A Bibliometric Review on Use of Google Trends in Stock Market Research

Divya Jain
Research Scholar, Manav Rachna International Institute of Research and Studies, (Deemed to be University) Faridabad,
and Assistant Professor, Delhi Institute of Advanced Studies
divyajain0803@gmail.com

Meghna Chhabra
Associate Professor, Manav Rachna International Institute of Research and Studies, (Deemed to be University) Faridabad

DoI: 10.23862/kiit-parikalpana/2023/v19/i1/220838
Date submitted: 18.08.2022; Revised: 4.5.2023

Abstract

As an investor sentiment measurement tool, there is growing adoption of internet technology in financial market. On a large scale, the public mood represented on the internet reflects the entire society. The internet's pervasiveness in people's lives has sparked a surge of interest among scholars in the field. The study of financial theories has been changed by the subject of market efficiency as a result of increasing anomalies. As a guide for future research, the purpose of this study is to conduct a bibliometric analysis focusing on tracing of investor sentiments through their web search-based queries measured by Google Trends. The analysis through VOS viewer covers 272 papers refined from SCOPUS database of 1330 articles. With the help of Citation and Co-citation analysis results identify foundation articles, turning point articles and article clusters. The study closes with recommendations for future research as well as theoretical implications.

Keywords: Bibliometric Study, Google Trends, Search Engine Data, Stock Markets Returns, VOS Viewer

INTRODUCTION & LITERATURE REVIEW

The influence of the behavior of an investor in his financial decision-making cannot be ignored and must be given due importance. The question on efficiency of markets due to increasing anomalies has revolutionized the study of financial theories. Economists have identified that the extreme fluctuations in the market cannot be explained only by the underlying fundamentals of the

financial markets. There are various psychological concepts and numerous theories which are applicable in the field of behavioral finance. Investor sentiment can be considered as a relevant factor to explain the investors' behavior in financial markets. Since no universal standard measure is there to determine investor sentiments, so various methods like surveys, indexes based on macro-economic variables have been utilized in past years. In recent years, new ways of measuring public mood and sentiment have emerged in the form of social media posts, blogs, news headlines or web search-based data.

The rapid evolution of digital landscape has made people to spend considerably more time on the internet using connected technology. A report by Digital Market Outlook on Statista.com (2020) states that in 2020, the number of internet users in India has increased to 696.77 million from 302.36 million in 2015 and it is expected to grow to a whopping number of 974.86 million by 2025. This continuous increase in internet users posits the need to examine the information accumulated through internet sources.

In the context of financial markets, a prominent impact on stock markets on the basis of large volume and rapidly disseminated data is quite evident. The connection between the market movements and web search-based data cannot be ignored and this is becoming a significant field of study and research as well. Study of Tantaopas, Padungsaksawasdi & Treepongkaruna (2016), stated that internet search intensity has been emerging as a better direct proxy for investors' attention in comparison to earlier indirect proxies used. There are different platforms available which can be utilized to gather the online data for the purpose of predictions. Out of those platforms, Google Search Volume Index is the most utilized one (Agarwal, Kumar & Goel, 2019). Based on the queries posted on Google across various regions and languages for any search term keyword, a platform is provided by Google known as 'Google Trends' (Google Search Volume Index), introduced in 2012. Earlier since 2008, Google provided with Google Insights for Search (GIS), a service to display data on search trends which later emerged as Google Trends in 2012. The present ongoing trend portrays the extensive usage of internet and social media platforms to represent the opinion and sentiments about each and every event. This area has emerged as a fascinating field of research as a huge amount of data is available, and a lot of exploitation and extraction is possible to generate eloquent results and new knowledge.

Prior to this review, there had been a limited number of literature review publications related to distinct themes of behavioral finance. In recent years, there has been an increased use of bibliometric analysis to overview varied research areas. Various researchers have also explored domains and branches

of behavioral finance bibliometrically. Work done by Hirsch (2005) states that the bibliometric analysis highlights the research trends and provides analytical overview of knowledge map in context of published scientific articles. Table 1 represents the list of these reviews along with the major findings of the study. Most of the reviews pertains to different themes. There is no work which directly and specifically traces the field of Google trends research with stock markets. Such gaps provide roadmap of this research.

Table 1: Bibliometric Studies in the Literature

Author	**Title of Study**	**Key Findings**
López-Cabarcos et al. (2019)	"*Investor sentiment in the theoretical field of behavioral finance*"	Relates behavioral finance to traditional finance.
(Paule-Vianez et al., 2020)	"*A bibliometric analysis of behavioural finance with mapping analysis tools*"	Different themes of behavioral finance and behavioral economics are identified
Fariska et al. (2020)	"*Defining and Measuring Microblogging Sentiment Investors on Stock Market: A Literature Review*"	Explored the emergence of online platforms as an important place for exchange of stock market information among investors. With advent of technology, new ways of capturing investor sentiment through social media platforms like Twitter, etc were revealed
Abdulrasool et al. (2020)	"*A review and bibliometric analysis of global research trends on the behavioural finance using scopus databases*"	The study discovers US and China as countries with more publications and good international collaborations. Currently explored areas include price anomalies and noise traders. The study also identifies potential areas for future studies could be sentiment analysis and perceived value.
Valcanover et al. (2020)	"*Behavioral Finance Experiments: A Recent Systematic Literature Review*"	Conducting a comprehensive literature review for the Journal of Behavioral Finance's behavioral finance research, highlighting notable authors, nations, and articles in the area.
Zhang et al. (2021)	"Big data analytics and machine learning: A retrospective overview and bibliometric analysis"	Deep learning and visual analytics were identified as subjects with a large future research potential. Their cluster-level understanding gives saturated areas such as firm performance and dynamic capacities, which necessitates reviving study using an interdisciplinary method.

