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A Systematic Literature Review on Early Warning Systems for Stock Market Crises: The Role of Investor Sentiment

Syarifuddin Rasyid[1], Darmawati[2], Ni Gusti Ayu Pitria[3,*], Fisca Mawa' Pangraran[4]
University of Hasanuddin, Indonesia[1,2,3,4]
Corresponding e-mail: pitriaayu06@gmail.com*

ABSTRACT

Purpose: This study systematically reviews existing research on early warning systems (EWS) for stock market crises, with a particular focus on the role of investor sentiment in enhancing prediction and mitigation efforts.

Method: This study employed a systematic literature review (SLR) methodology, analyzing 32 peer-reviewed articles published between 2015 and 2024. The articles were sourced from reputable databases such as Scopus, EBSCO, and IEEE, ensuring a rigorous and reliable selection of relevant research.

Result: The findings of this research indicate that investor sentiment significantly influences stock market dynamics and the occurrence of crises. The study emphasizes the importance of sentiment analysis in developing an early warning system (EWS) to enhance the accuracy and precision of stock market crisis predictions.

Practical Implications for Economic Growth and Development: This research suggests that incorporating investor sentiment into early warning systems can enhance crisis prediction accuracy, stabilize financial markets, and guide proactive risk management for investors and policymakers.

Keywords: *early-warning systems, stock market crises, the role of investor sentiment, systematic literature review*

INTRODUCTION

Amid the ever-changing dynamics of the global economy (Matyushok et al., 2021), the stock market serves as a barometer of economic health and a crucial tool for investors seeking to build wealth. However, it is also susceptible to sharp fluctuations (Milos et al., 2020) and crises that can lead to substantial losses. In this context, understanding the factors that influence stock price movements is essential. One such factor, often overlooked yet significantly impactful, is investor sentiment (Gao et al., 2020).

Investor sentiment refers to the collective feelings, hopes, and expectations of investors regarding market conditions, which can trigger mass behavioral shifts and dramatically alter the market's direction. Stock market crises often emerge with little warning, leaving investors vulnerable to poor decisions and significant capital losses (Mazur et al., 2021).

Previous studies have underscored the considerable influence of investor sentiment on stock market volatility and the onset of crises (Chen et al., 2020). However, many existing early warning systems (EWS) designed to predict and mitigate stock market crises have failed to adequately incorporate investor sentiment (Fu et al., 2020). In the realm of EWS for stock market crises, particularly those focusing on investor sentiment, several studies have laid a foundational understanding of the dynamics at play. A substantial body of literature explores the relationship between investor sentiment and stock market fluctuations, highlighting how sentiment can act as a precursor to market crises.

For example, Zhang et al. (2019) provide empirical evidence from the Chinese stock market, demonstrating that investor sentiment plays a critical role in market crises. This suggests that

sentiment analysis can be broadly applied across markets, emphasizing investor behavior as a key factor in predicting market downturns. Moreover, Dastkhan (2021) presents a network-based early warning system that integrates various indicators, including investor sentiment, to predict financial crises. This aligns with the findings of Liuxi (2023), who stresses the impact of investor sentiment on stock market responses, particularly in the aftermath of significant events like the COVID-19 pandemic. Both studies underscore the importance of incorporating sentiment analysis into EWS frameworks to improve predictive accuracy.

Despite these advances, Khan & Ahmad (2020) identified and measured stock market crises in Pakistan but did not consider the role of investor sentiment in these crises. Additionally, Ali and Houcine (2022) examined stock market reactions to the COVID-19 pandemic but did not specifically address how investor sentiment influenced these reactions. This gap points to the need for further research on how investor sentiment can serve as a leading indicator of market crises, especially in emerging markets.

Therefore, the development of effective EWS is critical. These systems aim to provide early signals of potential crises, enabling investors and policymakers to take appropriate actions to mitigate risks. While several EWS have been designed to predict market crises, many fail to account for investor sentiment as a key variable, creating a gap in the literature that needs to be addressed.

This study aims to conduct a systematic review of the existing literature on EWS for stock market crises, with a particular focus on the role of investor sentiment. We will collect and analyze studies that explore the relationship between investor sentiment and market movements. Through this approach, we hope to identify patterns, methodologies, and findings that may offer new insights for developing more effective EWS.

