Relationship between investor sentiment and stock returns: a bibliometric analysis using SCOPUS database

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Abstract: This paper provides a comprehensive bibliometric analysis of the literature on the relationship between investor sentiment and stock returns. It identifies the key authors, publications, journals, publication countries, and reoccurring keywords using VOSviewer. It analyses 983 publications (procured through the SCOPUS database) using four bibliometric techniques: co-citation analysis, citation analysis, co-occurrence analysis, and bibliographic coupling. The results of the co-citation analysis of references and author reveal that 'Investor sentiment and the cross-section of stock returns' by Baker and Wurgler (2006) is the most cited article, and M. Baker is the top-cited author. The bibliographic coupling of sources suggests that *Finance Research Letters* leads in publications, co-occurrence analysis of author keywords reveals that behavioural finance, asset pricing, and volatility are the most occurring keywords. Further, the citation analysis of countries shows that the USA leads in terms of the number of publications, substantially growing globally since 2000.

Keywords: investor sentiment; stock returns; bibliometric analysis; VOSviewer; SCOPUS database.

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Anindita Chakraborty has more than ten years of academic and research experience. She has done her MBA with scholarship from Jiwaji University, Gwalior in 2004 and obtained her PhD degree in the area of international finance from Jiwaji University, Gwalior in 2010. She has published over 50 research papers in various national and international journals. Her areas of interest are economic psychology, capital markets, behavioural and personal finance.

1 Introduction

Behavioural finance has emerged as a distinct discipline integrating psychology and sociology theories into financial models (Shiller, 2003). Recently, the behavioural finance literature investigating the effect of investor sentiment on stock returns has witnessed increased focus amongst researchers (Chen et al., 2021; Phuong, 2021; He et al., 2020; Li, 2020; Affuso and Lahtinen, 2019). Investor sentiment refers to the investors' overestimation (underestimation) of stock returns, which is not necessarily guided by its fundamental value (Baker and Wurgler, 2006; Berger and Turtle, 2012; Brown and Cliff, 2004; DeLong et al., 1990). It is also defined as the collective judgement error made by a group of investors who are irrational and trade on noise (Barberis et al., 1998; Black, 1986). The nexus of the sentiment-return relationship contradicts the stance of traditional finance theories, which assumes that markets are informationally efficient and stock prices reflect the discounted value of expected future cash-flows (Fama, 1970). The doctrine of standard finance is based on the assumption of rational investors who make logical decisions, and even if some investors deviate from the path of rationality, the arbitrageurs step in to mitigate the effect of any irrational trading on stock prices.

However, the idea of investor rationality has been questioned by several researchers, including Simon (1956) and Kahneman and Tversky (1979), who advocate in favour of a behavioural approach to asset pricing. The behavioural approach to asset-pricing is based on two fundamental arguments: the role of psychological biases (Kahneman and Tversky, 1979) and the availability of costly arbitrage (Shleifer and Vishny, 1997). In reality, investor decision making is highly prone to the waves of investors' irrationality (Barberis et al., 1998; Shiller, 2003), which can affect the stock prices when combined with limited arbitrage opportunities (Shleifer and Vishny, 1997). The investors' sentiment can significantly influence their investment decisions, which can substantially impact future stock returns and security prices, causing asset prices to deviate from their fundamental value significantly (Anusakumar et al., 2017). The high (low) sentiment period reflects the mental frame and future expectations of optimistic (pessimistic) investors regarding the capital market (Stambaugh et al., 2012). Short sale constraints exert a more substantial impact on the market when sentiment is high and vice-versa as a greater (lesser) number of investors participate in the market when the markets are bullish (bearish) (Barber and Odean, 2008; Karlsson et al., 2009; Kim et al., 2014; Liu, 2015; Stambaugh et al., 2012; Trichilli et al., 2020; Yu and Yuan, 2011).

The field of behavioural finance that studies the effect of investor sentiment on stock returns has witnessed tremendous growth in the past two decades but lacks cohesion. The reason for the lack of a unifying framework can be attributed to the recent emergence and novelty of the field of sentiment-return relationships. To the best of our knowledge, the only study 'Investor sentiment in the theoretical field of behavioral finance' (López-Cabarcos et al., 2020) conducted a bibliometric analysis on 'investor sentiment'. Still, it only reports a part of the phenomenon because it studies the foundations of investor sentiment through the lenses of the theoretical field of behavioural finance with a lesser emphasis on the effect of investor sentiment on stock returns. Hence, to identify the opportunities for future empirical research and conduct a comprehensive exploration of available literature, we intend to conduct a bibliometric study that provides a general overview of the foundations of the relationship between investor sentiment and stock

returns. We propose to conduct this bibliometric analysis to explore the answers to the following research questions:

RQ1   Which are the most influential publications that study the relationship between investor sentiment and stock returns?

RQ2   Who are the leading authors in the domain of investor sentiment and stock returns?

RQ3   Which are the leading journals that publish the literature on investor sentiment and stock returns?

RQ4   What are the major themes (keywords) that revolve around the area of investor sentiment and stock returns?

RQ5   Which are the leading countries that publish the literature on investor sentiment and stock returns?

This paper analyses sentiment-return relationship patterns through a bibliometric study of the literature procured from the SCOPUS database. In the bibliometric analysis, we identify the important publications and authors in the research area (through co-citation analysis), the prominent journals (through the bibliometric coupling of sources), frequently occurring keywords (through co-occurrence analysis of author keywords), and country of publications (through citation analysis). This study will provide a wide-ranging and comprehensive analysis of the sentiment-return relationship literature.

The rest of the research paper is structured as follows: Section 2 discusses the background and concept of investor sentiment and stock returns, Section 3 describes the detailed methodology followed as well as the sample publications selected for the bibliometric analysis, Section 4 outlines the results of the bibliometric study, Section 5 deals with the discussion, contributions, and limitations of the study, and Section 6 presents the conclusions of the study.

2   Investor sentiment and stock returns

2.1   Background

The genesis of theoretical works on investor decision-making can be accredited to pioneering scholars in the 1970s, who propounded that decision-making is based on probabilistic methods and statistical outcomes that favour the ground for investors' rationality. The early empirical works of Markowitz (1952), Fama (1970), Fama and MacBeth (1973), Black and Scholes (1973) and Merton (1976) emphasise the rationality of investors and market efficiency, leading to a positive relationship between security betas and expected returns. The axiom of expected utility theory complies with the notion of rational markets where investors' decision-making is based upon computational unbiased forecasts (Simon, 1955). However, the expected utility theory was criticised by eminent scholars (Kahneman and Tversky, 1979; Simon, 1956) on the ground that it cannot fully explain human behaviour at all times since all individuals do not make rational decisions and are guided by their fundamental beliefs. The idea of investors' irrationality led to the emergence of the prospect theory (Kahneman and Tversky, 1979). prospect theory revolves around the idea that individuals tend to value gains and losses differently based upon the offered prospect or their subjective evaluation of the prospect.

The emergence of prospect theory led to the emergence of the widespread belief that individuals' decision-making process has room for social, behavioural, and psychological factors that impact investors' investment decision-making. Shiller (1981) demonstrated that stock prices vary in response to investor sentiment as investors' cognition and emotions guide their investment patterns. This new perspective on the decision-making by investors led to the emergence of the field of behavioural finance, which incorporates the psychological and emotional facet of investment decision making (Shiller, 2003) that significantly affects the stock returns. It is based on the assumption that investors make a judgemental error, which sometimes defies logic leading to investors earning sub-optimal returns. The decision-making process by the investors is affected by heuristics and biases, which represent systematic deviations from rationality. Hence, investors' sentiment plays a critical role in influencing their investment decisions (Lucey and Dowling, 2005).

