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# A Bibliometric Analysis of Evolving Trends in Efficient Market Hypothesis

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**ABSTRACT**

This study aims to determine research trends with the topic of efficient market hypothesis. The method used is a bibliometric study, with Vosviewer analysis and PRISMA protocol. The analysis is based on big data from Scopus for the period between 2010 and 2023. Similarly, co-occurrence and co-authorship analyses are also performed. The conclusion that can be drawn from this study is that research publications related to efficient market hypothesis have experienced significant fluctuations and reached its peak in 2023. The country that dominates as the object of research is the United States with a very striking difference compared to other countries. It is hoped that this research can provide implications in the form of further directions and opportunities in conducting research related to efficient market hypothesis.

## INTRODUCTION

According to the theory of efficient markets, accounting is seen to be in direct competition with other sources of information, such as the media, financial experts, and even market prices. Accounting will continue to exist as a means of providing information to investors, but only if it proves to be beneficial, timely, and cost-effective compared to alternative sources.

The efficient securities market hypothesis also highlights the main purpose of accounting, which is to address information asymmetry. The adverse selection problem emerges when certain individuals possess privileged information, creating a need to establish measures, such as financial reporting, to protect investors who lack this information against potential abuse by those who are better informed. Efficient securities market theory provides a solid foundation for analyzing the impact of insider information on equity prices. Accounting can be conceptualized as a mechanism that facilitates the transfer of valuable information from within the organization to external parties. Furthermore, this not only facilitates more informed investment choices but also yields social advantages by enhancing the efficiency of securities markets. Accounting theorists recognized the significance of securities market efficiency in the late 1960s. Subsequently, the idea has significantly influenced numerous accounting studies and has had major implications for accounting procedures.

The concept of 'market efficiency', as defined in Fama's important analysis in 1970, typically refers to the informational efficiency of financial markets, highlighting the significance of information in determining prices. The efficient markets hypothesis precisely characterizes an efficient market as a market where new information is promptly and accurately incorporated into its existing security price. Fama (1970) provides an initial comprehensive analysis of the many types of information sets accessible to market

participants and categorizes the efficient market hypothesis into three distinct forms: weak-form, semi-strong-form, and strong-form.

In his landmark review, Fama (1970) examines the empirical data supporting the weak-form, semi-strong-form, and strong-form efficient market hypothesis. He provides extensive coverage to the first category. Pre-1970 empirical research often utilize serial correlation tests and technical trading rules, and their results clearly indicate that stock markets exhibit weak-form efficiency. Twenty years later, Fama (1991) performs a subsequent examination of the literature on market efficiency. Instead of prioritizing historical returns, he broadens the scope of weak-form efficient market hypothesis by examining the predictability of returns through the analysis of additional factors, such as the dividend–price ratio, earnings–price ratio, book-to-market ratio, and various interest rate indicators. The tests for the semi-strong-form and strong-form efficient market hypothesis are respectively referred to as event studies and tests for private knowledge. The paper presents increasing evidence of the capacity to forecast future returns based on past returns, dividend yields, and various term structure characteristics. However, the author cautions that these findings may be misleading and should be approached with skepticism.

Yen & Lee (2008) present a systematic examination of empirical data on the efficient market hypothesis spanning the past fifty years. The study clearly shows that the efficient market hypothesis no longer receives the same high level of support it once had during the prosperous 1960s. Instead, it has faced continuous criticism from the field of behavioral finance in the 1990s. In addition to the comprehensive review mentioned above, there are other survey papers that explore specific themes. For example, (1) Fama (1998) examines empirical research on event studies, specifically focusing on papers that discuss long-term return anomalies resulting from under and over-reactions to information. (2) Malkiel (2003) and Schwert (2003) critically analyze studies that provide evidence of statistically significant predictable patterns in stock returns. (3) Park & Irwin (2007) assess the profitability of technical trading rules in various speculative markets, including 66 stock market papers published between 1960 and 2004.

This study attempts to address the subject of how the development of research publications is related to the topic of efficient market hypothesis and what variables are commonly associated with the topic as an example of the direction of future research based on the advances that have occurred. In addition, we conduct a systematic review in four stages and utilize bibliometric methods to synthesize the existing literature. This research contributes to the literature in the following ways: (1) It provides a comprehensive summary of the fragmented literature using big data technology, particularly bibliometric analysis. (2) The analysis identifies key historical milestones, such as influential authors, journals, and institutions.

## LITERATURE REVIEW

### Efficient Market Hypothesis

There are three variants of efficient market hypothesis (EMH) proposed by Fama, which have been subsequently interpreted by many academics in different fields of study, both conceptually and statistically. The efficient market hypothesis posits that the current price of a security reflects all available information, rendering prior knowledge irrelevant for

predicting future prices. An efficient market is characterized by random data that follows a normal distribution and has the ability to anticipate future returns. The majority of researchers regard the efficient market theory as a theory that requires testing and revision based on the current market conditions. Therefore, the suitable instruments for assessing and scrutinizing the efficient market hypothesis involve utilizing predictability as a means of validating EMH. In 1970, Fama examined two commonly used approaches for verifying the efficient market hypothesis. The first test is the fair game model, which examines the potential for gaining higher profits using past price knowledge (weak-form efficient market hypothesis). The second test examines the serial covariances of returns. The serial covariances of a "fair game" should be zero. Additionally, it is important to note that the serial covariances between lagged values of a "fair game" are always zero.