Komalasaria et al. (2021)	"Herding behaviour in the capital market: What do we know and what is next?"	Uncertainty of information in capital markets has been identified as a cause of herding behavior in the literature. In addition, as a future study topic, the researchers might investigate and evaluate market circumstances that encourage herding behavior.
Choijil et al. (2022)	"Thirty years of herd behavior in financial markets: A bibliometric analysis"	After the subprime crisis, there has been an increase in study on herding behavior.
Avilés-Ochoa et al. (2021)	"*A bibliometric overview of volatility*"	Estimation, forecasting, and modelling are identified as major concerns linked with financial market volatility.
Su et al. (2021)	"*Online public opinion and asset prices: a literature review*"	Review of the literature on the influence of online public opinion on asset values via news and social media.

Purpose of the Study

With the view of the previously mentioned discussion, to identify the current dynamics in investor sentiment-stock market nexus, to provide the overview of ongoing research and to suggest the further directions for research, the present study researches investor sentiment through google trends to study its impact in stock markets through bibliometric analysis.

The current study recognizes the most prolific authors, the most cited and co-cited publications, highly publishing journals and countries, their relevance and significance in the current scientific literature. To identify the areas of existing literature requiring further research, it focuses on the dynamics and main research areas of this domain and suggest research gaps for future research projects. To identify the intellectual structure of current literature, the present study deliberates on the publication trends in the most influential journals, influential authors who have contributed in recent years and identifies the state of research collaboration in current literature.

RESEARCH METHODOLOGY

Data & Method

First of all, a reputed comprehensive bibliometric database is selected and Scopus is the widest journal accessing database on its record. Scopus is selected as the database for retrieval of articles and in October 2021 the database is searched for relevant key terms with Boolean Operators ("OR" & "AND") as depicted in Figure 1. Th initial search yielded 1332 articles, which were further screened on the basis of English language preference, removal of duplicates, relevant subject areas and relevancy of the paper to the key research area on the basis of reading of abstracts. Finally, for the purpose of citation and co-citation analysis, 272 research articles are bibliometrically studied with the help of Vos Viewer software.

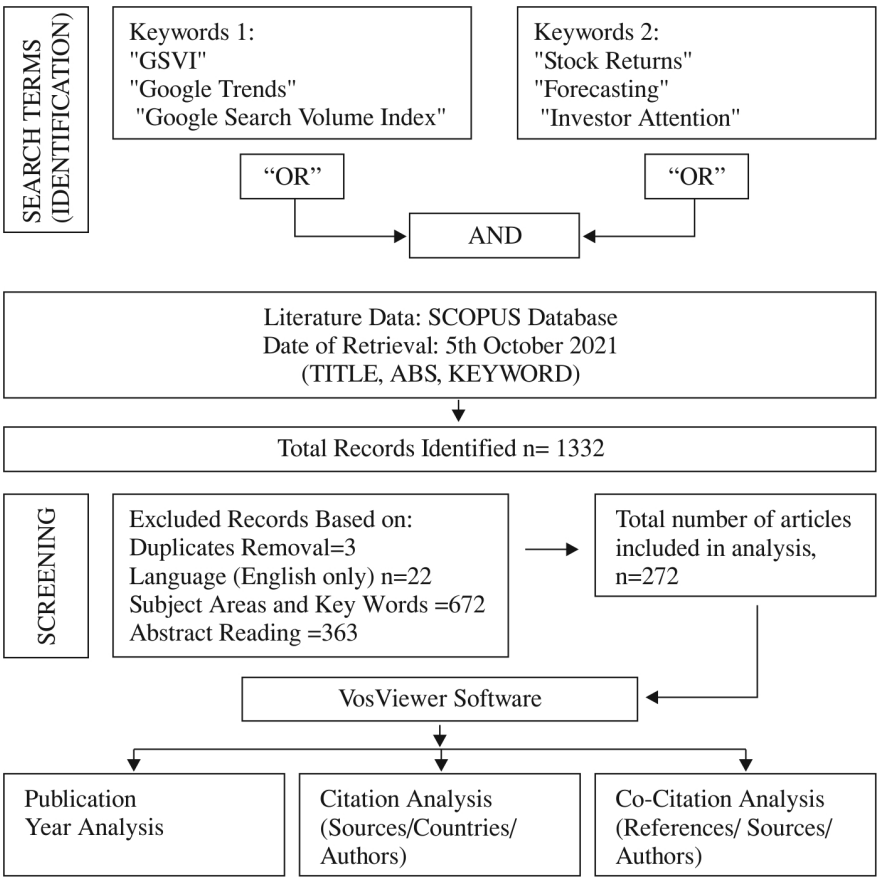

Figure 1: Data Retrieval & Framework (Author's Own)

Figure 2 highlights the steady growth in literature and its citation impact. A clear upward trend can be witnessed after 2016 suggesting increased interest of researchers in application of google trends to assess investor sentiments while taking investment decisions in stock market.

The study evaluates the different disciplines using google trends for forecasting and reveals all disciplines can be broadly classified as 2 groups. The economic and financial application of google trends in stock markets such as business, management and accounting, Economics, Econometrics and Finance. And the underlying technology in assessing this such as computer science, and decision sciences. Among all categories, literature in Business, Management and Accounting, Computer Science and Economics, Econometrics and Finance categories is maximum with more than 180 publications. Research on investor sentiments assessed through google trends presents the characteristics of diversified disciplines.

