt repayment capacity, particularly in severely affected sectors. To address these pressures, equity and debt support mechanisms as well as diversified investment strategies, such as investing in stock funds and high-performing bonds, were suggested to help firms maintain financial stability and reduce operational risks during crisis periods (Mirza et al., 2022).

**Cluster Yellow Blue and Turquoise: COVID Affects Global Investor Sentiment, Different Industries Need Different Business Adjustments**  
 Kang Sang Hoon, Vo Xuan Vinh, Bouri Elie, and other researchers, identified by large, highly connected nodes, are pivotal figures in their subfields, mainly researching the transmission of volatility across financial markets. Their work during the COVID-19 pandemic includes studying intraday volatility spillover among the oil, gold, and stock markets, exploring how the pandemic affects stock return forecasting with a focus on the influence of health news, examining the complexity and effectiveness of the green securities market, analysing the correlation between G7 stock markets and green bonds, and investigating global impacts (Mensi et al., 2023). Overall, these studies offer valuable insights into the pandemic's differential effects on global financial markets across industries and countries, indicating that companies should customize their business strategies according to industry specific characteristics.

The number of articles on a specific topic published in journals is highly skewed. When all journal literature is sorted in descending order by the number of articles published, it can be divided into three equal sized regions:

the core region, the related region, and the unrelated region, with the quantity relationship among them following a specific ratio. The formula is as follows:

$$\text{Unrelated Region} = 1: n: n^2$$

When a topic's publication quantity follows this pattern, it satisfies Bradford's Law, which helps identify core journals. For our study, 2,488 articles are distributed across 804 journals. As shown in Table 2, the distribution of literature and journals conforms to Bradford's Law, with approximately 858 articles in each of the three zones. This pattern indicates that a relatively small number of core journals account for a large proportion of publications, while the remaining articles are dispersed across a wider range of journals (Borgohain et al., 2021; Drott & Griffith, 1978).

**Table 2: Table Brad distribution table (m=3)**

Partition	Reference Frequency	Number of Periodicals	Number of Articles	Bradford Constant
Core Area	>9	44	830	\
Associative Zone	9~3	228	949	5.18
Uncorrelated Region	<3	532	709	2.33
Total	\	804	2488	\

When the literature was divided into three regions, the variance in the number of articles was 15,501, and the variance of the Bradford constant was 4.06. In contrast, categorizing the literature into four regions reduced the variance of the article count to 1,115 and the variance of the Bradford constant to 0.16, indicating a more even distribution of articles across regions. With the Bradford constant variance at 0.16 and each regional Bradford constant ranging between 2 and 4, the publication patterns of journals on this topic align well with Bradford's Law. As shown in Table 3, journals publishing 12 or more articles related to business risks and excessive indebtedness during the COVID-19 pandemic were identified as part of the minimum core region, providing a concise reference for further research in this area.

**Table 3: Statistics table of top 10 journals by publication volume**

Source	Documents	Citations	Average Citations
Journal of Risk and Financial Management	64	890	14
Risks	52	287	6
Finance Research Letters	51	2009	39
International Review of Financial Analysis	39	1411	36
Energy Economics	35	473	14
Economic Analysis and Policy	32	526	16
Financial and Credit Activity-Problems of Theory and Practice	31	17	1
Economic Modelling	27	327	12
Research in International Business and Finance	26	436	17
Technological Forecasting and Social Change	25	1214	49
Total	385	7590	-