2.2 Concept

The study of investor sentiment has gained steep momentum in the area of behavioural finance. Various scholars have defined investor sentiment over the years. Zweig (1973) defined investor sentiment as the difference in the valuation of the assets made by rational and irrational investors. Investor sentiment is the deviation of stocks above (below) their fundamental value due to unanticipated demand (supply) shocks (DeLong et al., 1990). Sentiment risk is the priced factor in determining stock prices, leading to overvaluation (undervaluation) of stock returns in the aggregate market. Investor sentiment exerts a strong influence over contemporaneous and future stock returns (Baker and Wurgler, 2006; Brown and Cliff, 2005). A high (low) investor sentiment indicates that investors are bullish (bearish) about the stock market (Liu, 2015). Investor sentiment is a contrarian predictor of stock returns (Baker and Wurgler, 2006), i.e., high (low) sentiment can lead to low (high) market returns (Frazzini and Lamont, 2008). Also, stocks that are hard to value and difficult to arbitrage are highly affected by investor sentiment (Baker and Wurgler, 2006, 2007).

Lemmon and Portniaguina (2006) studied the USA market and found that investor sentiment has predictive power to forecast returns on small stocks. Stambaugh et al. (2012) argue that the forecasting power of investor sentiment is visible in periods with high sentiment and on stocks in their short legs. Kumar and Lee (2006) show that noise trader's (retail investors) sentiment has greater explanatory power to predict returns for small, value, and low-priced stocks with low-institutional ownership. Few other studies also document the existence of the sentiment effect to reap small stock premiums (Neal and Wheatley, 1998; Swaminathan, 1996). Baker et al. (2012) advocate that a high level of investor sentiment is followed by subsequent low returns on the stocks that are difficult to arbitrage and hard to value. This points out that stock-specific characteristics can substantially impact investor sentiment (Baker and Wurgler, 2006, 2007; Lemmon and Portniaguina, 2006; Liston, 2016; Makris et al., 2013). Another stream of researchers believes that country-specific factors also drive investors' sentiment (Chui et al., 2010; Porta et al., 1998; Schmeling, 2009). Corredor et al. (2013) opine that both country-specific and stock-specific characteristics exert a stronger effect on investor sentiment. Also, investor sentiment affects stock returns across countries and is contagious across local and global markets, affecting international markets (Baker et al., 2012). Stock prices are also affected by firm-specific characteristics (Baker and Wurgler,

2006, 2007; Seok et al., 2019) as it drives investors' optimism (pessimism) about the expected future cash flows based on positive (negative) earnings announcements. Barberis et al. (1998), Berkman et al. (2009) and Zhang (2008) also document the effect of earnings announcement on stock returns. Li et al. (2017) document the existence of a causal relationship between investor sentiment and stock returns.

Empirical research also indicates that the performance of specific events such as sports affects the mood and sentiment of the local and global investors, which in turn has a bearing on stock returns. Payne et al. (2018) highlight that sports sentiment has a significant effect on stock returns before and after the super bowl games, and pre-game returns are positive for both (favoured and unfavoured) teams, but in the post-game regime, returns are significant for only favoured teams. The losses in the soccer game results negatively affect the post-game returns but winning leads to zero excess returns (Bernile and Lyandres, 2011). Few other scholars also document that the returns on stocks are affected by national and international sporting events due to fluctuations in sports sentiment (Dimic et al., 2018; Palomino et al., 2009). Investor sentiment can also lead to deviation of asset prices from their fundamental values in the period of pre (anticipated) or post terrorist attacks (Drakos, 2010; Chang and Zeng, 2011; Papakyriakou et al., 2019). Natural Calamities such as an earthquake can also trigger stock prices to deviate from their intrinsic value (Canbaş and Kandır, 2009; Hood et al., 2013; Shan and Gong, 2012). National and international news (Ishijima et al., 2015) and weather conditions (Brahmana et al., 2015; Wang et al., 2018) also substantially affect stock returns.

3   Methodology

3.1   Data

This bibliometric study is descriptive and follows a quantitative approach. The bibliometric analysis is a tool for studying the scientific literature by analysing the recorded information in the particular research field over time (Liu et al., 2014). It makes the use of quantitative techniques such as citation analysis, co-citation analysis, bibliographic coupling, co-authorship analysis, co-occurrence analysis to analyse the scientific data (Costa et al., 2019). To conduct bibliometric analysis, we used the SCOPUS database amongst the wide range of other databases (such as Web of Science, EBSCO, Google Scholar, ResearchGate, ProQuest, etc.) to identify the research publications in the field of investor sentiment and stock returns. The rationale behind using the SCOPUS database is that it is one of the largest scientific literature databases, including scientific journals, books, conference proceedings from around 11,000 publishers. It encompasses a broader spectrum of research outputs worldwide, catering to the field of science, social science, humanities, medicine, and others. However, the SCOPUS database suffers from certain limitations, such as using non-standard references and limited accessibility of publications published before 1995. We use only the SCOPUS database to extract the data. The choice of using only one database (SCOPUS) allows easy standardisation of data (Prado et al., 2016), which has been adopted in various studies such as Hammouti (2010), Huamani et al. (2015), Khudzari et al. (2018) and Morandi et al. (2015).

Table 1   Workflow of bibliometric analysis

Phases		Methods		Applications	
1	Design of the study	1.1	Research questions	RQ1	Which are the most influential publications that study the relationship between investor sentiment and stock returns?
				RQ2	Who are the leading authors in the domain of investor sentiment and stock returns?
				RQ3	Which are the leading journals that publish the literature in the domain of investor sentiment and stock returns?
				RQ4	What are the major themes (keywords) in the area of investor sentiment and stock returns?
				RQ5	Which are the leading countries that publish the literature on the relationship between investor sentiment and stock returns?
		1.2	Bibliometric methods	Co-citation analysis of references and authors, Bibliographic coupling of sources, Co-occurrence analysis of keywords, Citation analysis of countries	
		1.3	Time frame	1993 to 31 May 2021	
2	Collection of data	2.1	Search strings	'investor sentiment' in the title, abstract, and keywords AND 'stock returns' OR returns OR 'stock mispricing' OR mispricing OR 'stock market returns' OR 'stock price' OR 'security returns' OR 'asset pricing' OR 'stock valuations' OR 'equity returns' OR 'noise trader risk' OR 'forecasting returns' OR 'return predictability' OR overvaluation OR undervaluation searched in the title, abstract and keywords	
		2.2	Data source	SCOPUS database accessed on 31 May 2021	
		2.3	Data filtering criteria	Only publications available in the English language were selected	
		2.4	Data standardisation	The data were standardised using Bibexcel	
3	Analysis of data and visualisation	3.1	Descriptive analysis– Microsoft Excel	Overview of the number of publications and citations per year, Type of publications, and Subject area	
		3.2	Bibliometric analysis techniques – Microsoft Excel and VOSviewer	Description of prominent publications, leading authors, journals (impactful journals), important themes (keywords), and country of publications through four bibliometric techniques including co-citation analysis, bibliographic coupling, co-occurrence analysis, and citation analysis.	
4	Interpretation of data	4.1	Descriptive and content analysis	Described concurrently along with the analysis and visualisation of data.	

The data search was conducted on 31 May 2021. Hence all publications to this date have been included in the study. To search for the relevant literature, we used the search string 'investor sentiment' in the title, abstract, and keywords which was combined with 'stock

returns' OR returns OR 'stock mispricing' OR mispricing OR 'stock market returns' OR 'stock price' OR 'security returns' OR 'asset pricing' OR 'stock valuations' OR 'equity returns' OR 'noise trader risk' OR 'forecasting returns' OR 'return predictability' OR overvaluation OR undervaluation searched in the title, abstract and keywords using BOOLEAN operator AND. The search string was further refined to publications in the 'English' language to facilitate easy understanding and analysis of the results. We did not restrict the literature search based on year of publication, document type, study type, country, and publication source to ensure a broader coverage of literature, which is a must for bibliometric analysis to reap better results (Williams and Bornmann, 2016). The search fetched 983 results downloaded in the .CSV format, which were included in our study for analysis. The results were analysed using Microsoft Excel and VOSviewer. Table 1 describes the workflow of the bibliometric analysis.