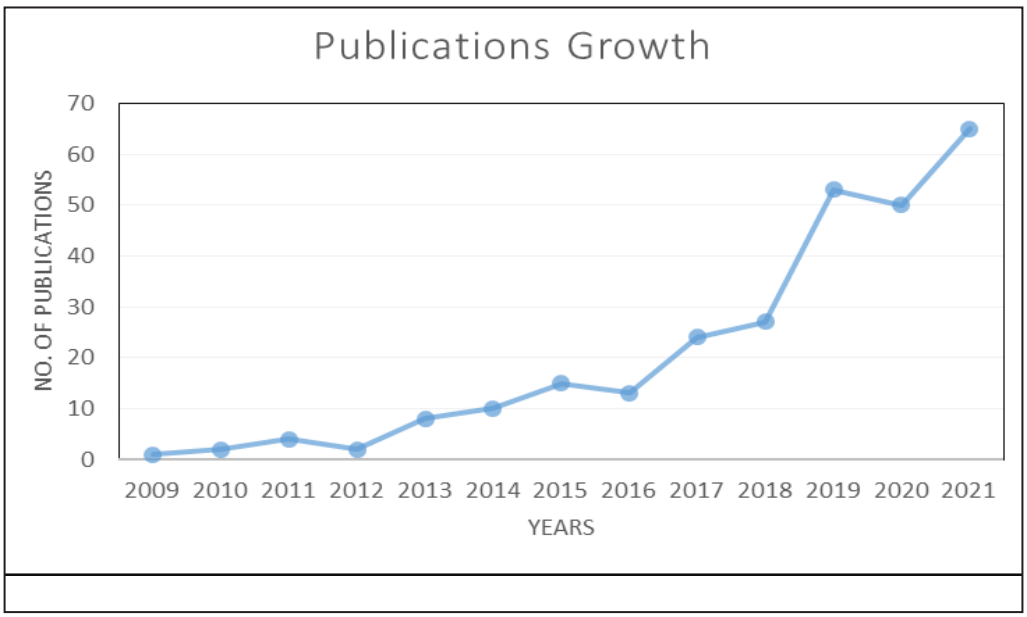

Figure2 : Number of Documents Published Year on Year

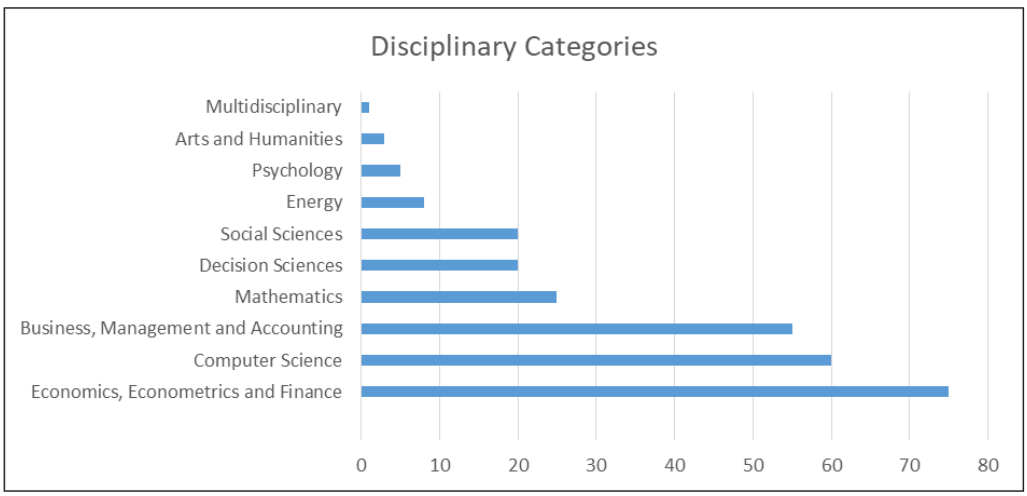

Figure 3: Disciplinary Categories

Citation Analysis

Citation by Sources

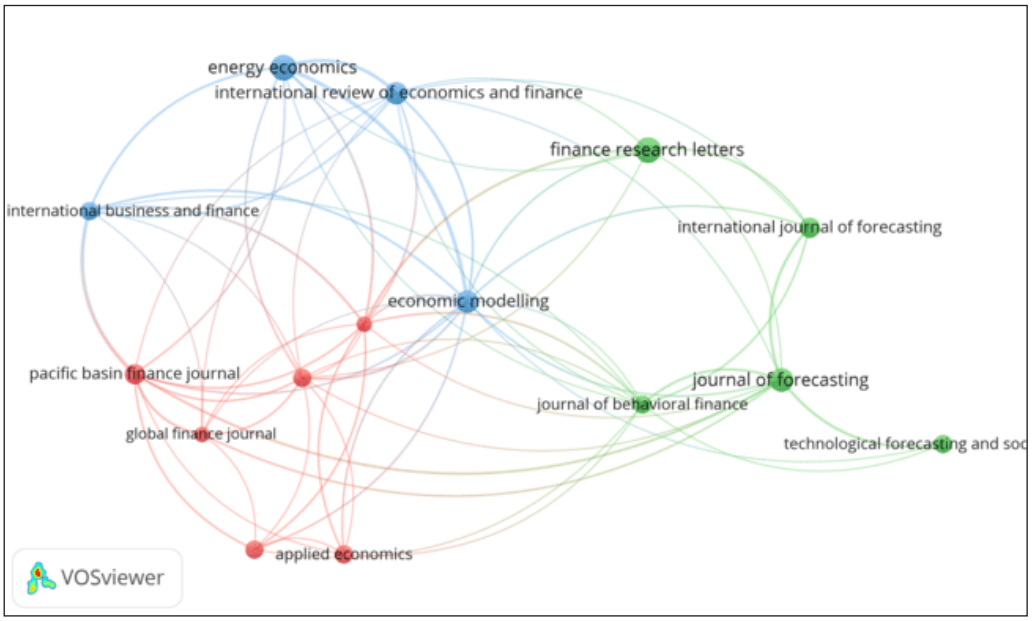

Figure 4: Network visualization map of the citation by sources

Notes: Minimum number of documents of a source = 3

Minimum number of citations of a source = 10 (132 sources, 18 meet d threshold, 15 linked)

