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Review

The Intellectual Structure and Evolution of Investment Efficiency Research: A Comprehensive Bibliometric Review

Donghui Zhao [1], Sue Lin Ngan [1,*], Mohd Fairuz Md Salleh [1,*], Wan Sallha Yusoff [2], Ainul Huda Jamil [1], Mohd Shahidan Shaari [2] and Ahmad Nizam Che Kasim [2]

[1] UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia
[2] Centre of Excellence Social Innovation and Sustainability, Faculty of Business & Communication, University Malaysia Perlis, Pauh Putra Campus, Kangar 02600, Perlis, Malaysia
* Correspondence: suelin.ngan@ukm.edu.my (S.L.N.); fairuz@ukm.edu.my (M.F.M.S.)

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Abstract: This study offers a comprehensive bibliometric analysis of investment efficiency (IE) research, focusing on the integration of advanced technologies and ESG (environmental, social, and governance) criteria in modern financial decision-making processes. Utilizing the Bibliometrix R package, the analysis reviews 950 peer-reviewed articles from 1970 to 2023. It employs advanced techniques such as factorial analysis, thematic evolution mapping, and collaboration network analysis to explore the intellectual structure and thematic progression of IE research. The data is extracted from the Web of Science Core Collection to ensure a high-quality dataset. The study identifies major contributions in areas such as corporate governance, capital management, and the integration of emerging technologies like artificial intelligence, machine learning, and blockchain. ESG factors are highlighted as a transformative theme reshaping investment strategies and the overall direction of the field. This study provides a framework for understanding IE's evolution, offering insights for researchers on ESG integration and technology's role. Practitioners can apply these findings to enhance strategies, while policymakers can use them to promote responsible investing and capital innovation.

Keywords: investment efficiency; bibliometric literature review; corporate governance; thematic evolution; ESG

JEL: G11; D92; M41

1. Introduction

Investment efficiency (IE) refers to the optimal allocation of resources across competing investment opportunities to maximize shareholder wealth through projects that yield the highest return relative to risk [1]. However, real-world market frictions, such as information asymmetries and agency conflicts, continue to disrupt this process, leading to inefficiencies that divert investments from their optimal trajectory [2,3]. Despite the extensive research on IE, the literature remains fragmented. Studies often isolate various metrics, determinants, and consequences without synthesizing them into a cohesive framework. This fragmentation hinders the development of a comprehensive understanding of IE and its drivers [4–7].

Traditionally, research on IE has been grounded in neoclassical investment models, which focus on efficient resource allocation to maximize shareholder value [1]. Over time, the field has evolved to include insights from behavioral finance, highlighting the influence of cognitive biases on investment decision-making. Cognitive biases often result in suboptimal outcomes, such as overinvestment or underinvestment [8]. In parallel, advancements in

empirical methodologies, from traditional regression analyses to machine learning and artificial intelligence, have further enriched the IE literature, captured its multifaceted nature and improving predictive accuracy [9,10]. A key theme in IE research is the persistence of barriers such as information asymmetry and agency conflicts, which impede efficient capital allocation [2,3].

In recent years, the growing integration of environmental, social, and governance (ESG) factors into investment strategies has added new dimensions to studying IE. This shift towards sustainable investing practices has introduced non-financial criteria into decision-making frameworks, signaling a broader movement towards responsible and long-term investment [11]. Incorporating ESG factors enhances transparency and mitigates some of the traditional challenges associated with information asymmetry, thereby improving resource allocation.

However, despite the progress in theoretical and empirical research, significant gaps remain in the literature. First, there has been no systematic effort to map the evolution of IE's theoretical and methodological foundations. This absence of a unified framework limits the ability to fully understand how IE has developed over time and across different contexts. Second, the application of advanced methodological innovations—particularly those that leverage big data, machine learning, and longitudinal studies—has not been fully explored. These tools could address the rapidly changing global financial landscape, marked by technological advancements and regulatory changes, including the increasing prominence of ESG factors [4].

This study addresses these gaps by conducting a comprehensive bibliometric analysis of IE research. Through this approach, the study identifies key trends, maps the intellectual trajectory of the field, and highlights how technological disruptions, ESG integration, and policy shifts are shaping the future of IE research. Specifically, this work explores how innovations in artificial intelligence, machine learning, and blockchain technologies transform resource allocation strategies in financial markets. By providing a transparent and replicable framework for analyzing IE, this study offers

valuable insights to both academic researchers and practitioners, helping to address critical challenges in modern investment decision-making [12,13].