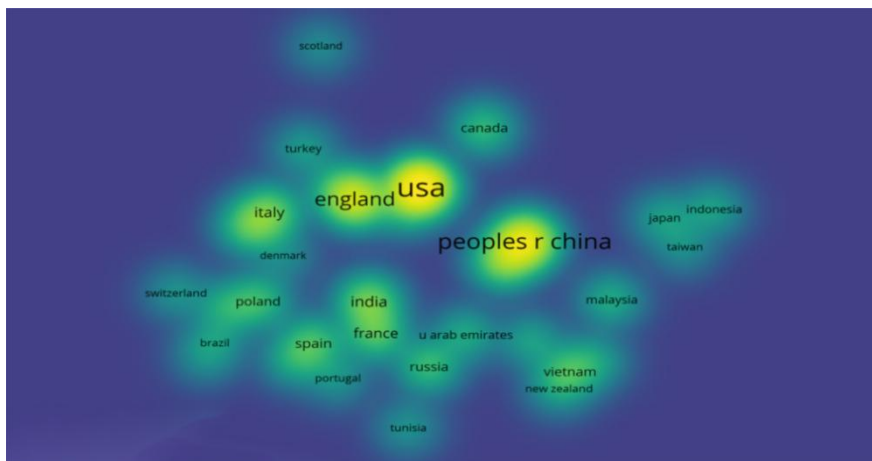
Over the past decade, research on this topic has mainly appeared in economics and management journals. "Journal of Risk and Financial Management" (64 articles), "Risks" (52 articles), and "Finance Research Letters" (51 articles) are the most productive outlets. In terms of average citations, "Technological Forecasting and Social Change", "Finance Research Letters", and "International Review of Financial Analysis" rank highest. These trends indicate increasing attention to enterprise investment and innovation management during crises, highlighting the role of diversified investment strategies in mitigating business risks (Xie et al., 2015; Russo & Zito, 2021).

These findings can also be interpreted through several foundational theoretical perspectives in business and management research. From the perspective of agency theory, corporate debt plays a dual role in organisational governance. Moderate leverage may help discipline managerial behaviour by limiting free cash flow and increasing monitoring by creditors, but excessive leverage may intensify conflicts between shareholders and creditors, particularly during periods of financial distress. The increased research attention to debt sustainability and financial vulnerability during the COVID-19 pandemic identified in this study reflects these theoretical concerns.

The growing research cluster on ESG finance during the pandemic can be interpreted through stakeholder theory, which emphasises that firms should consider the interests of multiple stakeholders, including investors, employees, and society. The increased focus on ESG investment and sustainable finance during the COVID-19 crisis suggests that firms adopting stakeholder-oriented governance structures may demonstrate stronger resilience during economic disruptions. From a strategic management perspective, this trend also reflects the rising importance of organisational resilience, as firms were forced to adjust financial strategies, operational structures, and risk management practices in response to the uncertainty created by the pandemic.

### 3.3 Distribution of Literature Publication by Country

Researchers analysed studies from 119 countries to determine which countries have made significant contributions in this thematic area. We analysed only countries with a publication count exceeding 30 articles to minimise data redundancy and enhance graphical clarity. Figure 4 presents the density of national publication quantities.



**Figure 4: Density map of research publication by country**

This paper used VOSviewer to analyze literature data and created a publication density map for countries with over 30 articles, where yellow hued and larger sized areas indicate higher volumes. China, the US, and the UK top the publication volume list, followed by Italy, India, and Spain, suggesting that research on corporate over leveraging and operational risk during COVID-19 mainly centers on these leading countries. A cooperation network map (Figure 5) was generated to clarify cross-country research collaborations, showing clustering effects among nations that reflect the pandemic's wide-reaching impact on business. Thicker lines indicate stronger collaborative ties, while different colored clusters represent varying collaboration intensities, with five major research clusters identified. The US-led cluster demonstrates strong links with China, the UK, and Canada, highlighting its leading influence, and the study also provides a statistical analysis of the top ten countries by publication volume.