Table 2: Citation by sources (Top 15)

Name of Journal	Cluster	TLS	TP	TC	Avg. Pub. Year	Avg. Citations
Journal Of Forecasting	2	22	7	304	2017.6	43.43
Economic Modelling	3	33	6	233	2016.3	38.83
Energy Economics	3	25	8	181	2018.9	22.63
Journal Of Banking and Finance	1	24	3	172	2016.7	57.33
Technological Forecasting and Social Change	2	6	4	167	2017.5	41.75
Finance Research Letters	2	11	8	140	2019.4	17.5
Pacific Basin Finance Journal	1	25	5	133	2017.0	26.6
International Journal of Forecasting	2	11	5	119	2019.8	23.8
International Review of Financial Analysis	1	17	4	106	2018.0	26.5

Journal of Behavioral Finance	2	15	4	35	2018.5	8.75
Applied Economics	1	8	4	30	2017.3	7.5
Research In International Business and Finance	3	21	4	26	2019.3	6.5
International Review of Economics and Finance	3	20	6	25	2020.2	4.17
Review of Behavioral Finance	1	10	4	23	2020.0	5.75
Global Finance Journal	1	12	3	14	2019.7	4.67

(TLS: Total Link Strength, TP: Total Publications, TC: Total Citations)

When analyzing cited journals in the area of google trends and investor attention, the total citations is used as the main indicator to identify the most influential journals. Table 2 displays the Top 15 highest cited journals. The Journal of Forecasting has the maximum number of citations with the citation frequency of 304 followed by Economic Modelling (233) and Energy Economics (181). The Energy Economics journal has the second most maximum link strength of 25 after 33 of Economic Modelling indicating the influence and relevance of studies of oil price and stock market nexus in this domain. The maximum number of publications (8) are in Energy Economics and Finance Research Letters but average citation of studies of Finance Research Letters is really less indicating non relatedness of the work. The work published in Journal of Banking and Finance has maximum average citation and good link strength revealing relatedness of studies. International Review of Economics and Finance and Review of Behavioral Finance can be identified as the emerging journals as average publication year is 2020. Most of the journals are from the field of economics or finance.

Citation by Countries

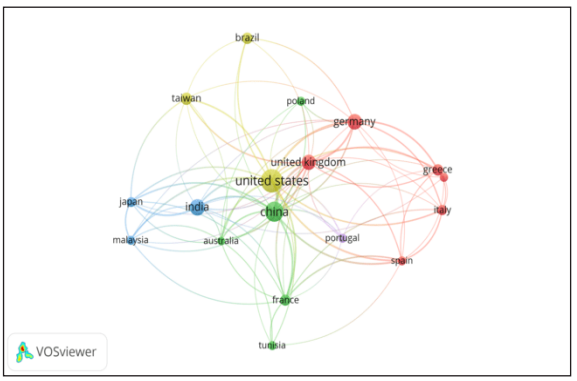

Figure 5: Network visualization map of the citation by countries (18 countries)
Notes: Minimum number of documents of a country = 5
Minimum number of citations of a country = 10 (57, 18 meet threshold)

With minimum number of documents as 5 from a country and minimum citations as 10, out of 57 countries only 18 meets the threshold as shown in network visualization map of countries in figure 5. United States has the highest contribution in terms of the maximum number of articles published (40) with highest total citations (563) and maximum link strength of 97. Germany and United Kingdom has fewer total publications than China and India but their total citations place them in top 3 countries which reveals the more relevance of the studies conducted in these countries. Malaysia and Poland can be considered as new emerging opportunity where average publication year is 2020 (as shown in Table 3) but citations are good in comparison to number of publications.

Table 3: Citation by Countries

Label (Countries)	**Cluster**	**TLS**	**TP**	**TC**	**Avg. Pub. Year**	**Avg. Citations**
United States	4	97	40	563	2017.4	14.07
Germany	1	42	18	439	2018.16	24.38
United Kingdom	1	55	17	373	2018.35	21.94
China	2	76	29	244	2019.17	8.41
France	2	39	9	164	2018.22	18.22
Greece	1	22	10	145	2018.4	14.5
Italy	1	20	8	131	2017.25	16.37
India	3	34	20	125	2019.05	6.25
Japan	3	30	7	119	2018	17
South Korea	1	9	6	114	2019.66	19
Spain	1	31	6	54	2019.33	9
Australia	2	32	5	51	2019.2	10.2
Poland	2	7	6	43	2019.83	7.16
Malaysia	3	21	6	24	2020	4
Taiwan	4	19	11	23	2018.81	2.09
Brazil	4	9	10	20	2019	2
Tunisia	2	9	6	17	2019.66	2.83
Portugal	5	12	6	11	2018.66	1.83

(TLS: Total Link Strength, TP: Total Publications, TC: Total Citations)