The research aims to answer the following key questions:

RQ1: What are the publication trends in IE research?
RQ2: Which studies have had the most significant impact on citations?
RQ3: Who are the primary contributors to IE research (regarding journals, authors, and regions)?
RQ4: What are the significant themes in IE research, and how have they evolved?
RQ5: What directions should IE research take in the future?

By leveraging systematic literature reviews and bibliometric analysis, this study provides a transparent and replicable field examination, identifying key trends, thematic groupings, and emerging research areas [14]. This comprehensive approach, recognized for its objectivity, offers a valuable framework for future research in corporate finance and investment efficiency, contributing to the broader discourse in these fields [15–18]. The article's structure is as follows: Section 2 outlines the theoretical framework, Section 3 details the research methodology, Section 4 presents the descriptive analysis, and Section 5 concludes with discussions and implications.

2. Theoretical Foundation

The study of investment efficiency (IE) has progressed through three critical perspectives: Classical Foundations, Behavioral Perspectives, and ESG Integration.

Classical Foundations. IE's origins lie in neoclassical economics, with Modigliani and Miller (1958) [1] emphasizing optimal resource allocation in perfect markets. The Efficient Market Hypothesis (EMH) by Fama (1970) [19] posits that markets are efficient when prices reflect all available information, leading to optimal investment decisions. However, this model ignores real-world frictions such as agency conflicts and information asymmetry, which can significantly impact IE by distorting capital allocation decisions [3,20].

Behavioral Perspectives. As limitations of classical models emerged, behavioral finance introduced the role of cognitive biases and irrational behavior in decision-making. Kahneman and Tversky's (1973) Prospect Theory demonstrated how investors often deviate from rational decision-making, leading to suboptimal outcomes like overinvestment or underinvestment [8]. More recently, empirical advancements, such as machine learning and big data analytics, have modeled these behavioral biases to understand better their impact on IE [21].

ESG Integration. A newer development in IE research is the integration of Environmental, Social, and Governance (ESG) criteria into investment strategies, shifting focus from purely financial outcomes to long-term sustainability [22,23]. Incorporating ESG factors enhances transparency, reduces agency problems, and mitigates

information asymmetry, improving resource allocation and efficiency [24]. ESG-driven strategies benefit long-term firm performance and enhance resilience in volatile markets [25].

This theoretical framework demonstrates the shift from classical models to behavioral insights and sustainability considerations, providing a comprehensive understanding of the evolving nature of investment efficiency.

3. Bibliometric Methodology

This study systematically employs comprehensive bibliometric content analysis to examine the literature on investment efficiency (IE). The methodological framework is structured around a four-phase protocol inspired by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which enhance the transparency and replicability of the review process [26,27]. The PRISMA framework was chosen due to its ability to improve methodological rigor and ensure the inclusion of relevant, high-quality studies. It also minimizes selection bias, allowing for a systematic review of the IE literature by establishing explicit inclusion and exclusion criteria [28,29]. This rigorous approach enhances the reliability of the study's findings, making them valuable to academic researchers and policymakers.

The bibliometric analysis integrates performance analysis and scientific mapping, conducted using the Bibliometrix R package, a widely recognized tool for bibliometric research [30]. The method allows a detailed exploration of publication trends, key contributors, and thematic evolutions in IE research, offering a replicable analytical framework. This study follows established scholarly practices to ensure that the field's breadth and depth are systematically captured [31,32].

3.1. Data Collection

Data for this analysis was collected from the Web of Science Core Collection (WoSCC), chosen for its superior indexing quality and fewer false positives than Scopus [33]. The search query included vital terms such as "investment efficiency", "investment inefficiency", "underinvestment" and "overinvestment", appearing in the titles, abstracts, and keywords of relevant articles. The search was confined to articles and review papers published between 1970 and 2023, providing a comprehensive overview of the field's historical development [34]. Only English-language publications were included to ensure consistency in the analysis, and only articles that had undergone double-blind peer review were selected to maintain the quality and credibility of the dataset [35].

To refine the dataset, results were limited to the "finance" and "business finance" categories, and citations were sourced from the Science Citation Index Expanded (SCI-EXPANDED) for accuracy. This initial search yielded 1182 documents as of February 2024. Following a manual screening process that involved removing duplicates, irrelevant papers, and non-peer-reviewed studies, the dataset was narrowed to 950 documents. The screening process ensured that only the most relevant studies contributing to the discourse on investment efficiency were retained. A visual representation of the data refinement process is provided in (Figure 1), showcasing the progression from initial search results to the final dataset.