The cost of acquiring information in the efficient market hypothesis is a significant determinant of investor willingness to purchase securities. Ball (1978) highlighted the issue by composing a comprehensive research article that unveiled the role of cost in the efficient market hypothesis as the rationale behind generating revenues. This occurs when investors mitigate risk and pursue excessive returns. Ball (1978) posited that the efficient market hypothesis is a fusion of pricing and the arrival of information. This is determined by analyzing post-announcement risk-adjusted anomalous returns, which should ideally yield zero results if the time following earnings releases aligns with market efficiency. Ball also contends that non-zero anomalous returns arise as a result of the deficiencies in the two asset pricing model parameters utilized in the studies to account for variations in risk. Moreover, Ball also contends with the definition of "available information". If "available information" is understood as information that is accessible to the general public or exclusively to individual investors, then it is a consequence of a competitive process in acquiring information. The process of searching, examining, and analyzing information will enhance efficiency in information management.

Lo & MacKinlay (1988) were among the pioneering researchers who sought to validate the efficient market hypothesis by analyzing the fluctuations in stock prices. The rejection of the random walk hypothesis, as argued by Lo and MacKinlay, does not necessarily indicate inefficiency in stock price development. Rather, it mostly stems from the stock's response to changing volatilities. Conversely, statistical tools for assessing random walk are just instruments for observing the progression of stock prices over time. However, the utilization of descriptive tools is more advantageous for explaining the pattern of stock price evolution.

The availability of information is essential for the efficient market hypothesis to analyze the market's response to news and events following the release of such information. Events and news can have varying impacts on investing decisions depending on the level of expectation held by investors. Shiller (1989) asserts that market volatility arises from the uncertainty around future revenues or dividends. Statistical measurement allows for the quantification of uncertainty. By studying and taking action regarding variables such as interest rates and other influencing factors, it becomes feasible to measure uncertainty in relation to those variables. In his survey study released in 1989, LeRoy (1989) examined the efficient market hypothesis and provided a comprehensive analysis of Fama's definition of an efficient market. LeRoy argued that achieving a state of "fully reflecting" available information does not necessarily imply that the market is in equilibrium. However, he suggested that

assessing expected return is a suitable method for articulating the concept of "fully reflecting" available information.

According to the previous discussion, the efficient market hypothesis does not solely entail the reflection of all accessible information, but also encompasses the reflection of investor response and behavior towards news and events. The rational response from an investor will have implications for the market by influencing the behavior of other investors in their investing decision-making process. The study conducted by Fama (1991) examines the implications of a good approach for combining hypothesis problems and generating new questions on return predictability. Fama's research reveals that the efficiency of the efficient market hypothesis is contingent upon how the market reacts to significant downturns and upturns in the economy. Everyday, the predictability of return can be used to examine the response to information. As stated by Fama (1991), the predictability of events will increase the perceived value of the efficient market hypothesis over time. In order to remain relevant, EMH must respond to current economic conditions and technological advancements, as the environment is constantly changing.

Daniel & Titman (1999) explained that the connection between the efficient market hypothesis and behavioral finance arises from biases and perceptions stemming from overconfident investors. Excessive confidence from investors has a significant impact on market prices, both directly and indirectly. The direct implication pertains to the excessive analysis of information data in financial reports. The indirect implication, on the other hand, relates to the impact on stock market prices for investors who disregard relevant information. This can lead to a decrease in their self-confidence, such as seeking advice from other investors or denying losses. Ongoing study is examining the potential impact of the efficient market hypothesis on financial crises. At the start of the introduction to the financial market, there is uncertainty surrounding the notion of efficient market hypothesis, which raises doubts about the existence of a really free market. Multiple investors achieve anomalous returns, resulting in the formation of speculative bubbles in the stock market. A bubble formed in the stock market due to the presence of profit takers. The profit taker's actions have influenced other investors to perceive the present stock price as the true value of the stock, compelling them to consistently put their funds into a single portfolio. This has ultimately led to a market bubble. In order to avoid the occurrence of a financial crisis, it is crucial to build a robust efficient market hypothesis framework that effectively disseminates information to all players in the market.

In his work, Malkiel (2003) presents arguments on the role of the efficient market hypothesis in causing financial crises. Malkiel asserts that the efficient market hypothesis encompasses not only the incorporation of "available information," but also the response to specific anomalies that arise in the stock market. Lo (2004, 2005) explores the concept of adaptive market hypothesis (AMH) as a new paradigm for examining the efficient market hypothesis. The study critiques EMH by specifically analyzing the behavior of market players. Lo suggests that the interaction between efficient market hypothesis and behavioral finance influences the market in an intellectual manner. Lo (2004) asserts that variations in investor perception arise from their approach to adapting to environmental changes, evaluating investment product performance, and navigating commercial and industrial competitiveness. According to Lo (2005), AMH is better suited for the current stock market conditions as it adjusts risks to accommodate changes in the market. On the other hand, EMH focuses on

transferring risks to a level that investors are willing to accept. Lo also believed that enhancing market efficiency and rationality would lead to a higher degree of market adjustment.