3.2   Method

Before proceeding with the analysis, we did data cleaning to remove any coding error for data standardisation, using BibExcel. The need to clean and standardise data is a common problem faced in the bibliometric study (Ferrara and Salini, 2012). Examples of data cleaning include standardising the use of author names, which refers to the same person but has been written differently, such as 'Fama, E. and Fama, E.F.', 'Vishny, R. and 'Vishny, R.W.' and so on. Similarly, the references were also cleaned by standardising the style, use of DOI, words, and journal names in references such as *The Journal of Finance* had many forms such as *J. Finance* or *J. Financ* or *Jour. of Finan.* and so on. After cleaning and standardising data, we analysed the sample publications using four bibliometric techniques: co-citation analysis, co-occurrence analysis, bibliographic coupling, and citation analysis. Co-citation refers to the frequency of citing two articles/sources/authors together. It allows the identification of authors and articles which are most cited in the domain of investor sentiment and stock returns. The co-occurrence analysis helps to identify the fundamental scientific topics, whereas bibliographic coupling establishes a similarity relationship between articles (Kurtz and Bollen, 2010). Citation analysis helps to identify the frequency or patterns in the sample documents.

    We use Microsoft Excel to describe the sample data. Further, we use VOSviewer 1.6.15 to analyse the literature on the relationship between investor sentiment and stock returns. VOSviewer is a bibliometric analysis software used for analysing and visualising scientific literature. It was developed by Nees Jan van Eck and Ludo Waldman. It allows the data analysis using citation networks, co-citation networks, co-authorship networks, bibliographic coupling networks, and co-occurrence networks (Van Eck and Waltman, 2010).

3.3   Sample description

Figure 1 shows the timeline of the publications per year and citations per year catering to the topic 'relationship between investor sentiment and stock returns', ranging from 1993 to 31 May 2021. It can be interpreted from the figure that the first study in the sample was published in *Financial Review* titled 'Does sentiment explain closed-end fund discounts? Evidence from bond funds' by Abraham et al. (1993). There have been continuous publications on the topic since 2000, and it has gained substantial momentum in the past decade. This indicates that this topic has grabbed researchers' attention across

the world because of its novelty and practicality. It also shows that there is also an upward trend in the number of citations received by the publications in the area of investor sentiment and stock returns, more specifically since the past decade. This shows the increasing interest of researchers in this area.

Figure 1 Number of publications and citations per year (see online version for colours)
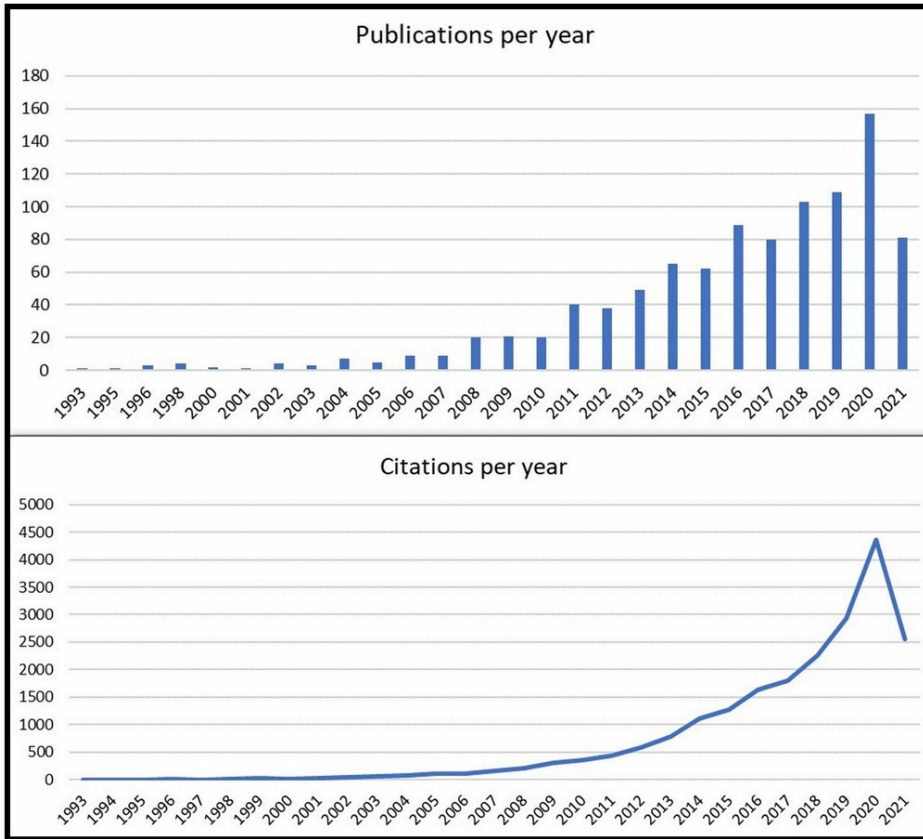
Table 2 shows the type of publications and the subject area within which researchers have studied the concept of investor sentiment and stock returns. The type of publications used in our study shows that out of 983 publications, 88.7% are research articles published in journals, 6.8% are conference papers, followed by 1.9% review papers, 1.6% book chapters, 0.4% conference review, 0.2% retracted, 0.1% are book review, erratum and short survey each. This shows that majority of the work done in this area is addressed through research articles.

Further, it also shows the subject area of publications pertaining to the topic of our study. The maximum number of publications are in the field of economics, econometrics, and finance (76.5%), followed by business management and accounting (38.2%). This is typical as the link between investor sentiment, and stock returns is a topic of financial economics. The publications in the area of computer sciences (9.1%) and decision

sciences (6.4%) indicate the use of artificial intelligence to enable data mining. The presence of publications in the area of mathematics (5.4%), engineering (3.1%), and physics and astronomy (1.5%) shows that the subject of investor sentiment and stock returns requires mathematical model building and the use of statistics. Publications in the area of social sciences (4.7%) and psychology (3.1%) indicate the involvement of human elements, including social dynamics and investors' psychological state. Since the publications can cater to more than one subject area, the sum of the subject area percentage is more than 100%.

Table 2   Type of publications and subject areas

Type of publication	No. of publications	Percentage of 983
Article	872	88.7080
Conference paper	67	6.8158
Review	19	1.9328
Book chapter	16	1.6276
Conference review	4	0.4069
Retracted	2	0.2034
Short survey	1	0.1017
Book review	1	0.1017
Erratum	1	0.1017
Subject areas	*No. of publications*	*Percentage of 983*
Economics, econometrics and finance	752	76.5005
Business, management and accounting	376	38.2502
Computer science	90	9.1556
Decision sciences	63	6.4089
Mathematics	54	5.4933
Social sciences	47	4.7812
Psychology	31	3.1536
Engineering	31	3.1536
Physics and astronomy	15	1.5259
Energy	17	1.7294
Environmental science	15	1.5259
Others	44	4.4760

Source: SCOPUS database (accessed 31 May 2021)

4   Results

4.1   Co-citation analysis

Table 3a shows the co-citations analysis of references. We show the top 10 results. The detailed analysis of the co-citations of the references refers to the foundations of the research area and lists the scientific publications that have received the most number of

citations. We have shown the citations received by each reference in the sample list of publications derived through the SCOPUS database and its link strength.