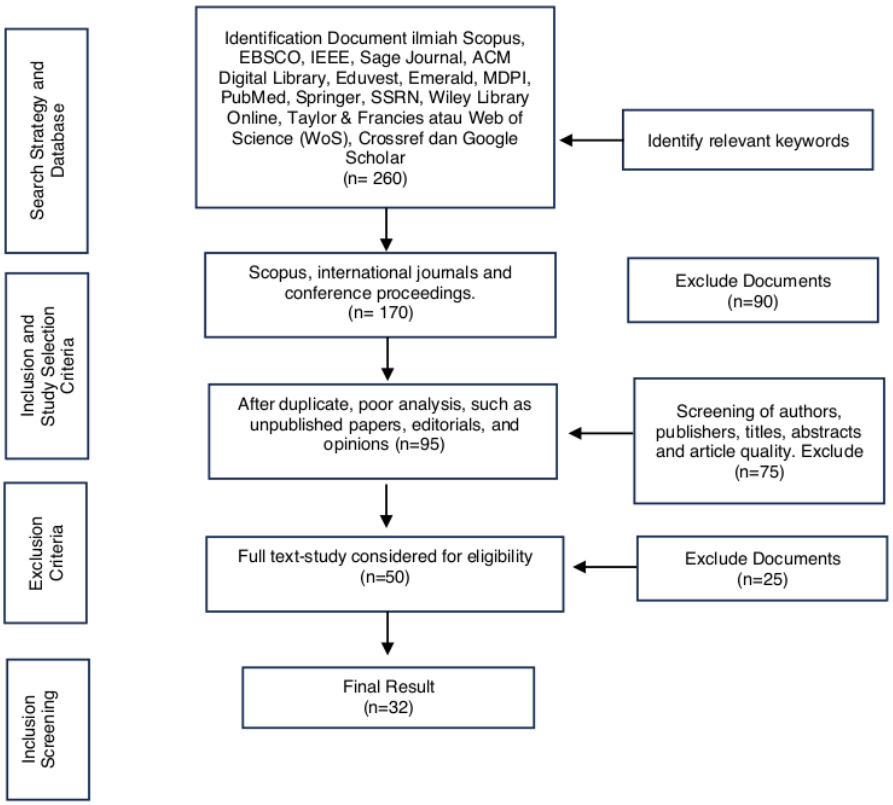
By integrating investor sentiment into EWS, this review seeks to make a significant contribution to both academic research in finance and the development of safer, more sustainable investment practices. Understanding how investor sentiment can be incorporated into an EWS will help create systems that are more responsive to market fluctuations.

In light of ongoing market uncertainty, understanding the factors that influence stock price movements is more critical than ever. One often-overlooked factor is investor sentiment, which reflects collective emotions, hopes, and expectations of market participants. This sentiment can play a crucial role in the occurrence of stock market crises, where psychological shifts can trigger collective reactions that lead to sharp price fluctuations. Therefore, exploring how investor sentiment can be integrated into early warning systems is essential to improving the accuracy and timeliness of crisis predictions. In this context, this study will pose several research questions that aim to explore the relationship between investor sentiment and the effectiveness of EWS in predicting stock market crises.

METHOD

The most relevant method for this article is the Systematic Literature Study. To achieve our research objectives, we conducted a Systematic Literature Review (SLR), inspired by Lopes & Farias (2022), Busalim et al. (2016), and Nerantzidis et al. (2022). An SLR is a data collection method used in social research that involves identifying, evaluating, and interpreting research fields relevant to a topic area or phenomenon of interest. In this context, we employed the PRISMA framework to enhance the transparency and reproducibility of our review process. PRISMA, which stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses, provides a structured approach to guide researchers in reporting systematic reviews effectively (Page et al., 2022). This method not only facilitates a comprehensive overview of existing literature but also helps identify gaps in research that warrant further investigation. Following the model outlined by Firmansyah & Umar (2023) and Nerantzidis et al. (2022), we set the research question and conducted a series of identification processes, including data and database search strategies, inclusion criteria, study selection, exclusion criteria, and inclusion screening, as shown in Figure 1.