## METHODS

This study uses bibliometric analysis as a foundational method to enhance our understanding of the efficient market hypothesis. The research questions were addressed by following the four distinct phases outlined within the PRISMA protocol (Figure 1). These stages include identification, screening, eligibility, and inclusion (Hansen et al., 2022; Kuckertz & Block, 2021; Lim et al., 2022; Rojas Molina et al., 2023). The identification stage considers several critical factors, including source type, search engine, categories, language, period, and keywords (Setiawan et al., 2023). This research exclusively targets journal articles, excluding other publication types, such as books, book chapters, and conference proceedings (Harsanto & Firmansyah, 2023), considering their limited contribution to the empirical and theoretical discussions. Regarding the search engine, this analysis solely relies on the Scopus database, a globally renowned repository featuring high-quality articles from prominent publishers. Within the spectrum of search categories, this study focuses on the Business, Management and Accounting, Economics, Econometrics, and Finance domains. To avoid language bias, the search language is exclusively English. The search timeframe covered 14 years, from 2010 to 2023. Finally, the keywords used for this study is: "Efficient Market Hypothesis".

In the initial identification stage 1,935 documents were identified based on keyword searches. Subsequently, a screening process was performed using specific identification criteria. Based on the data, we conducted a screening process that included the following aspects: year (N = 543 excluded), subject area (N = 395 excluded), language (n = 22), document type (n = 44) and source type (n = 120 excluded). This process culminated in a final count of 811 documents during the screening stage. The feasibility stage involved a meticulous review of keywords and titles to ensure that the selected articles were relevant to the research topic, which focused on EMH. This stage also included error checking of the data to ensure that they could be used for bibliometric analysis (N = 16 excluded). The inclusion stage was the final step, consisting of validation examinations, analysis of publication statistics, and bibliometric analysis based on 795 selected pieces of data. The validation process was independently conducted to ascertain the robustness and validity of the preceding stages. A preliminary statistical analysis was performed to extract various pertinent pieces of information. Finally, a comprehensive bibliometric analysis was performed using VOSviewer as the primary tool (Aria & Cuccurullo, 2017).

This study employs two bibliometric methods, namely, co-occurrence and co-authorship. The underlying assumption is that the frequent co-occurrence of words indicates a close relationship among the selected words (Zupic & Čater, 2014). Co-occurrence analysis is the method that focuses on instances in which two or more keywords appear together in documents or articles. This analysis identifies the relationships between keywords within the literature, helping to visualize conceptual connections through bibliometric networks (Callon et al., 1983). The co-occurrence analysis leads to conclusions regarding the development of EMH. The second method, co-authorship analysis, explores collaborations between two or more authors in article writing. Authors who collaborated in the research and co-wrote articles were considered co-authors. This analysis reveals patterns of collaboration among authors, offering insights into collaborative networks involving individuals and institutions

within academia. The co-authorship analysis leads to conclusions about the drivers of progress in efficient market hypothesis research. This complements the method used to answer the research questions.