Figure 2 Visual map of reference co-citation analysis (see online version for colours)
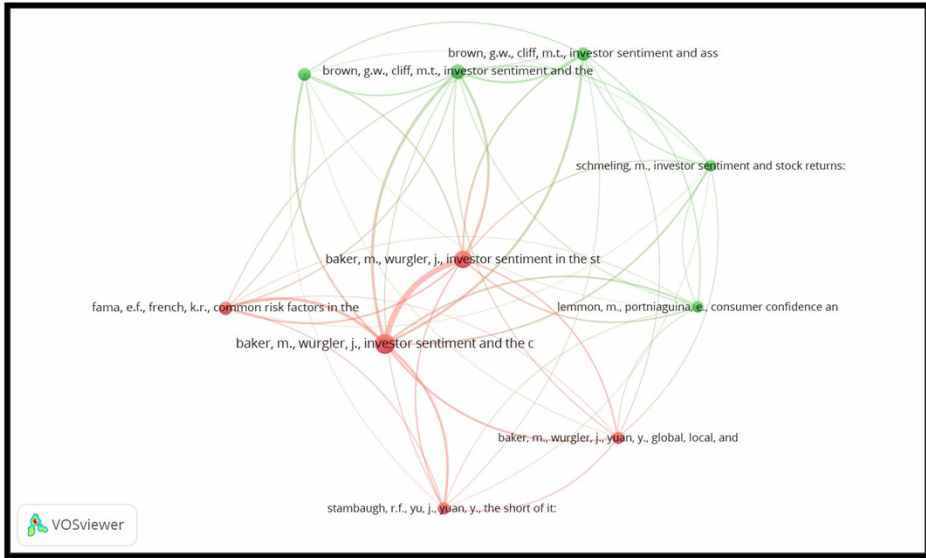
Baker and Wurgler (2006) studied the effect of investor sentiment on the cross-section of stock returns. It highlighted that stocks that are hard to value and difficult to arbitrage are most affected by investor sentiment. Baker and Wurgler (2007) focused on measuring investor sentiment through a top-down approach. It concluded that investor sentiment has an impact on the individual stocks as well as the stock market in aggregate. Brown and Cliff (2004) documented the existence of a strong correlation between investor sentiment and contemporaneous stock returns but also highlighted that investor sentiment has diminutive forecasting power to predict future stock returns in the short run. Brown and Cliff (2005), using survey data, the article highlighted that investor sentiment is the contrarian predictor of stock returns. Fama and French (1993) presented three stock market factors, namely factors related to market, firm size, and book-to-market equity, and two bond market factors, namely maturity and default risk, which affect returns on stocks and bonds. Barberis et al. (1998) presented a model of investor sentiment based upon investors' beliefs, heuristics, and psychological evidence, which leads to investors' underreaction or overreaction to the earnings announcement. Baker et al. (2012) explained that country-level returns negatively correlate with the global sentiment, but returns within the market are negatively correlated with global and local sentiment. Stambaugh et al. (2012) studied the effect of investor sentiment on the market anomalies concerning cross-sectional stock returns. Lemmon and Portniaguina (2006), using consumer confidence, it explored the time-series relationship between investor sentiment and small stocks premium. It concluded that sentiment could not explain the change in the value and momentum premiums. Schmeling (2009) examined the effect of consumer confidence (a measure of investor sentiment) on the stock returns

across 18 industrialised countries and documented the existence of a negative relationship between investor sentiment and stock returns.

The link strength refers to the degree of association between the articles. It indicates a distant relationship between the articles, and all the articles are consistent as per their position in the list as far as their citations and link strength is concerned.

Table 3a   Results of co-citation analysis of references in the sample

Author	Title	Journal	Citations in the sample	Citations in the SCOPUS	Link strength
Baker and Wurgler (2006)	Investor sentiment and the cross-section of stock returns	*The Journal of Finance*	487	1,859	439
Baker and Wurgler (2007)	Investor sentiment in the stock market	*Journal of Economic Perspectives*	366		337
Brown and Cliff (2004)	Investor sentiment and the near-term stock market	*Journal of Empirical Finance*	264	546	254
Brown and Cliff (2005)	Investor sentiment and asset valuation	*The Journal of Business*	222	445	217
Fama and French (1993)	Common risk factors in the returns on stocks and bonds	*Journal of Financial Economics*	215	9,733	189
Barberis et al. (1998)	A model of investor sentiment	*Journal of Financial Economics*	187	1,851	170
Baker et al. (2012)	Global, local, and contagious investor sentiment	*Journal of Financial Economics*	174	380	168
Stambaugh et al. (2012)	The short of it: Investor sentiment and anomalies	*Journal of Financial Economics*	173	561	158
Lemmon and Portniaguina (2006)	Consumer confidence and asset prices: Some empirical evidence	*Review of Financial Studies*	161	379	158
Schmeling (2009)	Investor sentiment and stock returns: Some international evidence	*Journal of Empirical Finance*	153	340	151

Source: Elaborated by the authors based on VOSviewer results

Figure 2 represents the reference co-citation of the top 10 articles. Each reference is depicted as a label, and the number of times the reference is cited, is represented in terms of font size, i.e., the greater the font size, the greater will be its citation frequency. Further, the distance between each reference represents the chances of them being cited together, i.e., the closeness between the references shows higher chances of them being cited together. The references belonging to the same cluster also indicate greater chances of them being cited together. As it can be seen that Figure 2 has been divided into two clusters represented in red and green colour. The cluster in red colour comprises five articles by Baker and Wurgler (2006), Baker and Wurgler (2007), Fama and French

(1993), Stambaugh et al. (2012) and Baker et al. (2012). The cluster in green colour also comprises five articles by Brown and Cliff (2004), Brown and Cliff (2005), Barberis et al. (1998), Lemmon and Portniaguina (2006) and Schmeling (2009). The green cluster can be accredited to the early works on studying the market behaviour in response to investor sentiment, laying the foundation for capturing and measuring the sentiment-return relationship. Thus, it can be categorised under the head 'basics of investor sentiment and market behaviour'. The red cluster majorly focuses on extending the work on the relationship between investor sentiment and stock returns spread over stock-specific, global-local sentiment and anomalies. It can be labelled as 'advances in nexus of sentiment-return relationship'.

Table 3b   Results of co-citation analysis of authors in the sample

Author	Citations	Link strength
Baker, M.	1,512	1,396.73
Wurgler, J.	1,427	1,330.28
Shleifer, A.	1,357	1,259.18
Fama, E.F.	1,057	969.96
French, K.R.	770	721.23
Yuan, Y.	614	587.18
Lee, C.M.C.	587	562.32
Brown, G.W.	562	546.89
Cliff, M.T.	516	504.34
Thaler, R.H.	513	492.83

Source: Elaborated by the authors based on VOSviewer results

Table 3b shows the co-citation analysis of authors highlighting that Baker, M. is the leading author in this domain with 1,512 citations, followed by Wurgler, J. (1,427), Shleifer, A. (1,357), Fama, E.F. (1,057), French, K.R. (770), Yuan, Y. (614), Lee, C.M.C. (587), Brown, G.W. (562), Cliff, M.T. (516) and Thaler, R.H. (513). This suggests that these authors are prominent in this domain and have contributed to the development and advancement of the literature concerning investor sentiment and stock returns.

Figure 3 represents the density visualisation of the co-citation analysis of authors. We show only those authors who have received at least 150 citations to avoid the clutter in the density map and show the prominent authors in the domain of investor sentiment and stock returns. The red colour represents the most cited authors, and the yellow colour represents the authors that have received fewer citations. Further, the author's position in the map highlights the association among them, i.e., the closeness between authors shows the possibility of them appearing together.

The results are spread around four clusters.