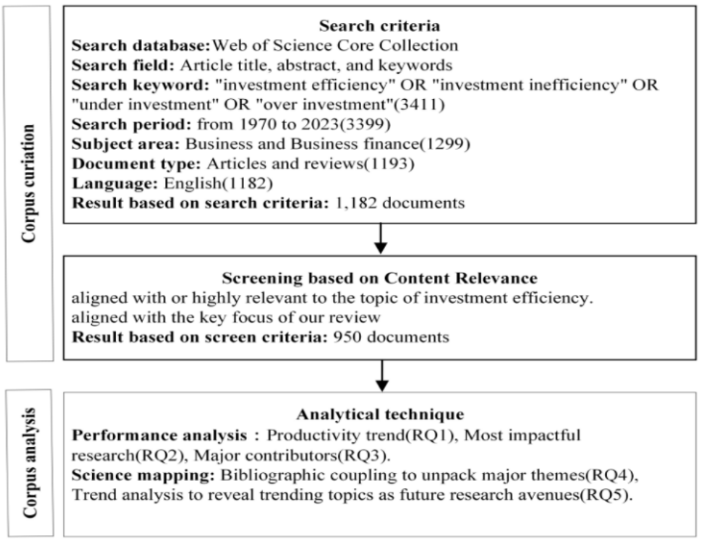

Figure 1. The review process of corpus curation and analysis.

3.2. Scientometric Analysis Methods

We employed a combination of performance analysis and scientific mapping techniques to explore the intellectual structure and emerging themes in IE research. These methods are valued for their objectivity and ability to reveal the complexity of research trends [36]. Using the final dataset of 950 documents, factorial analysis was used to identify thematic clusters, while trend analysis traced the evolution of these themes over time.

The Bibliometrix R package was pivotal in performing descriptive statistical analysis, helping to reveal key publication trends, influential works, and primary contributors within the IE research community [30,37–39]. The thematic evolution of the field was further analyzed through collaboration network analysis, mapping co-authorship and institutional affiliations to highlight significant research collaborations and knowledge dissemination patterns [31]. These tools identified established research frontiers and spotlighted emerging areas of interest, particularly in integrating technological advancements such as AI, machine learning, and blockchain alongside sustainable investing themes.

Overall, the scientometric analysis provides a nuanced understanding of the evolving landscape of IE research. It highlights the field's progression from classical finance theories to modern, data-driven approaches while offering valuable insights for future research directions. This methodologically rigorous approach ensures that the findings are transparent and replicable, aligning with best practices in bibliometric research.

4. Findings

4.1. Bibliometric Analysis

4.1.1. IE Study Productivity (Publication) Trends (RQ1)

Figure 2 illustrates the annual investment efficiency (IE) research publication trend. The first significant study appeared in 1987, with research activity remaining low until a noticeable surge after 2019. This increase is attributed to technological advancements in artificial intelligence (AI), machine learning, and blockchain, which have transformed investment strategies and efficiency. Market volatility driven by the global pandemic, political instability, and trade tensions has also contributed to a renewed focus on IE. The integration of environmental, social, and governance (ESG) factors has also played a crucial role, with sustainable investing becoming a key area of research, further expanding the field's scope.

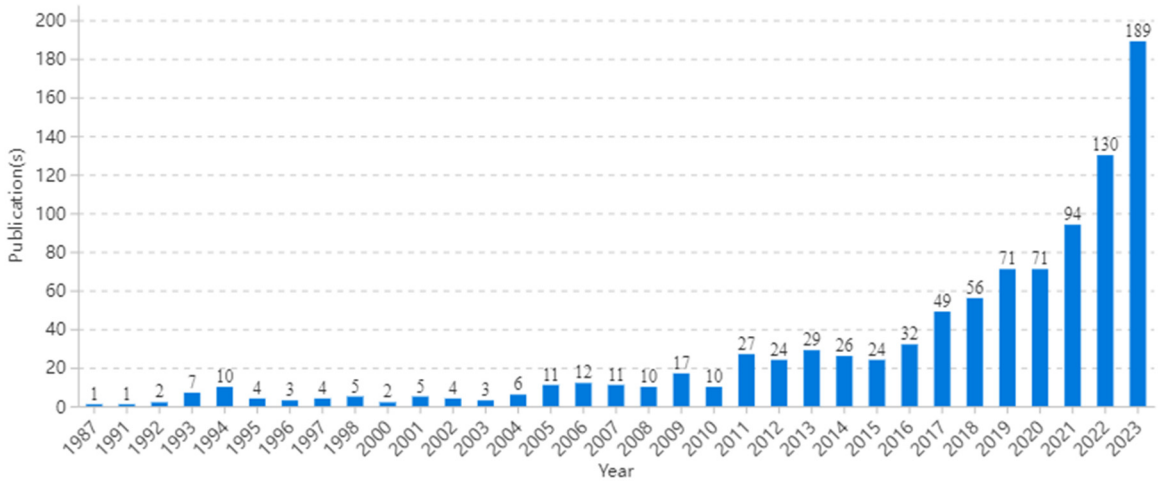

Figure 2. Productivity (publication) trend of IE research.