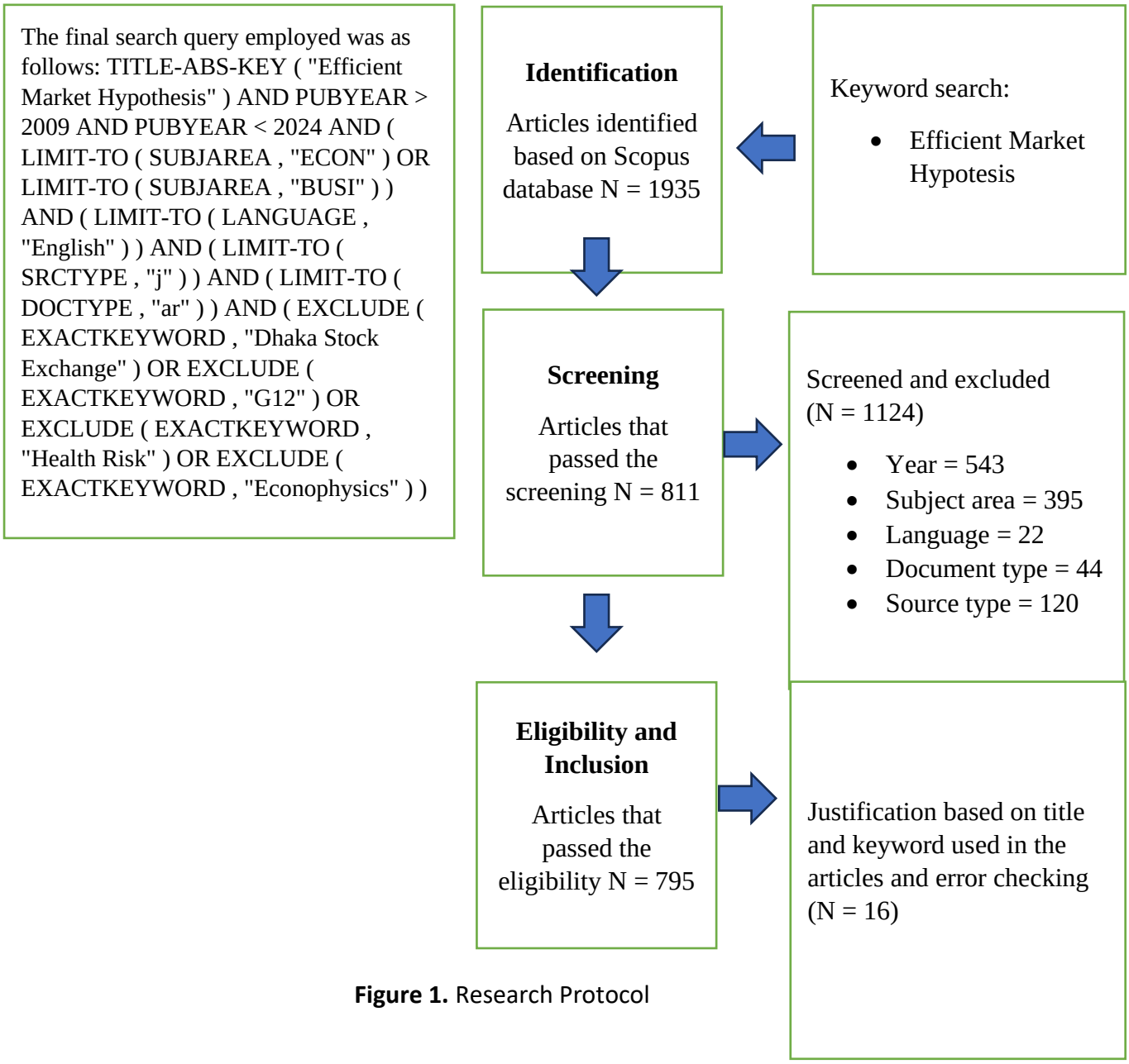



**Figure 1.** Research Protocol

## RESULTS AND DISCUSSION

### General characteristics of the literature

As shown in Figure 2, there is a discernible increasing trend in the number of publications, with an average of 57 documents published annually. A significant surge occurred in 2019, which showed an increase of 32% in documents (n = 17). Over the past decade, United States emerged as a leading country in terms of publications, boasting a total of 139 documents (Figure 3), followed by the United Kingdom with 89 documents, India with 64 documents and China with 49 documents. Regarding the number of publications, the

Summy State University (Ukraine) have made substantial contributions to research on efficient market hypothesis over the past decade producing 21 articles, respectively (as shown in Table 1). University of Pretoria (South Africa) contributed 10 publications, Universiti Utara Malaysia (Malaysia) and Brunel University London (United Kingdom) contributed 8 publications. Organizations in United Kingdom have contributed the most publications, followed by Ukraine, South Africa, and Greece. Table 1 also shows that, in United Kingdom and Ukraine, there are organizations (universities) with a higher interest in efficient market hypothesis research than in other countries. This also highlights the fact that universities are the centers of efficient market hypothesis studies.