Citation by Authors

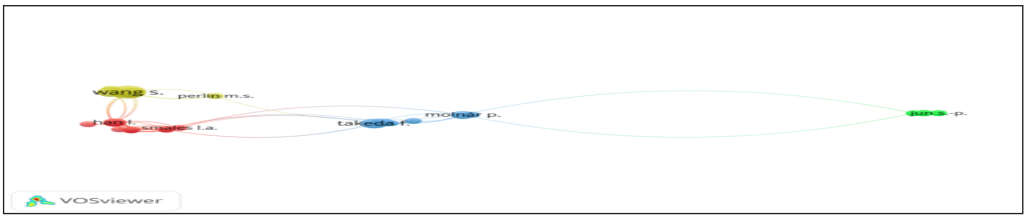

Figure 6: Network visualization map of the citation by authors
Notes: Minimum number of documents by an author = 2
Minimum number of citations of an author = 10 (556 authors, 38 meet d threshold, 28 linked)

Wang S. has the maximum number of publications 6 in number as shown in Table 4 but the work of Molnar P. has maximum citations of 133 with only 3 articles. The top three authors with maximum average citations are Jun S.P.(50), Yoo H.S. (50), and Molnar P. (44). Their number of publications are limited but the work is more cited which reflects the relevance of their studies for other researchers. As shown in figure 6, Molnar P. is central in the map which reflects relatedness of the studies. Also, for majority top authors the average publication year is around 2017-2018 which reflects recent growth in this research domain.

Table 4: Citation by Authors (Top 15)

Label	Cluster	TLS	TP	TC	Avg. Pub. Year	Avg. Citation
Wang S.	4	16	6	106	2017.83	17.66
Takeda F.	3	15	4	103	2017.75	25.75
Li X.	4	13	4	95	2017.25	23.75
Zhang X.	4	13	4	68	2018	17
Molnár P.	3	13	3	133	2018.66	44.33
Ma J.	4	13	3	94	2016.33	31.33
Han L.	1	19	3	74	2017.66	24.66
Yin L.	1	19	3	74	2017.66	24.66
Dharani M.	3	12	3	14	2020	4.66
Jun S.-P.	2	4	2	100	2019.5	50
Yoo H.S.	2	4	2	100	2019.5	50
Kita A.	1	11	2	56	2014.5	28
Wang Q.	1	11	2	56	2014.5	28
Lyócsa Š.	3	2	2	39	2020	19.5

Padungsaksawasdi C.	1	16	2	36	2018.5	18
Treepongkaruna S.	1	16	2	36	2018.5	18

(TLS: Total Link Strength, TP: Total Publications, TC: Total Citations)

Co-Citation Analysis

Co-Citation by Cited References

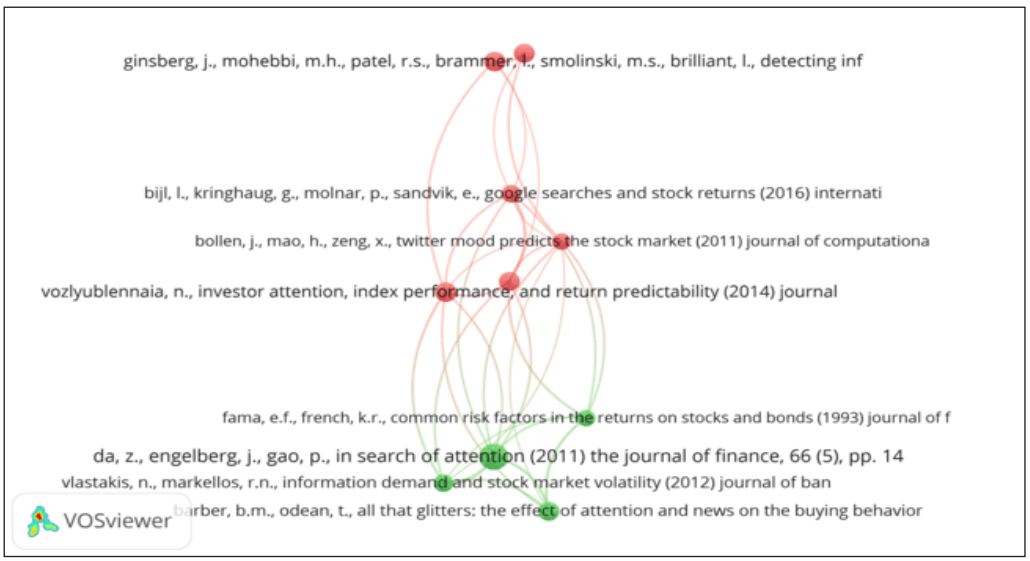

Figure 7: Network visualization map of Co-Citation
Unit of analysis =Cited References
Counting method: Full counting
Minimum number of citations of a cited reference= 8 (8467 references, 12 meet the threshold)

Table 5: Co-Citation by Cited References

Author	**Article**	**TLS**	**TC**
Da, Z., Engelberg, J., Gao, P., (2011)	*"In Search of Attention"*	22	19
Ginsberg, J., Mohebbi, M.H., Patel, R.S., Brammer, L., Smolinski, M.S., Brilliant, L., (2009),	*"Detecting Influenza Epidemics Using Search Engine Query Data"*	8	11
Vozlyublennaia, N., (2014)	*"Investor Attention, Index Performance, And Return Predictability"*	16	11
Barber, B.M., Odean, T., (2008)	*"All That Glitters: The Effect of Attention and News on The Buying Behavior of Individual and Institutional Investors"*	15	10