Fama, E.F. leads the first cluster, comprising of prominent authors such as French, K.R., Jegadeesh, N., Vishny, R.W., Thaler, R.H. Their work majorly focused on standard finance concepts and theories such as Fama and French's three-factor (market, size and value) model and five-factor (market, size, value, profitability and investment) model. Jegadeesh, N and Titman, S. introduced the momentum factor which explains the continuance pattern of stocks to perform (winning or losing). Vishny, R.W. and Barberis, N. developed a model of investor sentiment suggesting how investors make the

decision based on their psychological beliefs leading to the underreaction or overreaction in returns.

The second cluster is led by Shleifer, A. including authors Kahneman, D., Shiller, R.J. and Tversky, A. Their primary area of study was the application of psychology in finance, leading to the emergence of behavioural finance such as Kahneman, D. and Tversky, A. proposed the prospect theory which states that investors weigh losses and gains differently i.e. they make their decisions based on the possibility of losses and gains rather than the end result. Further, they stated that investors decision is largely affected by their heuristics and biases. Shiller, R.J. also focused on biases and bubbles in the stock market which has contributed to the literature of behavioural finance.

The third cluster headed by Brown, G.W. includes authors such as Cliff, M.T. and Schmeling, M. Their work primarily focused on studying the relationship between investor sentiment and stock returns. Brown, G.W. and Cliff, M.T. emphasised that there exists a strong correlation between investor sentiment and contemporaneous stock returns but has little explanatory power in forecasting near-term stock returns. Schmeling, M. highlighted that there exists a negative relationship between investor sentiment and stock returns.

Figure 3   Density map of co-citation analysis of authors (see online version for colours)
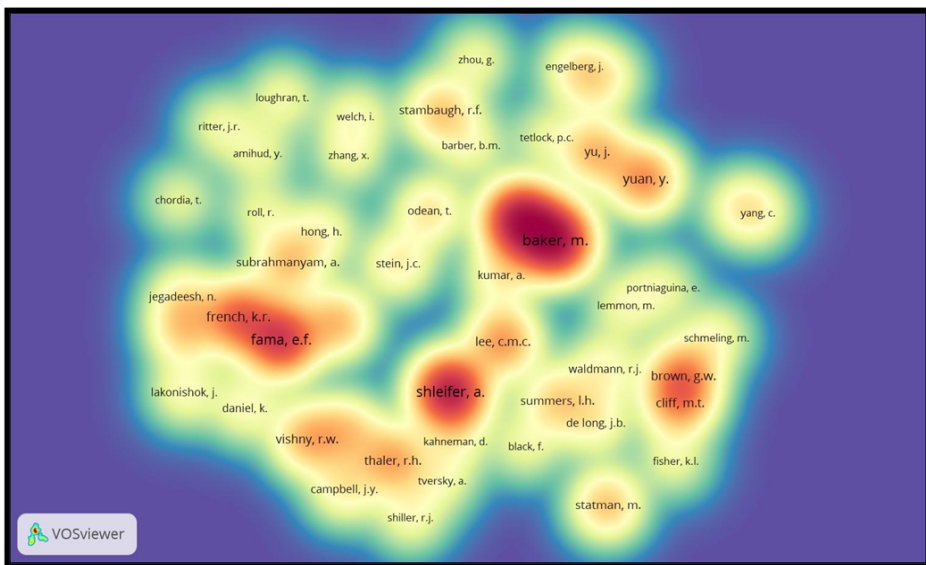
The fourth cluster led by Baker, M. includes authors such as Wurgler, J., Stambaugh, R.F. and Yuan, Y. Their work primarily focused on studying the relationship between investor sentiment and stock returns and also the development of sentiment index through various proxies such as CEFD (closed-end fund discount), TURN (share turnover), NIPO (number of initial public offering), RIPO (average first-day return on IPO), Share of Equity Issuance in total equity and debt issues (S), dividend premium (DIVPREM) to measure investor sentiment. Baker, M. and Wurgler, J. studied the effect of investor sentiment on the cross-section of stock returns. Further, they stated that stocks that are hard to value and difficult to arbitrage are most affected by investor sentiment.

Stambaugh, R.F. and Yuan, Y. studied the effect of investor sentiment on the market anomalies concerning cross-sectional stock returns.

4.2 Bibliographic coupling of sources

The bibliographic coupling of sources describes the publication source of the sample documents chosen for the study. Table 4 shows the results of the top 10 sources out of 339 sources (including journals, conference proceedings, review chapters, book chapters, workshop proceedings, and others) in which most publications on the topic 'relationship between investor sentiment and stock returns' appear as it is impossible to list all the sources in the single table. The citations refer to the number of citations received by the particular source, and link strength describes the publications' relevance with the concerned topic.

**Table 4**   Results of bibliographic coupling of sources

Source title	Number of publications	Citations	Link strength
Finance Research Letters	30	196	363.93
Journal of Banking and Finance	28	1,277	740.71
Journal of Behavioral Finance	24	229	599.48
The North American Journal of Economics and Finance	22	229	577.60
Emerging Markets Finance and Trade	22	212	429.46
Journal of Behavioral and Experimental Finance	18	160	556.30
International Review of Financial Analysis	18	305	506.68
Economic Modelling	18	235	427.32
Journal of Financial Economics	17	4,050	550.94
Quarterly Review of Economics and Finance	16	243	363.98

Source: Elaborated by the authors based on VOSviewer results

The *Finance Research Letters* tops the list with 30 publications that account for 14.08% of the top 10 sources and 3.05% of the total sample publications. The top-cited article in *Finance Research Letters* is 'Measuring the interdependence between investor sentiment and crude oil returns: New evidence from the CFTC's disaggregated reports' by Ji et al. (2019), with 43 citations in the SCOPUS. It highlights that a strong correlation exists between West Texas intermediate (WTI) returns and various types of investor sentiment. The *Journal of Banking and Finance* ranks second in terms of the highest number of published articles, with 28 publications that account for 13.14% of the top 10 sources and 2.84% of the total sample publications. The top-cited article in the *Journal of Banking and Finance* is 'Stock market volatility, excess returns, and the role of investor sentiment' by Lee et al. (2002), with 300 citations in the SCOPUS. This article highlights that sentiment is a systematic risk factor that is priced in the market. This journal has the highest link strength of 740.71, which signifies that the articles published in it are highly relevant to the field of investor sentiment and stock returns. It has 1,277 citations, ranking second to the *Journal of Financial Economics*, a highly cited journal in this field. The *Journal of Behavioral Finance* stands third with 24 publications which account for 11.26% of the top 10 sources and 2.44% of the total sample publications. *The North*

American Journal of Economics and Finance and *Emerging Markets Finance and Trade* grabs the fourth and the fifth position, respectively. Both the journals have almost the same number of articles published and citations. However, *The North American Journal of Economics and Finance* has greater link strength than *Emerging Markets Finance and Trade*. This signifies that the articles published in *The North American Journal of Economics and Finance* are more relevant to the field of study.