4.1.2. Most Influential (Cited) Studies (RQ2)

Table 1 summarizes the most cited studies on investment efficiency (IE). Berger and Ofek's (1995) work on the risks of diversification and overinvestment is the most cited, followed by Biddle et al. (2009) [40], which highlights the role of high-quality financial reporting in reducing information asymmetry and improving decision-making. Another critical contribution is Wurgler's (2000) research on inefficient capital allocation and its effects on economic growth. Other influential studies examine corporate governance, financial reporting practices, and policy uncertainty, which are crucial in shaping IE.

Table 1. Most impactful (cited) IE research.

Author(s)	Title	Journal	Year	TC
Berger, P. G., & Ofek,	Diversification's effect on firm value	Journal of Financial Economics	1995	1342
Biddle, G. C., Hilary, G., & Verdi, R. S.	How does financial reporting quality relate to investment efficiency?	Journal of Accounting & Economics	2009	1196
Wurgler, J.	Financial markets and the allocation of capital	Journal of Financial Economics	2000	880
Chen, S. S., & Chen, I. J.	Inefficient investment and the diversification discount: evidence from corporate asset purchases	Journal of Corporate Finance	2011	642
Jo, H., & Harjoto, M. A.	The causal effect of corporate governance on corporate social responsibility	Journal of Business Ethics	2012	523
Biddle, G. C., & Hilary, G	Accounting quality and firm-level capital investment	Accounting Review	2006	457
Heaton, J. B.	Managerial optimism and corporate finance	Financial Management	2002	450
Chen, F., Hope, O. K., Li, Q., & Wang, X.	Financial reporting quality and investment efficiency of private firms in emerging markets	Accounting Review	2011	445
Wang, Y., Chen, C. R., & Huang, Y. S.	Economic policy uncertainty and corporate investment: evidence from China	Pacific-Basin Finance Journal	2014	377
Cheng, M., Dhaliwal, D., & Zhang, Y.	Does investment efficiency improve after disclosing material weaknesses in internal control over financial reporting?	Journal of Accounting & Economics	2013	311

Note(s): TC = Total citations.

4.1.3. Most Productive (Publication) and Influential (Citation) Journals in IE Research (RQ3)

Table 2 lists the top ten journals regarding productivity (publications) and influence (citations) within IE research. The Journal of Corporate Finance, Finance Research Letters, and Journal of Banking & Finance lead with 53, 35, and 34 publications, respectively. The most cited journals include the Journal of Corporate Finance, the Journal of Financial Economics, and the Journal of Banking & Finance, with citations totaling 3503, 4089, and 1391 respectively. This highlights the significant impact these journals have on business and finance. Such data underscores the pivotal role of IE research within prominent business-focused publications.

Table 2. Most productive (published) and impactful (cited) journals for IE research.

Most Productive (Published) Journals for IE Research		Most Impactful (Cited) Journals for IE Research	
Journal	**TP**	**Journal**	**TC**
Journal of Corporate Finance	53	Journal of Corporate Finance	3503
Finance Research Letters	35	Journal of Financial Economics	4089
Journal of Banking & Finance	34	Journal of Banking & Finance	1391
Emerging Markets Finance and Trade	33	Financial Management	1196
Accounting Review	27	Emerging Markets Finance and Trade	297
Journal of Financial Economics	26	Journal of Finance	2020
Pacific-Basin Finance Journal	24	Accounting Review	1587
Accounting and Finance	23	Pacific-Basin Finance Journal	674
Research in International Business and Finance	23	Review of Financial Studies	861
International Review of Financial Analysis	19	Finance Research Letters	295

Note(s): TP = Total publications. TC = Total citations.