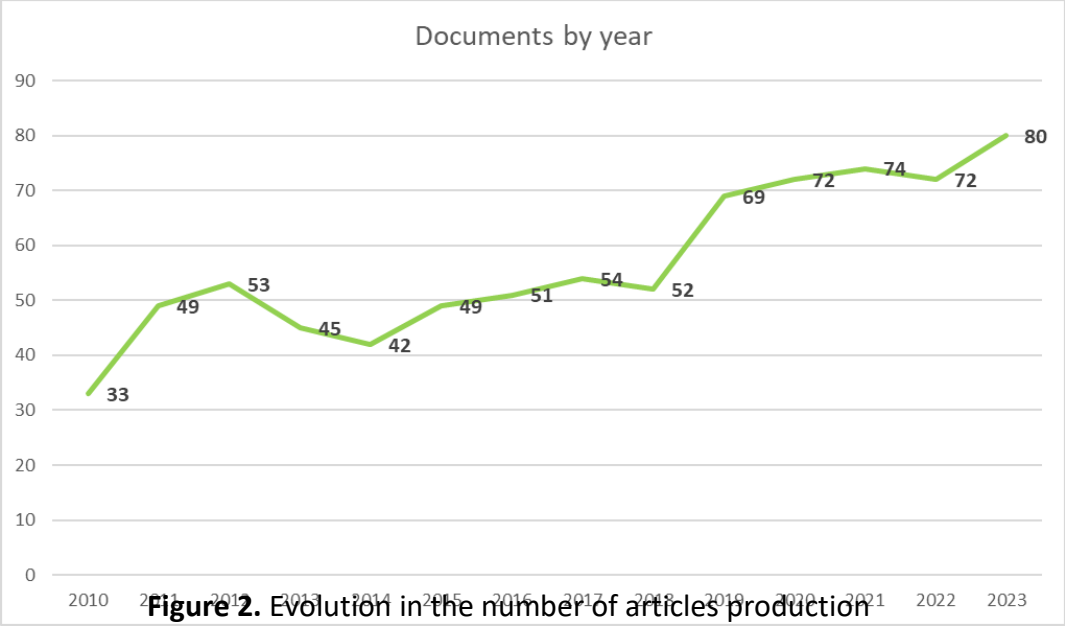



**Figure 2.** Evolution in the number of articles production

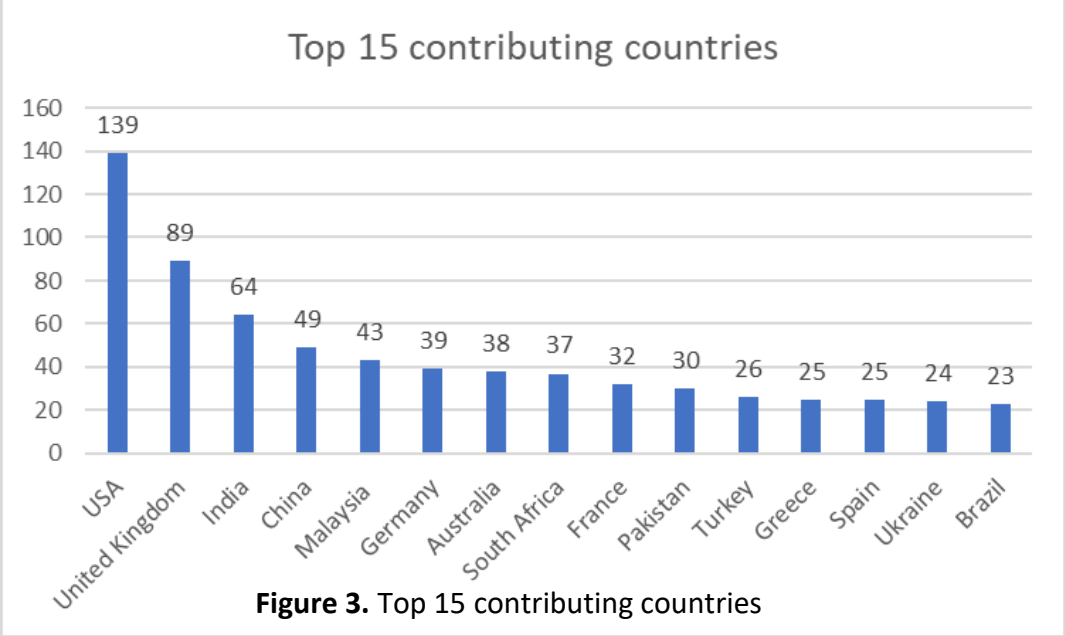



**Figure 3.** Top 15 contributing countries

**Table 1.** Top 15 Affiliations contributing to research on efficient market hypothesis

| Affiliation | Region | Number of Publications |
|---|---|---|
| Sumy State University | Ukraine | 21 |
| University of Pretoria | South Africa | 10 |
| Universiti Utara Malaysia | Malaysia | 8 |
| Brunel University London | United Kingdom | 8 |
| Bilkent Üniversitesi | Turkey | 7 |
| University of the Aegean | Greece | 7 |
| University of Cambridge | United Kingdom | 7 |
| University of the Western Cape | South Africa | 7 |
| Bucharest University of Economic Studies | Romania | 7 |
| University of Macedonia | Greece | 7 |
| University of Southampton | United Kingdom | 6 |
| Université de Tunis El Manar | Tunisia | 6 |
| Lebanese American University | Lebanon | 6 |
| Fundacao Getulio Vargas | Brazil | 6 |
| University of Houston-Victoria | United States | 6 |

**Source:** *Author's compilation*

**Network analysis of Co-occurrences**

Figure 4 presents a graphical depiction of the co-occurrence network obtained through bibliometric analysis using VOSviewer. This bibliometric network consists of nodes and edges (van Eck Nees Janand Waltman, 2014). Circular nodes denote keyword occurrences, with larger nodes indicating more extensive research on these keywords (Donthu et al., 2021). Edges, which connect lines between nodes, represent relationships and their strength within the research, with thicker edges signifying stronger or more frequent associations between nodes (Donthu et al., 2021). Furthermore, the proximity of nodes signifies the strength of the relationship between them.

Figure 4 provides information on variables that often appear along with topics about efficient market hypothesis, including market efficiency, stock market, event study, adaptive market hypothesis, financial market, commerce, random walk, hurst exponent, bitcoin, technical analysis, behavioral finance, hypothesis testing, emerging market and stock returns. So, we can say that these variables are closely related to efficient market hypothesis research.

Table 2 illustrates the frequently associated keywords in research related to efficient market hypothesis. The Cluster column highlights the interconnectedness of variables within each cluster, although this does not exclude the possibility of keywords being connected to other clusters. The Link column indicates the frequency of keywords linked to others, whereas the Total Link Strength column shows the strength of the connections. A higher total link strength indicates a stronger network of keyword connections. Additionally, the Average Publishing Year (Avg. Pub. Year) indicates the period in which a keyword appeared in publications.

Table 2 presents the top 15 most frequently used keywords in efficient market hypothesis research, considering 129 keywords and nine clusters represented by various colors. The term "efficient market hypothesis" emerged as the most prominent keyword, appearing 309 times, with a total link strength of 595. This signifies an extensive discourse on this topic, coupled with strong connections to other keywords. "market efficiency" and "stock market" followed with 77 and 63 occurrences, respectively. Table 2 shows the publication trends for this term between 2017 and 2018. The keyword "efficient market hypothesis" gained prominence with an average publication year of 2017.712.