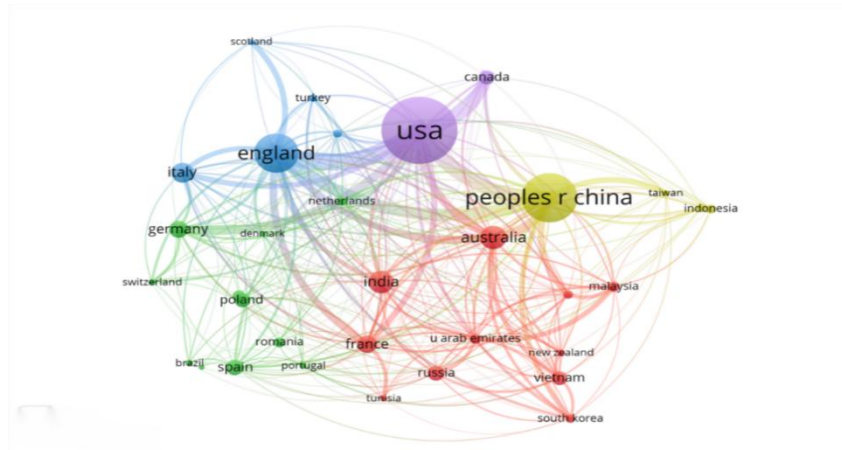


Figure 5: Research collaboration network map by country

As shown in Table 4, the data reveal that the USA tops the publication volume list with 510 articles, far outpacing other countries, while China ranks second with 364 publications. In terms of average citations per article, however, Spain leads with 36.29, highlighting the strong influence of its research. The USA and England both maintain relatively high citation averages of around 25 per article, which aligns with the results observed in the previous visual analysis. Overall, these findings underscore the diverse academic contributions and varying research impacts across different countries.

Table 4: Top 10 countries by publication volume: a statistical table

Country	Documents	Citations	Average Number of Citations
USA	510	12651	24.81
People's Republic of China	364	5260	14.45
England	283	7029	24.84
Australia	161	3237	20.11
India	153	1794	11.73
Italy	134	1231	9.19
France	116	2113	18.22
Germany	113	1686	14.92
Spain	100	3629	36.29
Russia	96	968	10.08
Total	2030	39598	-

### 3.4 Keyword Data

Analyzing keywords helps to understand an article’s research focus and topic trends. This study identified 2,574 documents containing 9,735 keywords related to the research theme, with “COVID-19” being the most frequent keyword, appearing 1,202 times. According to Price’s Law, core keywords should occur at least 26 times ( $m = 0.749 \times \sqrt{1202} \approx 26$ ), and a total of 105 core keywords were identified. As shown in Table 5, the most frequent keywords and their link strengths further highlight the central themes and interconnections within this research field.

$$m = 0.749 \times \sqrt{1202} \approx 26$$

Table 5: Table of keyword co-occurrence and link strength

Keyword	Occurrences	Total Link Strength
covid-19	1337	6635
risk	539	3284
impact	343	2363

Keyword	Occurrences	Total Link Strength
performance	216	1600
management	179	1230
volatility	138	947
model	137	834
market	134	841
determinants	130	866
uncertainty	128	855
Total	3281	19455

Figure 6 shows that the keyword "COVID-19" is the most commonly appearing term in this field, aligning with our research focus on the COVID-19 pandemic. Subsequently, keywords like "risk," "impact," "performance," and "management" show strong connections, suggesting that recent research on this topic focuses on business risks, the effects of COVID-19 on companies, performance, and management strategies during the pandemic.