4.1.4. Most Productive (Published) and Influential (Cited) Authors in IE Research (RQ3)

Table 3 highlights the top authors regarding productivity and influence in IE research. Kim Jeong-Bon and Yi Zhang lead the field, each with seven publications, followed by Gary Tian and Quoc Trung with six. Regarding citations, Gary C. Biddle and Gilles Hilary are prominent contributors, particularly in managerial accounting and financial reporting. Other influential scholars include Philip G. Berger, Eli Ofek, and Rodrigo S. Verdi, who have made significant contributions to understanding the role of financial reporting in investment efficiency.

Table 3. Most productive (published) and impactful (cited) authors for IE research.

Most Productive (Published) Authors for IE Research		**Most Impactful (Cited) Authors for IE Research**	
Authors	**TP**	Author	**TC**
Kim, Jeong-Bon	7	Biddle, Gary C.	1653
Zhang, Yi	7	Gilles Hilary	1653
Gary Tian	6	Philip G Berger	1342
Quoc Trung Tran	6	Eli Ofek	1342
Chen, Chen	5	Rodrigo S. Verdi	1196
Chen, Sheng-Syan	5	Jeffrey Wurgler	880
Chen, Zhong-Hua	5	Jo Hoje	742
Chien-Chiang Lee	5	Chen, S. M.	642
Li, Xiaozhong	5	Sun, Z.	642
Liu, Yunguo	5	Tang, S.	642
Lobo, Gerald J.	5	Wu, D.	642
Lu, Tong	5	WANG, Xin	589
Taylor, Grantley	5	Maretno Agus Harjoto	523
Ullah, Irfan	5	Chen, Feng	453
Wang, Y.Z	5	Heaton JB	450

Note(s): TP = Total publications. TC = Total citations.

4.1.5. Countries/Regions with the Most Productive (Published) and Influential (Cited) St Research (RQ3)

Table 4 reveals the top ten countries/regions leading in Investment Efficiency (IE) research regarding publications and citations. It shows China with 281 publications and 7747 citations, and the USA with 264 publications and 13,836 citations as the foremost contributors. The UK, Canada, Australia, Spain, and South Korea are significant participants. However, most IE research is concentrated in the USA, significantly exceeding China and other countries' productivity and influence.

Figure 3 visualizes the evolution of cross-country collaborations in investment efficiency (IE) research. Initially, from 1987 to 2003, international partnerships were limited. However, in 2004, collaborations began to increase, particularly between the USA, Canada, China, and France. This trend continued to expand from 2005 to 2010, with more countries, including the UK, South Korea, and Singapore, becoming active participants. By 2011–2015, international collaborations grew significantly, with strong networks forming across North America, Asia, and Europe. In the most recent period, 2016–2023, collaboration intensified, with China, the USA, and the UK leading the field, reflecting the increasingly global and interdisciplinary nature of IE research.

Figure 4 presents a three-field plot that visualizes the interconnections between crucial research themes, contributing countries, and institutional affiliations in investment efficiency (IE) research. The keywords, such as "performance", "agency costs" and "corporate governance", reflect the core topics in the field. Geographically, the USA and China dominate contributions, with notable involvement from the UK, Canada, and France. On the institutional level, universities in China and the USA, including Xiamen University and the University of Massachusetts, are prominent contributors. This visualization underscores the leading research clusters and highlights potential gaps and emerging trends in the global academic landscape of IE research.

Table 4. Most productive (published) and impactful (cited) countries for IE research.

Most Productive Countries/Territories for IE Research		**Most Impactful Countries for IE Research**	
Country	**TP**	**Country**	**TC**
China	281	United States	13,836
United States	264	China	6747
United Kingdom	48	Canada	1162
Australia	43	United Kingdom	1024
Korea	39	Australia	706
Canada	35	Spain	691
Spain	17	Korea	391
Germany	14	Italy	368
New Zealand	14	France	364
Vietnam	14	Singapore	295

Note(s): TP = Total publications. TC = Total citations.