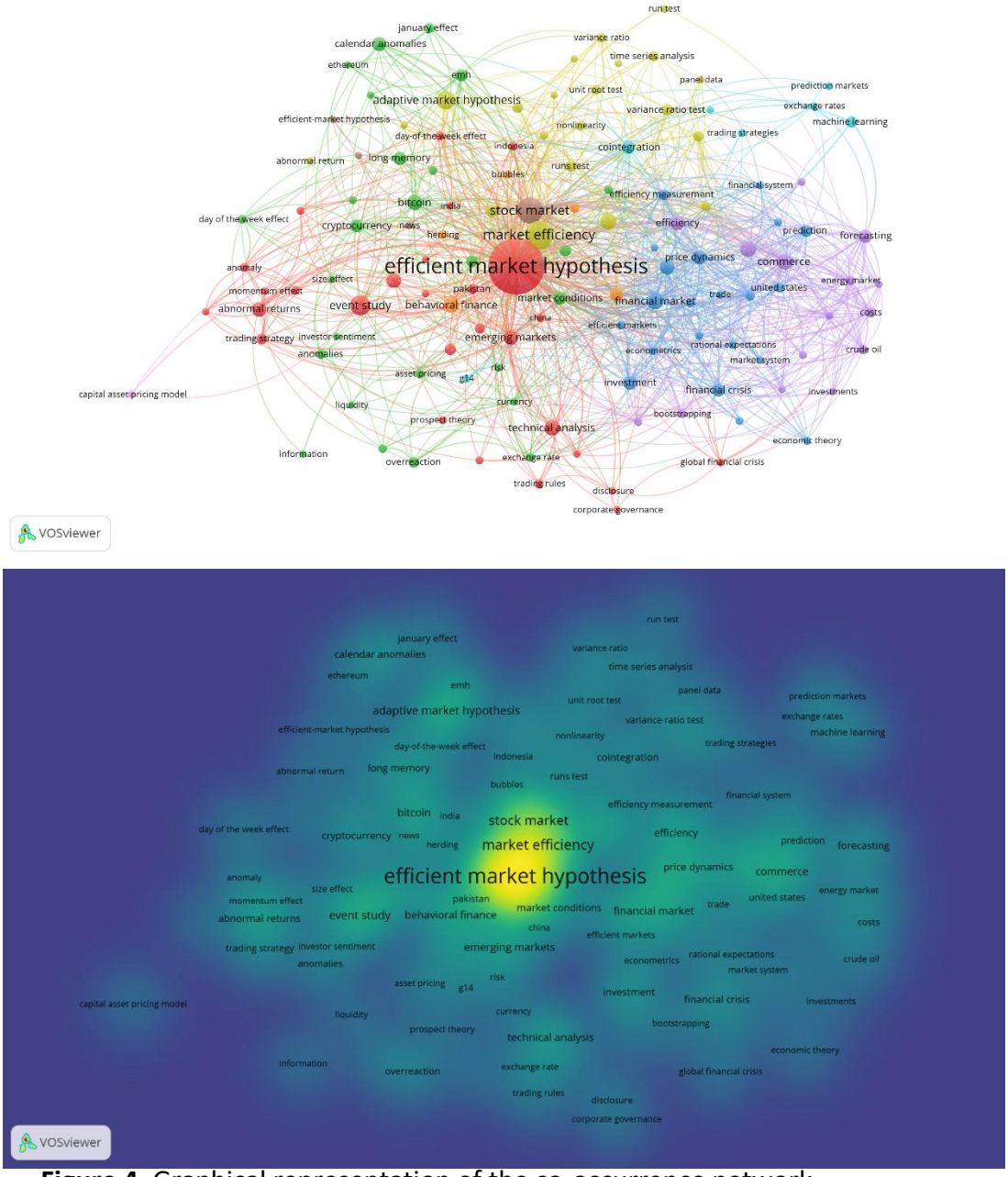



**Figure 4.** Graphical representation of the co-occurrence network

**Table 2.** Top 15 most frequently used keywords

| Label | Cluster | Links | Total Link Strength | Occurrences | Avg. pub. year |
|---|---|---|---|---|---|
| Efficient market hypothesis | 1 | 122 | 567 | 309 | 2017.712 |
| Market efficiency | 4 | 73 | 153 | 77 | 2017.4675 |
| Stock market | 8 | 78 | 217 | 63 | 2017.3651 |
| Event study | 1 | 24 | 46 | 36 | 2017.75 |
| Adaptive market hypothesis | 4 | 29 | 66 | 31 | 2019.3548 |
| Financial market | 3 | 47 | 108 | 26 | 2017.7308 |
| Commerce | 5 | 51 | 125 | 23 | 2017.3478 |
| Hurst exponent | 5 | 27 | 53 | 23 | 2016.6522 |
| Random walk | 4 | 34 | 56 | 23 | 2015.8696 |
| Behavioral finance | 7 | 25 | 40 | 21 | 2018.8571 |
| Bitcoin | 2 | 35 | 55 | 21 | 2021 |
| Technical analysis | 1 | 27 | 48 | 21 | 2016.9048 |
| Emerging markets | 1 | 36 | 46 | 20 | 2017.15 |
| Hypothesis testing | 3 | 44 | 98 | 20 | 2015.15 |
| Stocks returns | 1 | 21 | 31 | 20 | 2016.2 |