Choi, H., Varian, H., (2012)	*"Predicting The Present with Google Trends"*	8	10
Kim, N., Lucivjanska, K., Molnar, P., Villa, R., (2019)	*"Google Searches And Stock Market Activity: Evidence From Norway"*	20	10
Bijl, L., Kringhaug, G., Molnar, P., Sandvik, E (2016)	*"Google Searches and Stock Returns"*	15	9
Da, Z., Engelberg, J., Gao, P., (2015)	*"The Sum of All Fears Investor Sentiment And Asset Prices"*	12	9
Vlastakis, N., Markellos, R.N., (2012)	*"Information Demand and Stock Market Volatility"*	17	9
Bollen, J., Mao, H., Zeng, X., (2011),	*"Twitter Mood Predicts The Stock Market"*	13	8
Fama, E.F., French, K.R., (1993)	*"Common Risk Factors In The Returns On Stocks And Bonds"*	17	8

(TLS: Total Link Strength, TC: Total Citations)

The frequency with which one paper cites two other papers is known as co-citation (Small, 1973). This method is commonly used in bibliometric analysis to investigate the intellectual structure of the most prominent documents in a topic. In terms of the general research area, the more frequently two articles are co-cited, the more similar they are (Culnan, 1987). Publications that are too old and contain few citations, or documents that are too new, do not have a legitimate impact on the research domain (Pilkington & Fitzgerald, 2006). As a result, the study used a co-citation criterion of 8 papers for research in order to focus on the most influential publications in the field. Out of 8467 references, 12 meets the threshold. Figure 7 & Table 5 represents the network visualization and citations and link strength of the articles. The articles in a cluster have a common theme and are distinct from those in other clusters. The most cited reference with highest link strength is *"In Search of Attention"* by Da et al. (2011) with 22 link strength and 19 citations. The study represents that SVI is linked with but distinct from known investor attention proxies. It is more likely to assess the attention of retail investors since it catches investor attention in a timelier manner. An increase in SVI indicates that stock prices will rise in the following two weeks, with a price reversal occurring later in the year. It also adds to IPO stocks' high first-day returns and long-term underperformance.

The article "*Detecting Influenza Epidemics Using Search Engine Query Data*" by Ginsberg et al. (2009) is the second most cited article as it was the first study which utilized google trends data for the purpose of research and as it is related to diagnosis of a disease so it has less link strength. The next article in the list is article of Vozlyublennia N. (2014) "*Investor Attention, Index Performance,*

and Return Predictability" establishes the significant relationship and states that following the increase in attention, there is a large short-term change in index returns. A shock to returns on the other hand causes a long-term shift in attention. "*Google Searches and Stock Market Activity: Evidence from Norway*" by Kim et al. (2019) is a recent article published in 2019 but has second most link strength and good citations as well. The results of the study provide contradictory results and suggests that GSVI (Google Search Volume Index) provides no robust trading signal information and it cannot be used to predict or correlate future abnormal returns. The study of Barber and Odean (2008) titled "*All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors*" identified that individual investors were discovered to have attention driven buying behavior. On high volume days, they are net purchasers after both extraordinarily negative and extremely positive events.

Co-Citation by Cites Sources

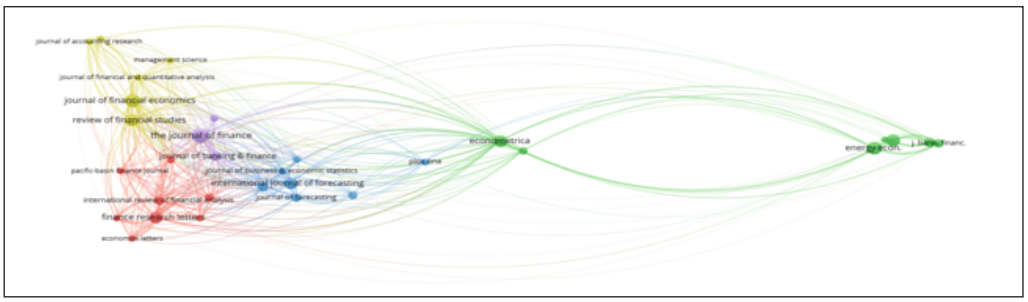

Figure 8: Network visualization map of Co-Citation
Unit of analysis =Cited Sources
Counting method: Full counting
Minimum number of citations of a cited source= 30 (3017 Sources, 31 meet the threshold)

Table 6 : Co Citation of Cited Sources (Top 15)

Journal	**Cluster**	**TLS**	**TC**
The Journal of Finance	5	3296	192
Journal Of Financial Economics	4	2810	160
Energy Economics	2	749	143
Review of Financial Studies	4	2450	136
J. Finance	2	764	131
Finance Research Letters	1	2061	122
Econometrica	2	1637	122

International Journal of Forecasting	3	1774	117
Journal Of Econometrics	3	1428	82
Journal Of Banking & Finance	5	1805	79
J. Financ. Econ.	2	909	78
International Review of Financial Analysis	1	1347	68
J. Bank. Finance	2	839	67
Journal Of Forecasting	3	858	60
Tourism Management	3	347	60

(TLS: Total Link Strength, TC: Total Citations)

The top most co cited source is the Journal of Finance with maximum link strength of 3296 with 192 citations. After this, the Journal of Financial Economics is the second top most the list with 2810 link strength and 160 citations. The third top most co-cited journal is Energy Economics with 143 citations but the link strength is low for the same (764). This reflects studies related to oil prices are similar in nature and relevant for the further work by the researchers.