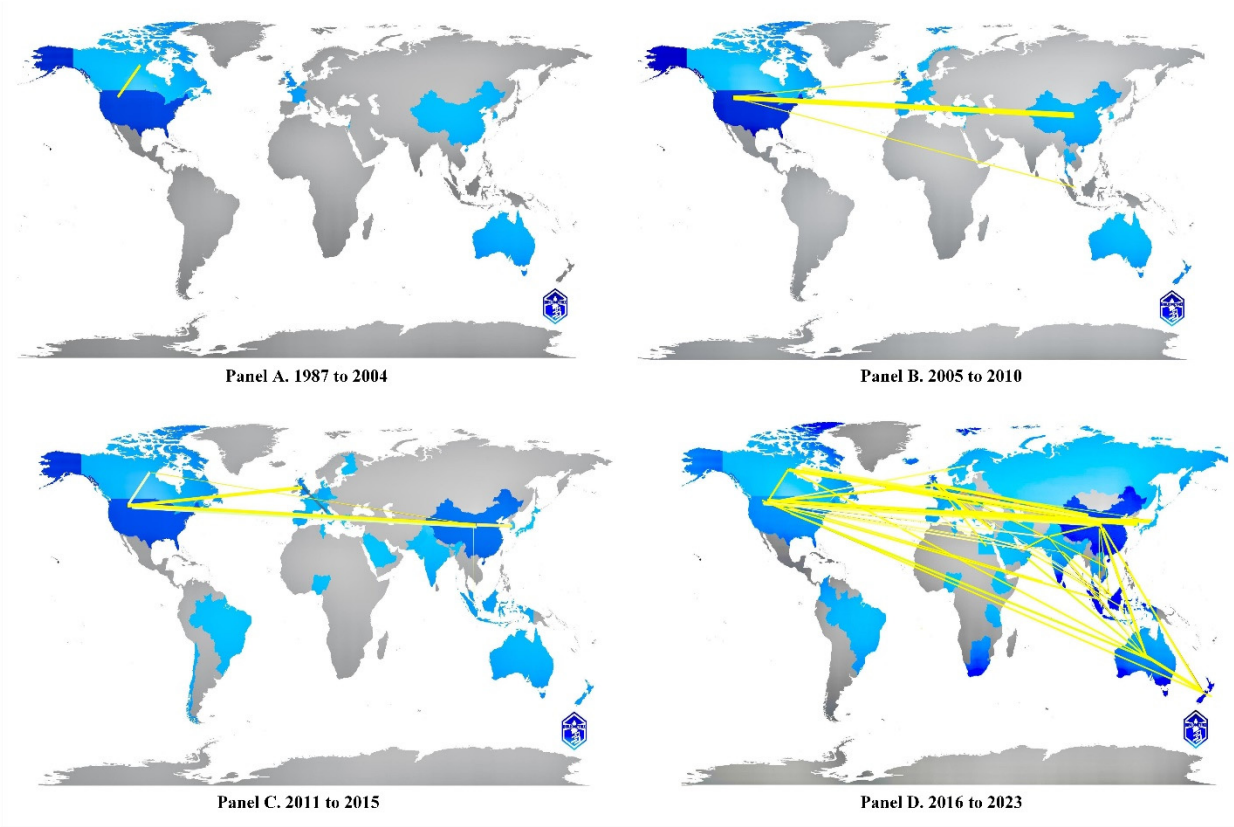

Figure 3. Cross-country collaborations for IE research.