**Source:** *Author's compilation*

**Network analysis of Co-authorship**

Transitioning to co-authorship analysis, Table 3 introduces the 15 most productive authors in efficient market hypothesis research. Plastun, a., Grupta r., and Caporale, g.m. claimed the top positions with the highest number of Scopus publications, contributing 20, 9, and 8 documents, respectively. Plastun, a. has average publication year of 2019 and Grupta r., and Caporale, g.m. shared an average publication year of 2018. Additionally, when examining the Total Link Strength, Plastun, a., Grupta r., and Wohar, m.e. exhibited the strongest network connections, underscoring their robust collaboration with other authors. Collaborative research efforts involving multiple authors can enrich efficient market hypothesis research by leveraging diverse experiences and expertise. Figure 8 shows the authors' network in this field.

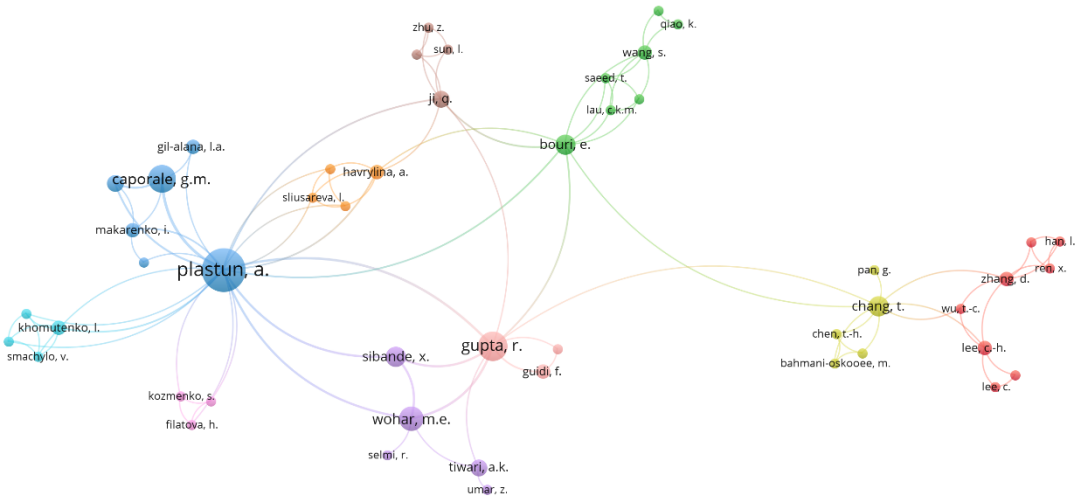
Figure 5 visually represents 10 distinct clusters within the author network, denoted by the colors blue, light blue, pink, purple, orange, brown, green, light green, red and light pink. These clusters indicate the grouping of authors based on specific research areas or focal points in efficient market hypothesis. Figure 5 also conveys essential information regarding

network density. Network density represents the degree to which the nodes within a network are interconnected through edges, thereby shedding light on the level of integration within the network. A higher network density indicates a greater number of connections linking certain nodes, which is indicative of a heightened level of interaction and relationships among the authors within the network. Plastun and Caporale exhibited a significantly higher network density than their peers.

**Table 3.** Top 15 highly productive authors

| Label | Cluster | Links | Total Link Strength | Documents | Avg. pub. year |
|---|---|---|---|---|---|
| Plastun, a. | 3 | 21 | 45 | 20 | 2019.25 |
| Grupta, r. | 10 | 9 | 22 | 9 | 2018 |
| Caporale, g.m. | 3 | 4 | 13 | 8 | 2018.375 |
| Wohar, m.e. | 5 | 5 | 15 | 6 | 2019.5 |
| Bouri, e. | 2 | 9 | 12 | 4 | 2020.5 |
| Chang, t. | 4 | 9 | 9 | 4 | 2014.25 |
| Sibande, x. | 5 | 3 | 12 | 4 | 2019.75 |
| Gil-alana, l. | 3 | 3 | 7 | 3 | 2017.6667 |
| Ji, q. | 8 | 7 | 9 | 3 | 2021.3333 |
| Tiwari, a.k. | 5 | 3 | 3 | 3 | 2019.3333 |
| Gil-alana, l.a | 3 | 2 | 2 | 2 | 2016 |
| Guidi, f. | 10 | 2 | 3 | 2 | 2012 |
| Havrylina, a. | 7 | 6 | 7 | 2 | 2021.5 |
| Khomutenko, l. | 6 | 4 | 5 | 2 | 2022.5 |
| Lee, c.-h. | 1 | 5 | 5 | 2 | 2013.5 |