Figure 4   Visual map of bibliographic coupling of sources by average publication year (see online version for colours)
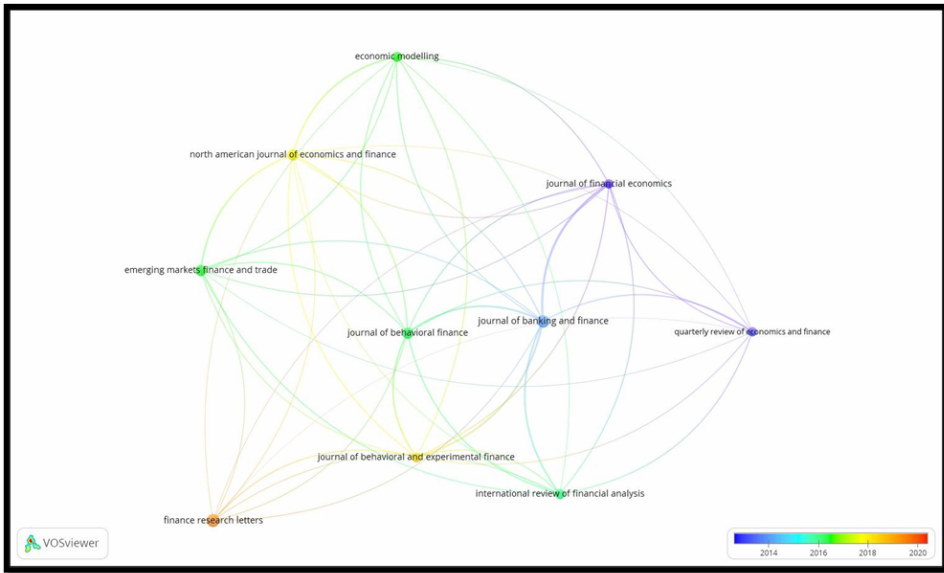
The results stress that articles published in the *Journal of Banking and Finance* are more relevant to the field. Also, the inclusion of 'economic modelling' in the top 10 list suggests that the domain of investor sentiment and stock returns does not only caters to the area of financial decision making or psychological theories but also incorporates the use of the statistical application to build statistical and mathematical models based on the quantum of the relationship between investor sentiment and stock returns. Further, the inclusion of the *Journal of Financial Economics*, which has the maximum number of citations (4,050) to date and fourth-highest link strength (550.94), points that the articles published in it are highly relevant to the field and hence are most cited. The top-cited article in this journal is 'A model of investor sentiment' (Barberis et al., 1998) with 1,851 citations in the SCOPUS, which presents a model of investor sentiment based upon investors' belief heuristics, and psychological evidence.

Figure 4 shows the visual map of the top 10 results of the bibliographic coupling of sources based on the average publication year. The *Journal of Behavioral Finance* is located at the centre, signifying its relevance in the area of investor sentiment and stock returns in terms of publications. It appears in the green colour suggesting the average publication year to be 2016, which can be interpreted that *Journal of Behavioral Finance* has published articles on the topic of investor sentiment and stock returns more intensively in the past decade. The *Journal of Banking and Finance* also appears in the

centre (shown in blue colour) and has the second most number of published articles, as indicated by its circle size with the average publication year 2014. The circle colour (yellow and orange) indicates that *Finance Research Letters*, *The North American Journal of Economics and Finance* and *Journal of Behavioral and Experimental Finance* have more recently published articles. The results are consistent with Table 4. The *Journal of Finance* has only six published articles (because of which it was not included in the table and map as the results are arranged as per the number of published articles) but has received 3,282 citations and has a link strength of 274.89, indicating that the publications in this journal are highly relevant in the field of investor sentiment and stock returns. The top-cited article in this journal is 'Investor sentiment and the cross-section of stock returns' (Baker and Wurgler, 2006) with 1,859 citations in the SCOPUS, highlighting that stocks that are hard to value and difficult to arbitrage are most affected by investor sentiment.

4.3   Co-occurrence of author keywords

Table 5 shows the top 10 keywords that frequently appear in the author's keywords revolving around the publications on the link between investor sentiment and stock returns analysed based on average publication years. It caters to publications that revolve around investor sentiment and stock returns because of which top occurring author keywords such as 'investor sentiment', 'investor sentiments', 'sentiment', 'stock return', and 'stock returns' have been excluded from the list. Occurrences signify the frequency of the keywords appearing in the publications. Link strength refers to the relevance of the keywords pertaining to the study. The keywords that appear frequently are 'behavioural finance' followed by 'asset pricing', 'volatility' and 'return predictability'. This strengthens the point that the fundamental area of investor sentiment roots from the subject of behavioural finance affecting stock returns, asset pricing and has predictive power to forecast stock returns.

**Table 5**   Results of author keywords co-occurrence

Keyword	Occurrences	Link strength
Behavioural finance	76	62.00
Asset pricing	39	29.00
Volatility	36	27.00
Return predictability	32	27.00
Market efficiency	32	23.00
Stock market	29	23.00
Sentiment analysis	22	12.00
Anomalies	18	14.00
Social media	16	13.00
Mispricing	16	12.00

Source: Elaborated by the authors based on VOSviewer results

Figure 5 shows the author keywords that revolve around the relationship between investor sentiment and stock returns. The figure indicates that 'asset pricing', 'anomalies', 'return predictability' are the most common keyword, represented by its

large circle size appearing in the centre of the map in blue colour, signifying that the articles' average publication year containing the keyword ranges between 2016 and 2017. Keywords such as 'mispricing', 'behavioural finance', 'stock market', 'sentiment analysis', and 'social media' have frequently occurred in the author keywords between the average publication years 2018-19. This signifies that in recent years (2017 onwards), new dimensions have been added to the domain of investor sentiment and stock returns, such as sentiment analysis and incorporation of social media to measure investor sentiment (Affuso and Lahtinen, 2019; Behrendt and Schmidt, 2018; Piñeiro-Chousa et al., 2017; Renault, 2017; Siganos et al., 2017). The figure also shows the reoccurrence of keywords such as 'COVID-19' and 'predictability' in the more recent years ranging between 2020–2021.

Figure 5   Visual map of author keywords co-occurrence by average publication year (see online version for colours)
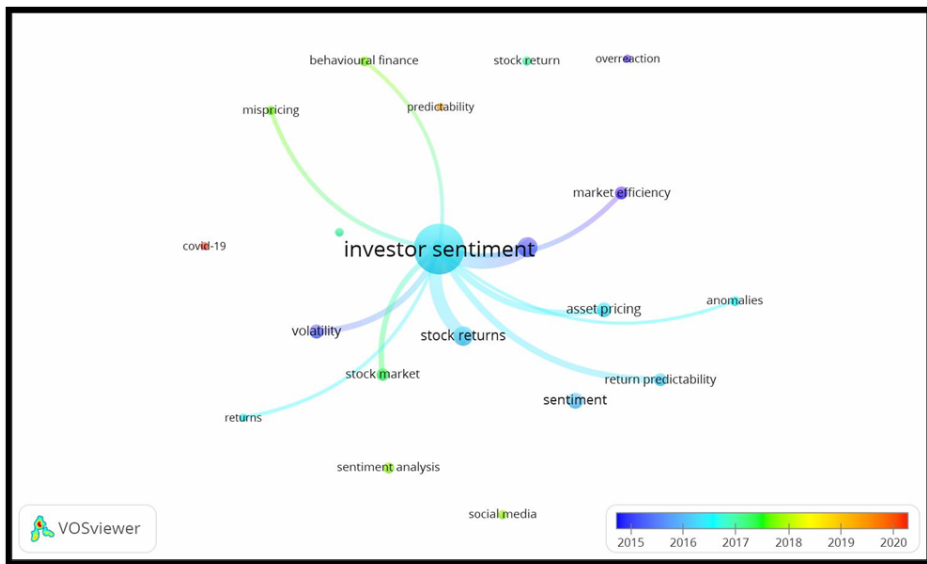
4.4   Citation network of countries

Table 6 shows the list of the top 10 countries with the most publications in investor sentiment and stock returns. The USA tops the list with the highest number of articles on investor sentiment and stock returns with 268 publications, followed by China (251), the UK (96), Taiwan (71), and India (46), respectively. The USA has the highest number of citations (13,695) and link strength (3,041), signifying that the articles published in the USA are more relevant in the field of investor sentiment and stock returns. China holds the second position in terms of no. of publications (251), indicating the growing interest of Chinese researchers in the area of investor sentiment and stock returns as compared to other nations. Further, it also shows that the research on investor sentiment and stock returns is still evolving and shows expansion trends across multiple countries globally.