Co-Citation by Cited Authors

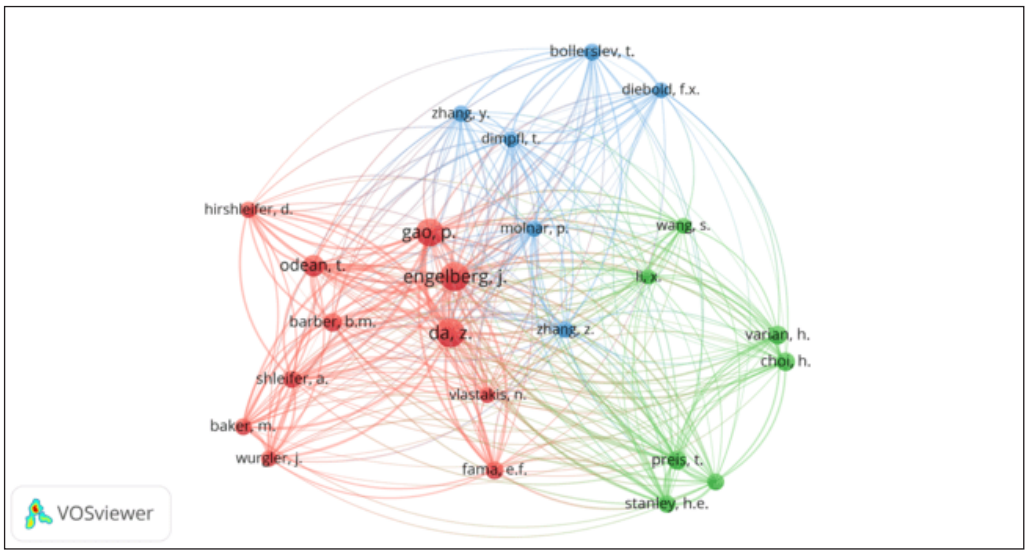

Figure 9: Network visualization map of Co-Citation
Unit of analysis =Cited Authors
Counting method: Full counting
Minimum number of citations of an author= 50 (9647 authors, 24 meet the threshold)

Table 7: Co- Citation of Cited Authors (Top 15)

Label (Authors)	Cluster	TLS	TC
Da, Z.	1	2198	176
Engelberg, J.	1	2173	172
Gao, P.	1	2059	160
Odean, T.	1	1348	99
Preis, T.	2	894	76
Choi, H.	2	557	75
Varian, H.	2	559	74
Barber, B.M.	1	1004	72
Fama, E.F.	1	869	70
Shleifer, A.	1	876	64
Stanley, H.E.	2	739	63
Bollerslev, T.	3	656	61
Moat, H.S.	2	720	61
Baker, M.	1	797	60
Molnar, P.	3	766	57

(TLS: Total Link Strength, TC: Total Citations)

Regarding the co-cited authors, out of 9647 co-cited authors, 24 meet the threshold of minimum 50 citations and are represented in Figure 9 and Table 7. The top three authors are Da, Z., Engelberg, J. and Gao, P. with maximum link strength and total citations of more than 150 each. All of them belongs to cluster 1 (red cluster). This shows first cluster included the most influential authors. This group of authors focused on establishing the utility of google trends as a measurement tool for investors attention. Most of the top 15 authors belongs to this cluster only. From cluster 3 (blue cluster) only two authors in top 15 are there: Bollerslev, T. and Molnar, P.

CONCLUSION

Google Trends has the advantage of gathering vast volumes of data, processing it to make analysis easier, and even making it freely available. As a consequence, Google Trends is a great tool for highlighting the advantages and disadvantages of big data. Furthermore, Google patterns research trends give valuable insights into how big data applications and usages are evolving. The study differs from standard literature reviews in that it aids new researchers in comprehending the scope of the issue under investigation, its evolution, and emerging and stagnant trends.

The noticeable academic attention which the concept of google trends and stock market returns received in past decade, makes this research stream as an interesting field of research. The work done in this study intends to fill the void of literature which is yet not fully

explored. By combining and utilizing distinct bibliometric methods of citation and co-citation analysis, the study tries to explore how literature is capturing the constantly changing online behavior of investors and its relation with stock market returns. The findings of the study provide comprehensive structure of google trends and stock markets literature to get acknowledgement of academia about the current contribution, potential research resources and scope of future research in the said field.

The studies based on bibliometric assessment subjects to their own limitations as results are highly dependent on choice of database, the keywords used in search criteria and methods used in analysis. Still the study manages to positively contribute in literature. The research contributes by providing useful information to researchers working in the field. To understand the intellectual structure of the existing literature co-citation and content analysis is done. The results identify most prominent journals publishing in this field along with most prolific authors. Increase in publications in last few years categorizes the field as fashionable research area. Co-citation analysis helps in identifying the most cited work or the seminal papers of the research field which can provide base for the future new research. The study domain swings between two disciplines: Finance & IT. The disciplinary categories publishing in this domain provides new lines of research in context of application of computer science approaches to define improved insights in the field of study. The measurement of investor sentiments with technological advancements provides new research scopes and guides the way for application of interdisciplinary approaches and new ways of considering investor sentiments to improvise their contribution in modeling stock market returns. Over the course of time research has evolved but witnesses lack of academic collaborations, cross industry studies, and theoretical development impede the current literature. There is need of further research to overcome limitation of existing theoretical and empirical framework. The current bibliometric analytical review the current literature. It establishes the lack of robust theoretical framework. The difference in macroeconomic conditions across industries can also guide the way for cross-industry studies.