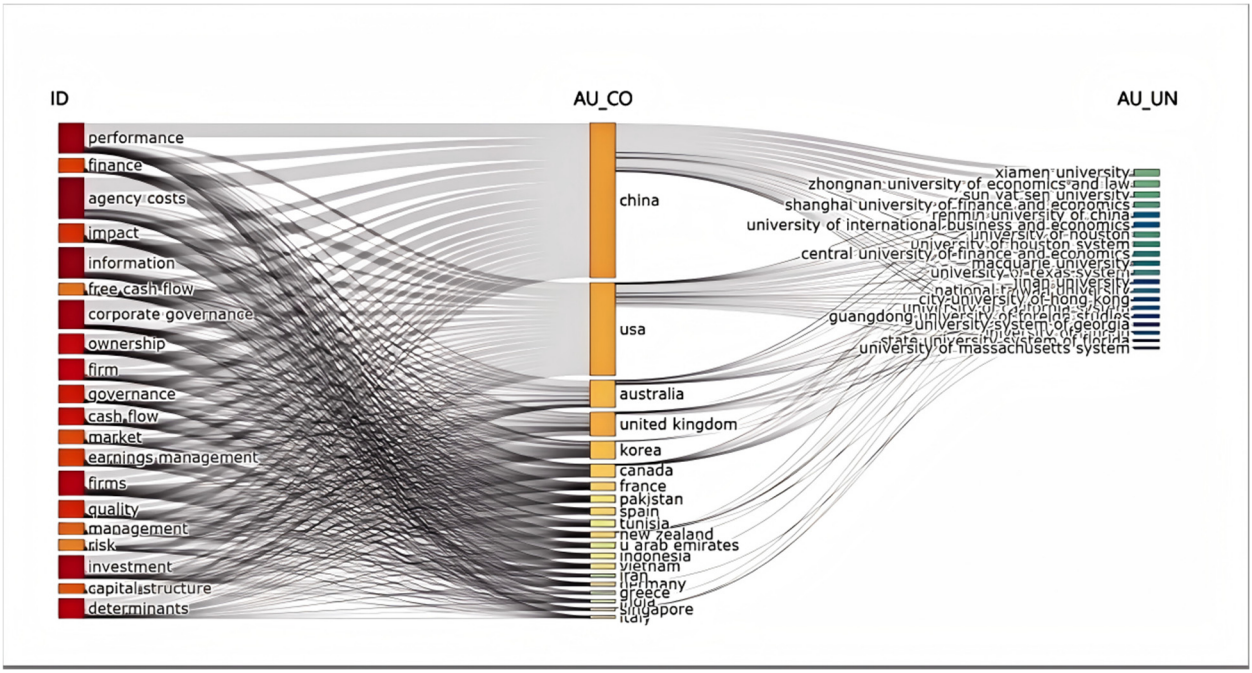

Figure 4. R Studio-Three-fields plot (left-keywords from the data records, middle–countries, right-authors affiliations).

4.2. Scientific Mapping of IE Research (RQ4–RQ5)

4.2.1. Main Themes of IE Research (RQ4)

Keywords play a crucial role in highlighting the core focus of academic research. This study used keyword co-occurrence analysis to identify major thematic trends in investment efficiency (IE) research, avoiding the bias toward older studies that citation analysis may introduce. Figure 5 illustrates these key themes, including agency costs (230 occurrences), information (159 occurrences), performance (159 occurrences), and corporate governance

(153 occurrences). These themes are critical for understanding variations in firm performance and their impact on shareholder wealth, indicating their continued relevance to academic research and practical investment strategies.

Keywords provide critical insights into the evolution of investment efficiency (IE) research themes, especially amid rapid technological advancements and changing financial landscapes. This study analyzed keyword co-occurrences in 950 articles to map the thematic structure and dynamic trends in IE research, offering a clear view of how key topics interconnect and how the field has progressed. Using the Bibliometrix software package, multivariate correspondence analysis (MCA) and K-means clustering were applied to categorize the data [41,42]. These methods helped identify keyword nodes and visualize thematic clusters, as shown in Figure 6.

Figure 5. Word cloud representation of keywords in IE research (1987–2023).

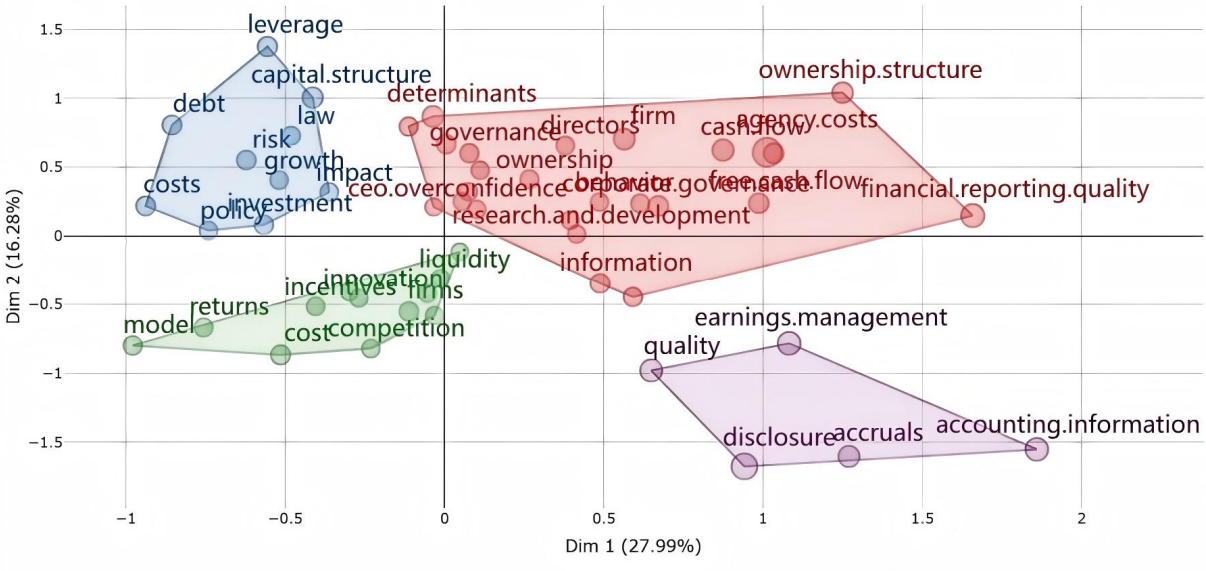

Figure 6. Thematic clusters based on the co-occurrences of words in the titles and abstracts of IE research (1987–2023).