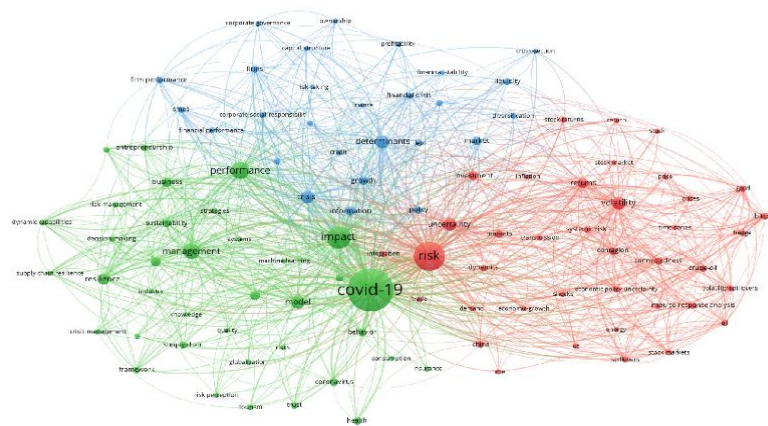


Figure 6: Main Research Cluster Map

#### 4. Discussion and Future Research

Assessing the long-term impact of the COVID-19 pandemic on corporate financial structure has become an important research topic. The global spread of the pandemic created severe cash flow pressures for many firms, prompting increased borrowing to sustain operations, which may affect long-term financial stability (Adrian, Natalucci & Qureshi, 2022). Rising debt levels can increase financial risks and financing costs, making firms more vulnerable to future uncertainties. The impact of the pandemic is also dynamic and varies across industries and regions, influencing corporate financing decisions and financial resilience (Thi Mai Nguyen et al., 2023; Deviyanti et al., 2023). Some industries are more sensitive to pandemic shocks, while firms in certain regions benefit from policy support and stronger resilience (Nurlaily & Nasution, 2021; Lu et al., 2021). In response to such challenges, firms may improve financial resilience by adopting diversified financing strategies, strengthening cash flow management, and reducing excessive debt (Hassan et al., 2021). Understanding these dynamics is important for explaining how corporate financial structures evolve during large-scale economic disruptions (Shen et al., 2020).

During the COVID-19 pandemic, businesses across industries faced rising debt and financial pressure, leading many firms to adopt strategies aimed at strengthening financial resilience. Firms that responded quickly to changing market conditions were generally better able to manage financial shocks (Kadar & Jaki, 2024). Companies with stronger ESG practices also demonstrated more sustainable responses to the crisis (Cheema-Fox et al., 2021), while excessive leverage highlighted the need for systemic protection to maintain financial stability (Erdem & Rojahn, 2022). However, responses varied across industries and firm sizes. Retail and catering businesses often relied on short-term loans, rent deferrals, or renegotiation with suppliers to manage cash flow pressures (Kelly & Chicksand, 2024), whereas firms in technology and healthcare sectors expanded production or invested in research and development through market financing (Erdiaw-Kwasie et al., 2023). Larger firms generally had greater access to diversified financing options such as bank loans, bonds, and equity markets (Thi

& Kong, 2025), while smaller firms relied more on external support and strategic adjustments to remain competitive (Ogunmokun, Mafimisebi & Obembe, 2024). Overall, effective cost control, flexible strategy adjustment, and collaboration with governments and financial institutions are critical for improving corporate resilience and managing excessive debt during major economic disruptions (Feng & Xue, 2023; Tavadyan & Aslanyan, 2023; Acciarini, Boccardelli & Vitale, 2021).

The COVID-19 pandemic has significantly disrupted global supply chains and increased corporate financial risks. Lockdowns, trade restrictions, and shortages of raw materials interrupted production and logistics, while declining global demand created inventory backlogs and sales pressures (Moosavi et al., 2022; Moosavi, Fathollahi-Fard & Dulebenets, 2022). These disruptions reduced corporate revenues while fixed costs and liabilities remained unchanged, intensifying liquidity pressures and debt burdens for many firms (Paul et al., 2021). Highly leveraged firms became particularly vulnerable, facing higher financial and credit risks and an increased probability of default (Magwedere & Marozva, 2022; Krykhovetska et al., 2024). Such financial distress can also generate spillover effects across supply chains and industries (De Vito & Gómez, 2020; Baixauli-Soler et al., 2024). Overall, the pandemic has revealed the vulnerability of global supply chains and highlighted the need for stronger resilience and risk management strategies to address future large-scale disruptions (Raj et al., 2022; Duong et al., 2023; Bani-Irshid et al., 2023).

The COVID-19 pandemic accelerated digitalisation and online shopping, significantly changing consumer behaviour and reducing traffic to traditional physical stores (Afridi et al., 2021; Manjur, 2022). Growing health and safety concerns also shifted demand toward products such as health goods and protective equipment (Sanje & Basa, 2022). In response, businesses adjusted their market positioning and strategies by expanding online sales channels, strengthening digital marketing capabilities, and improving product innovation and supply chain management (Lemes et al., 2021; Setini et al., 2021). These behavioural shifts have complex implications for corporate financial conditions and debt levels. While online sales can create new revenue opportunities (Valaskova, Durana & Adamko, 2021), uncertain demand and market fluctuations may increase operational risks and cash flow pressures, particularly for highly leveraged firms (Ma et al., 2022; Nigmonov & Shams, 2021). Therefore, future research should further explore how changes in consumer behaviour influence enterprise financial stability and debt management, as well as how firms of different sizes and industries adapt their strategies to maintain resilience under market uncertainty (Gano & Buccat, 2024; Dias et al., 2022; Pu et al., 2021).