Table 6 Citation table of top 10 Countries with the most number of publications on the relationship between investor sentiment and stock returns

Country	No. of publications	Citations	Link strength
USA	268	13,695	3,041.00
China	251	2,628	1,634.00
UK	96	1,514	832.00
Taiwan	71	487	404.00
India	46	187	267.00
South Korea	41	469	409.00
Australia	41	702	307.00
Germany	35	1,049	471.00
Tunisia	33	225	307.00
France	28	338	253.00

Source: Elaborated by the authors based on VOSviewer results

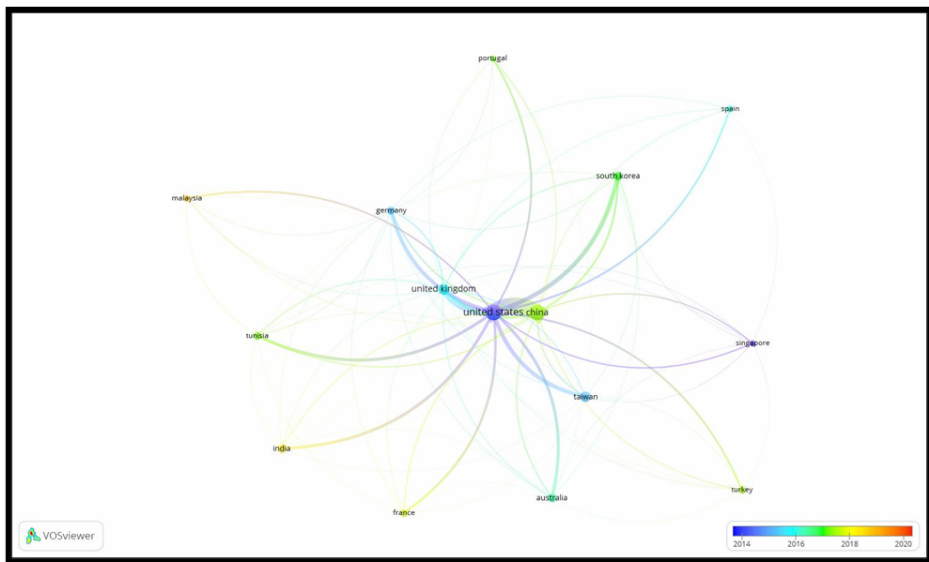**Figure 6** Country of publications

Figure 6 shows the visual map of leading countries with the most publications in the field of investor sentiment and stock returns. The figure shows that the USA and China are located at the centre. The USA appears in blue, suggesting the average publication year ranging between 2014–2015, whereas China appears green, indicating the average publication year ranging between 2016–2018. This shows that although the articles catering to investor sentiment and stock returns are prominent in the USA, China has substantially gained momentum in recent years with an increasing number of publications in the domain. The figure also shows that from 2018 onwards, there has been growing interest among other countries such as India, Malaysia, Tunisia, France, and Turkey in the domain of investor sentiment and stock returns.

Table 7   Top 15 most cited articles on the relationship between investor sentiment and stock returns since 2016 and content analysis

Author	Title	Journal	Citation	Identified gaps	Suggestions for future research
Stambaugh and Yuan (2017)	Mispricing factors	*Review of Financial Studies*	119	Most studies on factors affecting stock mispricing correspond to a single anomaly instead of taking into account wider multiple anomalies.	Test empirically whether the mispricing factors show a significant relation to lagged investor sentiment.
You et al. (2017)	Oil price shocks, economic policy uncertainty and industry stock returns in China: asymmetric effects with quantile regression	*Energy Economics*	94	Most studies on the oil-stocks relationship do not mark a clear distinction between bearish and bullish sentiment. Only a few studies consider the time-varying relationships between oil and stock prices. The available studies neglect the distributional heterogeneity of stock returns and do not take account into the nonlinear effects of oil price changes	Future studies can incorporate the effect of oil-price shocks and economic policy uncertainty on stock returns separately for industries
Liu et al. (2020)	The COVID-19 outbreak and affected countries stock markets response	*International Journal of Environmental Research and Public Health*	76	Lack of studies that access the impact of COVID-19 on the stock markets of affected nations	Future research can focus on studying investor sentiment and uncertainty in a holistic approach. Studies can also explore the investor confidence inside and between foreign markets.
Renault (2017)	Intraday online investor sentiment and return patterns in the U.S. stock market	*Journal of Banking and Finance*	72	Most studies that study the effect of investor sentiment on stock returns follow quantitative methodology rather than the use of qualitative analysis, such as using text mining.	Future researchers can study whether value-relevant information about fundamental stock prices could be extracted from various published contents on the internet network identified to facilitate traders to process information and trade quickly. Future research can focus on the development of intraday investor sentiment over time and across different types of traders.

Table 7 Top 15 most cited articles on the relationship between investor sentiment and stock returns since 2016 and content analysis (continued)

Author	Title	Journal	Citation	Identified gaps	Suggestions for future research
Barber et al. (2016)	Which factors matter to investors? Evidence from mutual fund flows	*Review of Financial Studies*	69	The available literature does not address which of the performance measures is the best predictor of mutual fund flows.	The difference between the knowledge level of sophisticated and less sophisticated investors can be incorporated to study the performance of funds in the eyes of the investor, resulting in subjective evaluation of fund performance
Jiang et al. (2019)	Manager sentiment and stock returns	*Journal of Financial Economics*	65	Lack of research on corporate managers' sentiment as most studies focus on investor sentiment only.	Use of manager sentiment index to study various financial issues
Antoniou et al. (2016)	Investor sentiment, beta, and the cost of equity capital	*Management Science*	58	Lack of evidence that trading by unsophisticated investors is not symmetric across optimistic and pessimistic sentiment periods	Studies can incorporate the use of model-free methods to derive valuations of assets
Ichev and Marinč (2018)	Stock prices and geographic proximity of information: evidence from the Ebola outbreak	*International Review of Financial Analysis*	51	Lack of studies that take into account whether the Ebola outbreak events affect investor sentiment which has a bearing on stock returns	Future studies can study the effect of media-driven optimism and pessimism during the outbreak of epidemics (here refer to Ebola)
Zhang et al. (2018)	Improving stock market prediction via heterogeneous information fusion	*Knowledge-Based Systems*	50	Most studies follow either the quantitative approach or qualitative approach to study the sentiment-return relationship, rather than creating a unifying framework to include both the approaches	Future work can incorporate the use of psychological biases into prediction models. Also, studies can incorporate domain-specific sentiment to access the sentiment-return relationship
Naifar (2016)	Do global risk factors and macroeconomic conditions affect global Islamic index dynamics? A quantile regression approach	*Quarterly Review of Economics and Finance*	50	Lack of empirical evidence to establish the symmetric or asymmetric relationship between financial market conditions or macroeconomic variables and returns.	Future researchers can study the dynamics of other Islamic equity indices for emerging and developed regions

Table 7   Top 15 most cited articles on the relationship between investor sentiment and stock returns since 2016 and content analysis (continued)

Author	Title	Journal	Citation	Identified gaps	Suggestions for future research
Smales (2017)	The importance of fear: investor sentiment and stock market returns	Applied Economics	46	Lack of uniform proxies to measure investor sentiment in time-series or cross-sectional framework. Also, there exists little empirical evidence of the sentiment-return relationship in terms of the state of the economy.	Future studies can address how the markets respond to the sentiment during inflation or recession or across stock and across the industry which is more sentiment-driven.
Sun et al. (2016)	Stock return predictability and investor sentiment: a high-frequency perspective	Journal of Banking and Finance	46	Availability of limited literature that focusses on multiple sources of textual analysis of media contents	Future studies can focus more on studying the impact of investor sentiment on stock returns in aggregate. Also, researchers can study the impact of investor sentiment on other asset pricing-related topics, including anomalies.
Guo et al. (2017)	Can investor sentiment be used to predict the stock price? Dynamic analysis based on China stock market	Physica A: Statistical Mechanics and its Applications	45	Traditional linear econometric models are not suitable to study the sentiment-return relationship. Lack of studies that quantify the time-varying lead-lag structure between two-time series	Future studies can make use of more direct investor sentiment indictor
Ji et al. (2019)	Measuring the interdependence between investor sentiment and crude oil returns: New evidence from the CFTC's disaggregated reports	Finance Research Letters	43	Availability of limited literature that focuses on sentiment-return relationship based on trader type (producer, swap dealer, speculator, and small trader)	More future studies can focus on traders' actions and their influence on market participants. Also, future studies can focus on managing trader's hedging and speculative strategies.
Shen et al. (2017)	Investor sentiment and economic forces	Journal of Monetary Economics	41	Lack of studies that focus on the effect of stock market mispricing on the pricing of macro-related factors.	Future studies can incorporate investor sentiment into economic theory to explain the macro-economic state.