Figure 1. Articles Selection Process



Source: Developed by the authors (2024)

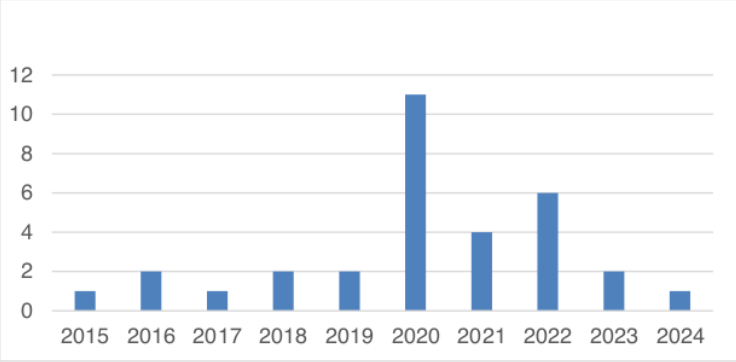
Search Strategy and Database

A search strategy is a predefined set of keywords used to search a database. It incorporates search principles essential for producing accurate results and considers all possible terms, keywords, and phrases related to the topic to guide the selection of literature during the reading of titles, abstracts, or full texts (Salih et al., 2021). The search strategy is determined after defining the research question, objectives, assessing quality, and synthesizing results (Hiebl, 2023). Therefore, only relevant data were considered by selecting pertinent publications for this study. The search criteria followed the scope of several scientific repositories, including Scopus, EBSCO, IEEE, Sage Journal, ACM Digital Library, Eduvest, Emerald, MDPI, PubMed, Springer, SSRN, Wiley Library Online, Taylor & Francis, Web of Science (WoS), Crossref, and Google Scholar. To avoid distractions caused by first-time implementation issues, we focused on journal articles published between 2015 and 2024 and applied the SLR methodology as inspired by de Geus et al. (2020) and Nerantzidis et al. (2022). This yielded a total of 450 articles. After defining the search space, we selected keywords to narrow the study's scope (Kuhail et al., 2023). The keywords considered were Early-Warning Systems, Stock Market Crises, and The Role of Investor Sentiment. After applying the search criteria based on publication year and keywords, we retrieved 32 relevant articles, as shown in Figure 1.

RESULT AND DISCUSSION

Figures 2 shows the distribution of research publications related to early warning systems and investor sentiment over time. The visualization helps readers understand the temporal trends in research interest. The publication numbers likely reflect the growing academic attention to the topic of early warning systems for stock market crises between 2015 and 2024. Fluctuations in publication frequencies may indicate evolving research priorities, significant market events, or increasing recognition of the importance of investor sentiment in market dynamics.

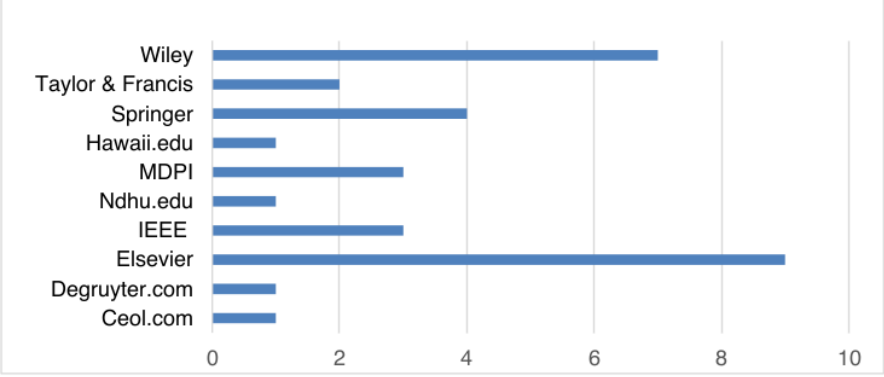
Figure 2. Number of Publication Per Year



Source: Processed data (2024)

Figure 3 illustrates the distribution of research publications on early warning systems for stock market crises and investor sentiment across academic journals. The figure shows that these publications are spread across several leading scholarly publishers, with Taylor & Francis likely being one of the major contributors to research in this area. This suggests that the topic of early warning systems and investor sentiment has received significant attention from reputable journals, reflecting the academic and practical importance of the research in understanding financial market dynamics and investment risks.