References

Abdulrasool, H. D., & Othman, R. B. (2020). A review and bibliometric analysis of global research trends on the behavioural finance using scopus databases. *International Journal of Management (IJM),* 11(10). http://www.iaeme.com/IJM/issues.asp?JType=IJM&VType=11&IType=10

Agarwal, S., Kumar, S., & Goel, U. (2019). Stock market response to information diffusion through internet sources: A literature review. *International Jour-*

nal of Information Management, *45*, 118–131. https://doi.org/10.1016/j.ijinfomgt.2018.11.002

Avilés-Ochoa, E., Flores-Sosa, M., & Merigó, J. M. (2021). A bibliometric overview of volatility. *Journal of Intelligent & Fuzzy Systems*, *40*(2), 1997–2009. https://doi.org/10.3233/jifs-189202

Choijil, E., Méndez, C. E., Wong, W. K., Vieito, J. P., & Batmunkh, M. U. (2022). Thirty years of herd behavior in financial markets: A bibliometric analysis. *Research in International Business and Finance*, *59*, 101506. https://doi.org/10.1016/j.ribaf.2021.101506

Culnan, M. J. (1987). Mapping the intellectual structure of MIS, 1980– 1985: A co-citation analysis. *MIS Quarterly*, 11(3), 341. https://doi. org/10.2307/248680

Costa, D. F., Carvalho, F. D. M., & Moreira, B. C. D. M. (2019). Behavioral economics and behavioral finance: A bibliometric analysis of the scientific fields. *Journal of Economic Surveys,* 33(1), 3-24.

Da, Z., Engelberg, J., & Gao, P. (2011). The Sum of All FEARS: Investor Sentiment and Asset Prices. *SSRN Electronic Journal*. Published. https://doi.org/10.2139/ssrn.1509162

Da, Z., Engelberg, J., & Gao, P. (2011). In search of attention. *The Journal of Finance*, 66(5), 1461-1499.

Fariska, P., & Nugraha, M. M. A. R. (2021, September). Defining and Measuring Microblogging Sentiment Investors on Stock Market: A Literature Review. In *5th Global Conference on Business, Management and Entrepreneurship (GCBME 2020)* (pp. 29-35). Atlantis Press.

Farrukh, M., Shahzad, I. A., Meng, F., Wu, Y., & Raza, A. (2020). Three decades of research in the technology analysis & strategic management: a bibliometrics analysis. *Technology Analysis & Strategic Management*, *33*(9), 989–1005. https://doi.org/10.1080/09537325.2020.1862413

Ginsberg, J., Mohebbi, M. H., Patel, R. S., Brammer, L., Smolinski, M. S., & Brilliant, L. (2009). Detecting influenza epidemics using search engine query data. *Nature*, 457(7232), 1012-1014.

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences*, *102*(46), 16569–16572. https://doi.org/10.1073/pnas.0507655102

Jun, S. P., Yoo, H. S., & Choi, S. (2018). Ten years of research change using Google Trends: From the perspective of big data utilizations and applications. *Techno-*

logical Forecasting and Social Change, *130*, 69–87. https://doi.org/10.1016/j.techfore.2017.11.009

Kim, N., Lučivjanská, K., Molnár, P., & Villa, R. (2019). Google searches and stock market activity: Evidence from Norway. *Finance Research Letters*, 28, 208–220. https://doi.org/10.1016/j.frl.2018.05.003

Komalasari, P. T., Asri, M., Purwanto, B. M., & Setiyono, B. (2021). Herding behaviour in the capital market: What do we know and what is next? *Management Review Quarterly*. Published. https://doi.org/10.1007/s11301-021-00212-1

López-Cabarcos, M. N., Pérez-Pico, A. M., Vázquez-Rodríguez, P., & López-Pérez, M. L. (2019). Investor sentiment in the theoretical field of behavioural finance. *Economic Research-Ekonomska Istraživanja*, *33*(1), 2101–2119. https://doi.org/10.1080/1331677x.2018.1559748

Paule-Vianez, J., Gómez-Martínez, R., & Prado-Román, C. (2020). A bibliometric analysis of behavioural finance with mapping analysis tools. *European Research on Management and Business Economics*, *26*(2), 71–77. https://doi.org/10.1016/j.iedeen.2020.01.001

Pilkington, A., & Fitzgerald, R. (2006). Operations management themes, concepts and relationships: A forward retrospective of IJOPM. *International Journal of Operations & Production Management*, 26(11), 1255–1275. https://doi.org/10.1108/01443570610705854

Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the American Society for Information Science,* 24(4), 265–269. https://doi. org/10.1002/asi.4630240406

Su, Y., Qu, Y., & Kang, Y. (2021). Online public opinion and asset prices: a literature review. *Data Science in Finance and Economics*, *1*(1), 60–76. https://doi.org/10.3934/dsfe.2021004

Subudhi, R. N. (2019). Testing of Hypothesis: Concepts and Applications. Methodological Issues in Management Research: Advances, Challenges, and the Way Ahead, 127–143. https://doi.org/10.1108/978-1-78973-973-220191009

Tantaopas, P., Padungsaksawasdi, C., & Treepongkaruna, S. (2016). Attention effect via internet search intensity in Asia-Pacific stock markets. *Pacific-Basin Finance Journal*, 38, 107-124.

Urquhart, A. (2018). What causes the attention of Bitcoin? *Economics Letters*, *166*, 40–44. https://doi.org/10.1016/j.econlet.2018.02.017

Valcanover, V. M., Sonza, I. B., & da Silva, W. V. (2020). Behavioral Finance Experiments: A Recent Systematic Literature Review. *SAGE Open*, *10*(4), 215824402096967. https://doi.org/10.1177/2158244020969672

Vozlyublennaia, N. (2014). Investor attention, index performance, and return predictability. *Journal of Banking & Finance*, *41*, 17–35. https://doi.org/10.1016/j.jbankfin.2013.12.010

Zhang, J. Z., Srivastava, P. R., Sharma, D., & Eachempati, P. (2021). Big data analytics and machine learning: A retrospective overview and bibliometric analysis. *Expert Systems with Applications*, *184*, 115561. https://doi.org/10.1016/j.eswa.2021.115561