Table 7 provides an overview of the top 15 most cited articles on 'investor sentiment and stock returns' since 2016. It identifies the significant gaps in the literature and suggests scope for future research.

5 Discussion, contributions and limitations

5.1 Discussion

The study aimed to provide a general overview of the foundations of the relationship between investor sentiment on stock returns through a bibliometric study of the literature procured from the SCOPUS database. We have analysed the publications on sentiment-return literature through four bibliometric techniques: co-citation analysis, citation analysis, co-occurrence analysis, and bibliometric coupling. In the bibliometric study, we identify the important publications and authors in the research area (through co-citation analysis), the prominent journals (through the bibliometric coupling of sources), frequently occurring keywords (through co-occurrence analysis of author keywords), and countries with leading publications in the subject area (through citation analysis).

The results of the co-citation analysis of references and authors reveal that 'Investor sentiment and the cross-section of stock returns' (Baker and Wurgler, 2006) is the most cited article followed by 'Investor sentiment in the stock market' (Baker and Wurgler, 2007). Other prominent studies in the field are 'Investor sentiment and the near-term stock market' (Brown and Cliff, 2004) and 'Investor sentiment and asset valuation' (Brown and Cliff, 2005). The results of the co-citation analysis of authors reveal that Baker, M. is the most cited author in the field of investor sentiment and stock returns. This notion is consistent with the fact that studies such as 'Investor sentiment in the stock market' (Baker and Wurgler, 2007), 'Investor sentiment and the cross-section of stock returns' (Baker and Wurgler, 2006), and 'Global, local, and contagious investor sentiment' (Baker et al., 2012) makes it to the top 10 list, as shown in Table 3. Other prominent authors in the field are Wurgler, J., Shleifer, A., Yuan, Y., Brown, G.W. and Cliff, M.T.

The results of bibliographic coupling of sources indicate that *Finance Research Letters* has the highest number of publications (30) followed by *Journal of Banking and Finance* (28), *Journal of Behavioral Finance* (24), *The North American Journal of Economics and Finance* and *Emerging Markets Finance and Trade* with (22) each. *Journal of Financial Economics* has the maximum number of citations (4,050) to date, highlighting the fact that the articles published in this journal are highly relevant in the field of investor sentiment and stock returns. Further, the *Journal of Banking and Finance* has the highest link strength (740.71), indicating that the articles published in this journal are highly relevant in the field of investor sentiment and stock returns.

The results of co-occurrence analysis of author keywords reveal that the keywords which frequently occurs around investor sentiment and stock returns are 'behavioural finance', 'asset pricing', 'volatility', 'return predictability', 'market efficiency', 'anomalies', 'mispricing' and 'stock market'. Recently, since 2017 new dimensions have been added to the domain of investor sentiment and stock returns, such as sentiment analysis and incorporation of social media to measure investor sentiment.

The citation analysis of the country of publications reveals that the USA leads in terms of the number of publications (268), followed by China (251), the UK (96), Taiwan (71), and India (46). The USA has the highest number of citations (13,695) and link strength (3,041.00), followed by China with (2,628) citations and link strength (1,634.00), signifying that the articles published in these countries are highly relevant to the field of investor sentiment and stock returns.

The results also suggest that investor sentiment not only caters to the field of economics, econometrics and finance but also has its connection with psychology, computer science, mathematics, engineering, physics and astronomy, amongst the others. 88.22% of the published documents are in the form of articles published in peer-reviewed journals.

5.2   Contributions

To the best of our knowledge, this is the first bibliometric study that exclusively focuses on the broader coverage of the relationship between investor sentiment and stock returns to date. We have extensively and exhaustively studied the available literature on the topic to identify the prominent work to explore and establish the directions that can help future researchers. The study has implications for researchers and academicians in understanding the theoretical foundations of the sentiment-return relationship by shedding light on the impact of investor sentiment on stock returns. This bibliometric study will provide directions to future researchers regarding the relevant journals, authors, important keywords, and prominent articles in the domain of investor sentiment and stock returns, through which the researchers can widen their scope in this domain and also find new avenues for future research. The domain of investor sentiment and stock returns encompasses the studies pertaining to the varied subject areas such as physics, engineering, mathematics, the knowledge about which can lead to better insights to understand the sentiment-return relationship.

5.3   Limitations

Although we have tried our level best to be as comprehensive and inclusive as possible, the study might be subjected to a few limitations, which are common in the bibliometric studies (Ferrara and Salini, 2012). The bibliometric analysis results are highly affected by the keywords used by the authors to identify the publications. Also, the list of publications derived through the SCOPUS database is based on the search strings chosen by us to identify the studies, which may not be universal. Another limiting factor is that the sample publications used for the bibliometric analysis have been extracted from the single (SCOPUS) database.

6   Scope for future research

This paper systematically reviews the recent literature and identified the future research directions that can facilitate future researchers in this area. The future studies can focus on:

- incorporating the effect of oil-price shocks and economic policy uncertainty on stock returns separately for different industries

- exploring the investor confidence inside and between foreign markets

- extracting value-relevant information about fundamental stock prices from various published contents on the internet network identified to facilitate traders to process information and trade quickly

- incorporating the knowledge level of sophisticated and less sophisticated investors, resulting in subjective evaluation of fund performance and managing trader's hedging and speculative strategies

- effect of media-driven optimism and pessimism during the outbreak of epidemics and pandemics

- studying the dynamics of other equity indices for emerging and developed region

- how the markets respond to the sentiment during inflation or recession or across stock and across the industry which is more sentiment-driven.

7 Conclusions

This paper provides a comprehensive bibliometric analysis of the literature on the relationship between investor sentiment and stock returns. It attempts to identify the key authors, publications, journals, country of publications, and frequently occurring keywords to overview the sentiment-return literature through VOSviewer. The results were analysed based upon four bibliometric techniques: co-citation analysis, citation analysis, co-occurrence analysis, and bibliographic coupling. The results of the co-citation analysis of references reveal that 'Investor sentiment and the cross-section of stock returns' by Baker and Wurgler (2006) is the most cited article. Co-citation analysis of authors indicates that Baker, M. is the top-cited author in the domain of investor sentiment and stock returns. The bibliographic coupling of sources suggests that *Finance Research Letters* leads in publications, followed by the *Journal of Banking and Finance*. The co-occurrence analysis of author keywords reveals that 'behavioural finance', 'asset pricing', and 'volatility' appear to be the most reoccurring keywords around investor sentiment and stock returns. The citation analysis of countries reveals that the USA tops the list of countries with the most number of published articles in the domain of the relationship between investor sentiment and stock returns.

Further, the publications catering to the relationship between investor sentiment and stock returns are dominantly from the field of economics, econometrics, and finance. Also, the publications in the domain are substantially growing globally, and there have been consistent publications on the topic since 2000.

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