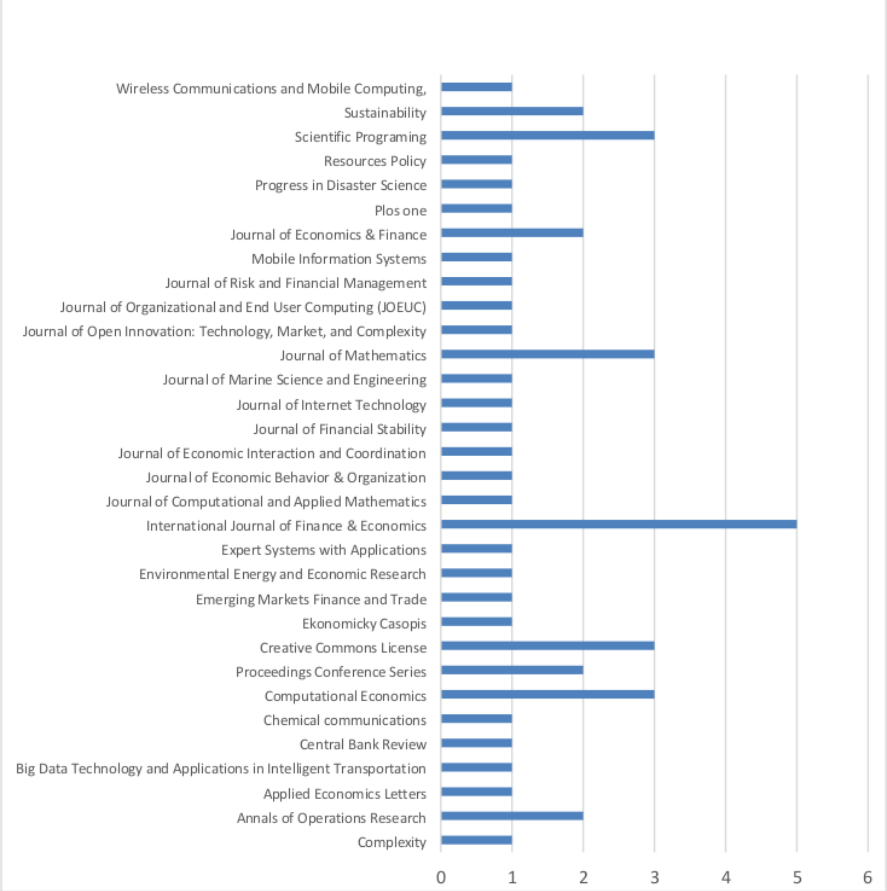
Figure 3. Number of Publication Per Scholarly Publisher



Source: Processed data (2024)

Figure 4 depicts the distribution of research publications on early warning systems for stock market crises and investor sentiment across academic fields. The figure shows that this research topic is multidisciplinary, covering fields such as finance, economics, business management, computer science, data analytics, and risk management. This cross-disciplinary distribution of publications highlights a growing academic interest in understanding market dynamics, risk prediction, and investor behavior through a comprehensive and integrated approach. It confirms that to fully understand the complexity of stock market crises and the role of investor sentiment, a research approach that transcends the boundaries of a single discipline is necessary, offering richer and deeper insights.