## **5. Conclusion and Limitations**

This study applies bibliometric analysis to examine the evolving research landscape concerning corporate overleveraging and business risk during the COVID-19 pandemic. By analysing a large body of literature from the Web of Science database and applying bibliometric techniques such as co-citation analysis, keyword co-occurrence analysis, and visualisation mapping, the study provides a systematic overview of the intellectual structure, key research themes, and development trends in this field. The results identify major research clusters related to financial vulnerability, corporate resilience, supply chain disruption, ESG finance, and crisis-driven strategic adjustment.

The findings demonstrate that the COVID-19 pandemic has had a significant and widespread impact on corporate financial structures and operational risk. The crisis intensified financial pressure for firms with high leverage, particularly in capital-intensive industries, while supply chain disruptions and declining demand further amplified operational uncertainty. At the same time, the literature increasingly highlights the importance of effective financial management and risk mitigation strategies in strengthening corporate resilience during crisis periods.

From a theoretical perspective, these findings can be interpreted through the lens of strategic management theory. In particular, the growing emphasis on corporate resilience reflects the importance of developing dynamic capabilities, which enable firms to sense environmental changes, reconfigure resources, and adapt their strategic responses under conditions of uncertainty. Firms with stronger dynamic capabilities are better positioned to adjust their financial structures, diversify financing channels, and respond effectively to sudden economic disruptions. In addition, the findings highlight the importance of strategic flexibility, which allows organisations to modify investment decisions, operational strategies, and financing arrangements in response to rapidly changing environments. During crisis events such as the COVID-19 pandemic, firms that maintain greater strategic flexibility may be better able to reduce financial vulnerability and maintain operational stability.

Methodologically, this study contributes to business and management research by demonstrating how bibliometric mapping can be used to systematically analyse complex and rapidly evolving research topics during global crisis events. By visualising knowledge structures, identifying influential scholars and journals, and tracing the evolution of key research themes, bibliometric analysis provides a valuable methodological framework for synthesising fragmented academic debates. This approach enables researchers to better understand how theoretical discussions and empirical studies in corporate finance, risk management, and strategic management have developed during periods of large-scale disruption.

The findings also provide practical implications for managers and policymakers. For example, firms operating in capital-intensive sectors should adopt more flexible financing structures and strengthen liquidity management to reduce financial vulnerability during crisis periods. At the same time, companies should improve their ability to adapt to external shocks by developing dynamic capabilities, enhancing strategic flexibility, and implementing diversified risk management strategies. Governments and financial institutions can also support corporate resilience by providing policy support and financial instruments that help firms maintain stability during periods of economic uncertainty.

Despite these contributions, this study has several limitations. First, the bibliometric analysis relies primarily on the Web of Science database, which may exclude relevant publications indexed in other databases such as Scopus or emerging interdisciplinary sources. Future research could incorporate multiple databases to provide a more comprehensive view of the literature. Second, the COVID-19 pandemic represents a rapidly evolving global crisis, and the literature in this field continues to expand. As new studies emerge, future bibliometric analyses may further refine our understanding of research trends and theoretical developments related to corporate debt, business risk, and organisational resilience.

Overall, this study provides a comprehensive overview of the academic landscape on corporate leverage and business risk during the COVID-19 pandemic. By combining bibliometric methods with theoretical interpretation, the research contributes to a deeper understanding of how firms manage financial risk and build resilience in response to large-scale economic shocks.

**AI Statement:** We declare that the concept, structure, and main content of this paper are all original. We acknowledge the use of artificial intelligence to improve grammar and interpretation, which has been thoroughly reviewed and validated by the authors.

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