**Source:** *Author's compilation*




VOSviewer

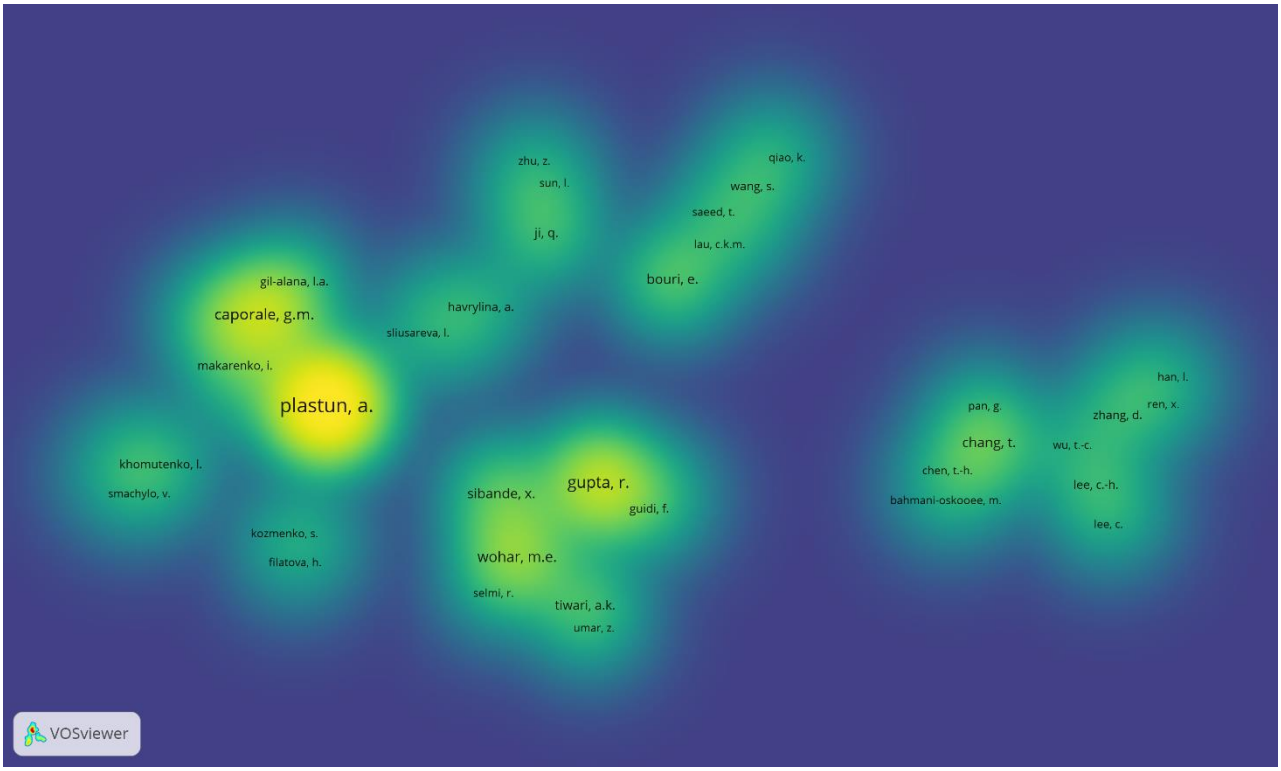



**Figure 5.** Graphical representation of the author's network.

## CONCLUSION

Overall, this study highlights the growing scholarly interest in the efficient market hypothesis research to address the following questions: How has research on efficient market hypothesis evolved, and how could it advance further? The trajectory of investigations on this topic has displayed consistent expansion since 2010, despite a slight decrease in 2018, reaching its peak in 2023 with 80 publications. This significant increase can be attributed to several factors. First, the active involvement of publishing countries such as the United States, the United Kingdom, and India played a pivotal role. Several affiliations, including Sumy State University, University of Pretoria, and Universiti Utara Malaysia have made significant contributions to efficient market hypothesis research. Finally, the momentum in efficient market hypothesis research has been fortified by the prolific efforts of authors such as Plastun, a., Grupta r., and Caporale, g.m., who have actively collaborated and published on this topic.

This study found that research developments related to efficient market hypothesis developed very variedly, as evidenced by the abundance of publications related to these topics. There are several variables related to the topics of efficient market hypothesis, including market efficiency, stock market, event study, adaptive market hypothesis, financial market, commerce, random walk, bitcoin, technical analysis, behavioral finance, hypothesis testing, emerging market and stock returns. However, there are still many unexplored variables that are related to the topic in this study and can be considered for further research as renewables for further research, such as digital technologies, and innovation capability.

It is important to acknowledge the limitations of this study. First, the analysis exclusively focused on articles published in English-language journals, excluding papers published in languages like Croatian, Spanish, Portuguese, Russian, Ukraine, or Lithuanian. Combining articles from different languages can introduce bias and errors in the bibliometric analysis process. Therefore, further research could separately analyze non-English literature to complement the literature on the efficient market hypothesis. Second, specific document types including books, book chapters, letters, and conference proceedings were not included in the research. Additionally, the bibliometric analysis was confined to the Scopus database because of its established quality and support from previous reviews. Future investigations could explore other databases involving the WOS to expand their scope. Third, bibliometric analysis only analyzes bibliometric datasets (e.g., keywords, titles, abstracts, citations, and affiliations). Further research can perform systematic literature reviews to gather information, such as the methods used, theories used, and mapping causality effects that are not available in bibliometric analysis. Finally, this research exclusively employed VOSviewer as an analytical tool, leveraging its strengths in co-occurrence and co-authorship analyses to obtain information on the development of a topic and its drivers. Future reviews should consider integrating VOSviewer and R analyses to provide a more comprehensive graphical representation.

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