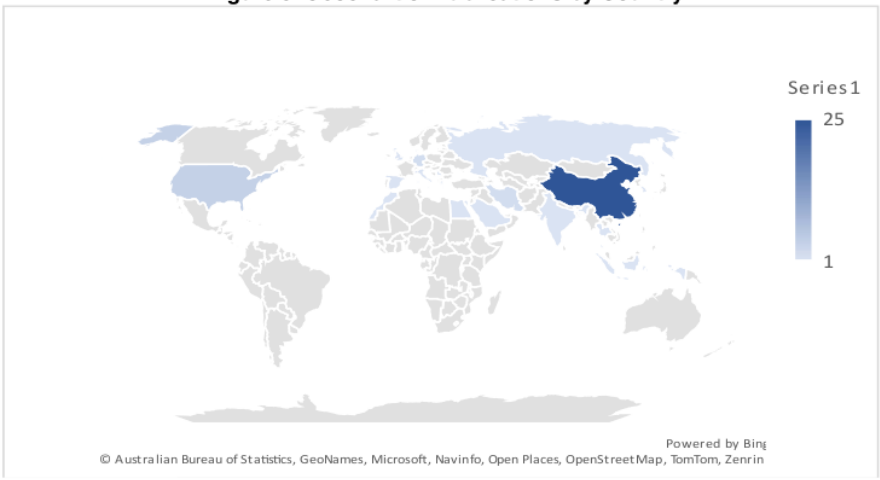
Figure 4. Number of Publication Per Academic Journal



Source: Processed data (2024)

Figure 5 shows the global distribution of research on early warning systems and investor sentiment. From the document's details, it is evident that China dominates the research landscape, with multiple Chinese research teams contributing studies. The geochart helps readers understand the geographical concentration of research efforts, revealing potential research hubs and regional interests in studying stock market crises and investor sentiment.

Figure 5. Geochart of Publications by Country



Source: Processed data (2024)

Key Elements in Building an Effective Early Warning System for Capital Markets

An early warning system (EWS) is a critical component of disaster risk management, designed to provide early information about potential hazards to enable individuals, communities, and organizations to prepare and act in a timely manner, thereby reducing losses or negative impacts (Shukla et al., 2023). The development of an effective EWS requires the integration of several key elements (Sufri et al., 2020), namely risk knowledge, monitoring, dissemination, and response, as outlined in Table 1.

Risk knowledge in capital markets involves understanding the various factors that can influence stock prices, such as global economic conditions, government policies, and internal company factors like financial performance and management. Identifying potential risks also requires analyzing previous patterns of market movements, whether through technical or fundamental analysis (Probohudono et al., 2022). Additionally, observing changes in external factors, such as inflation, interest rates, or exchange rate fluctuations, can provide a clearer understanding of potential impacts on the capital market.

Table 1. Summary of Selected Documents on Early Warning Systems (EWS) Elements

Authors	Year	Country	Focus On Early Warning Systems (EWS) Elements			
			Risk Knowledge	Monitoring	Dissemination	Response
Faranda et al.	2015	South Korea	✓	✓	✓	
Tong & Tong	2022	China	✓	✓		✓
Sufri et al.	2020	Australia	✓			
Personal & Archive	2018	Spanyol	✓	✓	✓	
Filippopoulou et al.	2020	Greece	✓			
Li & Chen	2024	China	✓	✓	✓	✓
Wang et al.	2020	China		✓		
Wen et al.	2021	China	✓			✓
Kimmel et al.	2016	Cananda	✓	✓	✓	
Lei & Li	2022	China	✓			
Du & Shu	2023	China	✓	✓	✓	
Ashraf et al.	2019	Pakistan	✓			
Markose et al.	2023	Germany	✓			
Kurum et al.	2018	United States				

		Japan China				
Bertschinger & Pfante	2020	Germany	✓			
Danieli & Jakubik	2022	Denmark Germany England Italy Switzerland	✓	✓	✓	✓
Faranda et al.	2015	Euro		✓	✓	
Xu et al.	2020	China		✓		
Liu et al.	2022	United States	✓		✓	✓
G. Wang et al.	2020	China	✓	✓		
Krinitz et al.	2017	Germany	✓	✓	✓	✓
Semin et al.	2020	Russia				
He et al.	2019	China	✓			
Zabidi et al.	2022	Saudi Arabia		✓	✓	✓
Sun & Huang	2016	China	✓			
Dastkhan	2021	Iran		✓	✓	✓
Fu et al.	2020	China	✓			
Zhang et al.	2022	China	✓	✓	✓	✓
Ouyang et al.	2021	China	✓	✓		
Z. Zhang & Chen	2022	China	✓	✓		✓
R. Zhang et al.	2019	China	✓		✓	
Feixiong-Ma et al.	2020	China	✓	✓		✓

Source: Processed data (2024)

Furthermore, monitoring serves to detect potential risks that could affect the stock market. This involves tracking real-time market data, including stock price movements, trading volumes, and other economic and financial indicators (Bustos & Pomares-Quimbaya, 2020). Technology plays a crucial role in this process, with the use of algorithms and systems based on big data or machine learning enabling more effective market monitoring and early detection of volatility or risky trend changes (Kavin, 2023; Pathak et al., 2023). These systems can process large volumes of data quickly and provide early signals of potential changes in the market, allowing time to mitigate the impact of losses.

Once a risk is detected, rapid and appropriate dissemination is essential to ensure that market participants can respond quickly. This dissemination can be done through various communication channels, such as company financial reports, policy announcements from regulators, and trading platforms and applications used by investors (Cantaluppi et al., 2021). The dissemination of clear and easily accessible information helps reduce uncertainty and allows all relevant parties to make decisions with accurate and timely information (Jazbec et al., 2021). Additionally, the use of automatic notifications through trading applications or social media platforms is an effective way to accelerate the distribution of information to investors at large.

The final step in the capital market early warning system is the response to potential risks or warnings that have been disseminated. This response includes actions such as portfolio adjustments, selling stocks to avoid losses, or hedging risky investment positions (Zhang & Chen, 2022). On the other hand, market regulators may take measures such as imposing circuit breakers to temporarily halt trading and prevent greater panic (Li & Yao, 2022). A rapid and coordinated response between investors, financial institutions, and market regulators is key to maintaining market stability and mitigating the impact of a crisis.

Overall, the construction of an early warning system in the equity capital market should integrate precise risk knowledge, sophisticated market monitoring, rapid and effective information dissemination, and a coordinated response. By using modern technologies such as big data analysis and artificial intelligence, EWS can improve prediction accuracy and enable market participants to act more quickly and appropriately in managing risks.

The Role of Economic Policy Uncertainty and Investor Sentiment in Predicting Stock Market Movements

Economic policy uncertainty (EPU) plays an important role in predicting future stock market growth, although there is no direct relationship with current market movements. On the other hand, high volatility often occurs during market crashes, but this information is less useful for predicting future market movements (Helseth et al., 2020). Investor sentiment, whether optimistic or pessimistic, has a significant influence on the financial performance of listed companies, which can obscure the analysis being performed (Nobohudono et al., 2022). In this context, high financial market risk perception is usually associated with low risk-free interest rates, high capital costs for risky firms, and a decline in future real output and investment. These risk perceptions tend to decrease after positive economic news, but may increase again (Pflueger et al., 2020).

In addition, modern technology provides the opportunity to use machine learning models to identify and analyze risk factors in the stock market. These models show high accuracy in predicting stock values based on parameters such as closing price, price differences, and daily returns (Singh et al., 2022). Additionally, models incorporating elements of prospect theory can help explain various stock market anomalies by considering investors' past gains and losses, as well as making quantitative predictions about the average return of assets based on volatility, skewness, and capital gains overhang (Barberis et al., 2020). With this comprehensive approach, early warning systems can be more effective in responding to ever-changing market dynamics.

Overall, investor sentiment plays a crucial role in stock price movements and can serve as a useful indicator for predicting the possibility of a market crisis. Significant fluctuations in sentiment can lead to large changes in stock prices, even without fundamental changes in underlying economic factors. Therefore, monitoring and analyzing investor sentiment is an integral part of effective market risk management, both for individual investors and financial institutions, in order to respond early to potential crises.

CONCLUSION

This research aims to understand the role of investor sentiment in enhancing the effectiveness of early warning systems (EWS) in predicting and mitigating the risk of stock market crises. The results show that investor sentiment plays a crucial role in stock market dynamics, significantly influencing crisis predictions. The integration of sentiment analysis into the EWS model has been shown to improve both the accuracy and responsiveness of the system.

This research has practical implications for creating more stable financial markets. By incorporating investor sentiment into the EWS, market participants and policymakers can take more informed actions to manage risks, thereby promoting sustainable economic development. Future research is recommended to further explore the application of artificial intelligence and machine learning technologies in processing investor sentiment in real-time, as well as analyzing its impact on markets in developing countries.

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PAGE 3

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