Figure 6 reveals three major thematic clusters: Corporate Governance and Reporting Quality, Capital Management and Earnings Management, and Capital Structure and Financial Determinants. These clusters represent the central focus areas within IE research, highlighting the interconnectedness of these topics over time and the field's continued development.

Red Cluster: Corporate Governance and Reporting Quality (TP:389, TC:12,126)

This cluster centres on themes such as “agency costs”, “governance” and “financial reporting quality”, which are essential in understanding how corporate governance mechanisms influence transparency and accuracy in financial reporting. High-quality financial reporting is critical in mitigating information asymmetry and agency conflicts, ultimately improving investment efficiency [43]. Studies in this cluster, such as those by Biddle et al. (2009) and Chen et al. (2011) [43,44], emphasize that effective governance frameworks and reporting standards significantly shape investment decisions by reducing frictions in capital allocation. Moreover, Pan et al. (2020) [45] examined how political involvement as a governance factor impacts investment efficiency, mainly when governments act as significant investors. Research in this cluster underscores the pivotal role that corporate governance and reporting play in enhancing decision-making processes and reducing inefficiencies. Focusing on financial transparency highlights its importance in addressing information asymmetries, enabling more efficient resource allocation and improving overall firm performance.

Green Cluster: Capital Management and Earnings Management (TP:262, TC:5186)

This cluster revolves around terms like “costs”, “management”, and “earnings management”, focusing on how firms optimize their financial strategies. Studies in this area explore managerial decisions regarding capital allocation, cost control, and earnings reporting, all which influence perceptions of investment efficiency. Heaton (2002) [46] explored the impact of managerial optimism on capital management strategies, showing how behavioral factors shape operational efficiency. Harford et al. (2014) [47] added to this by examining the link between refinancing risk and cash management, while Johnson (2003) [48] investigated how debt maturity affects firm-level investment decisions. This cluster also addresses how conservative accounting practices can improve investment efficiency, as discussed by Lara et al. (2016) [49]. Additionally, studies such as McLean et al. (2012) [50] connect legal protections and financial planning, linking governance structures to operational strategies aimed at improving efficiency. Collectively, research in this cluster emphasizes the role of managerial and operational practices in shaping both capital and earnings management, while also considering the ethical dimensions of financial reporting.

Blue Cluster: Capital Structure and Financial Determinants (TP:262, TC:6257)

The blue cluster focuses on capital structure, corporate finance, and the factors influencing firms’ financing decisions. It explores how firms balance debt and equity financing, which impacts their risk profile, investment capacity, and operational efficiency. For instance, Jo and Harjoto (2012) [51] examined how corporate governance affects firms’ adherence to corporate social responsibility (CSR), linking governance practices to financial decision-making and capital structure choices. Research by Chen et al. (2011) [44] further explores how financial reporting quality influences private firms’ investment decisions in emerging markets, where information asymmetry is often more pronounced. Other studies, Wang et al. (2014) [52], analyzed how economic policy uncertainty affects corporate investment, especially in volatile markets like China. Additionally, Admati and Pfleiderer (2022) [53] highlighted the role of venture capitalists in structuring financial contracts for startups, emphasizing the importance of intermediaries in enhancing investment efficiency. This cluster highlights how external factors, such as economic policy, and internal factors, such as governance and financial reporting, shape firms’ financing strategies and affect their overall investment efficiency. It also illustrates the significance of optimizing capital structure to improve performance outcomes and reduce inefficiencies.

In summary, the cluster analysis reveals a diverse yet interconnected research landscape within IE. The field has evolved to include themes ranging from corporate governance and financial reporting to capital management and operational efficiency. Studies that have contributed the most impactful insights have been those examining how governance, transparency, and financial strategy interplay to influence investment decisions. As the field continues to evolve, future research will likely build on these themes, integrating technological innovations and sustainability considerations into the broader conversation on investment efficiency.

4.2.2. Thematic Mapping of Evolution in Investment Efficiency (IE) Research (RQ5)

This study builds on keyword co-occurrence analysis to explore the evolution of themes in investment efficiency (IE) research. Using a thematic map (Figure 7), the analysis categorizes keyword clusters into four quadrants based on centrality (thematic importance) and density (thematic development). This provides a visual representation of the intellectual structure of IE research from 1987 to 2023, illustrating how topics have evolved in relevance and development.

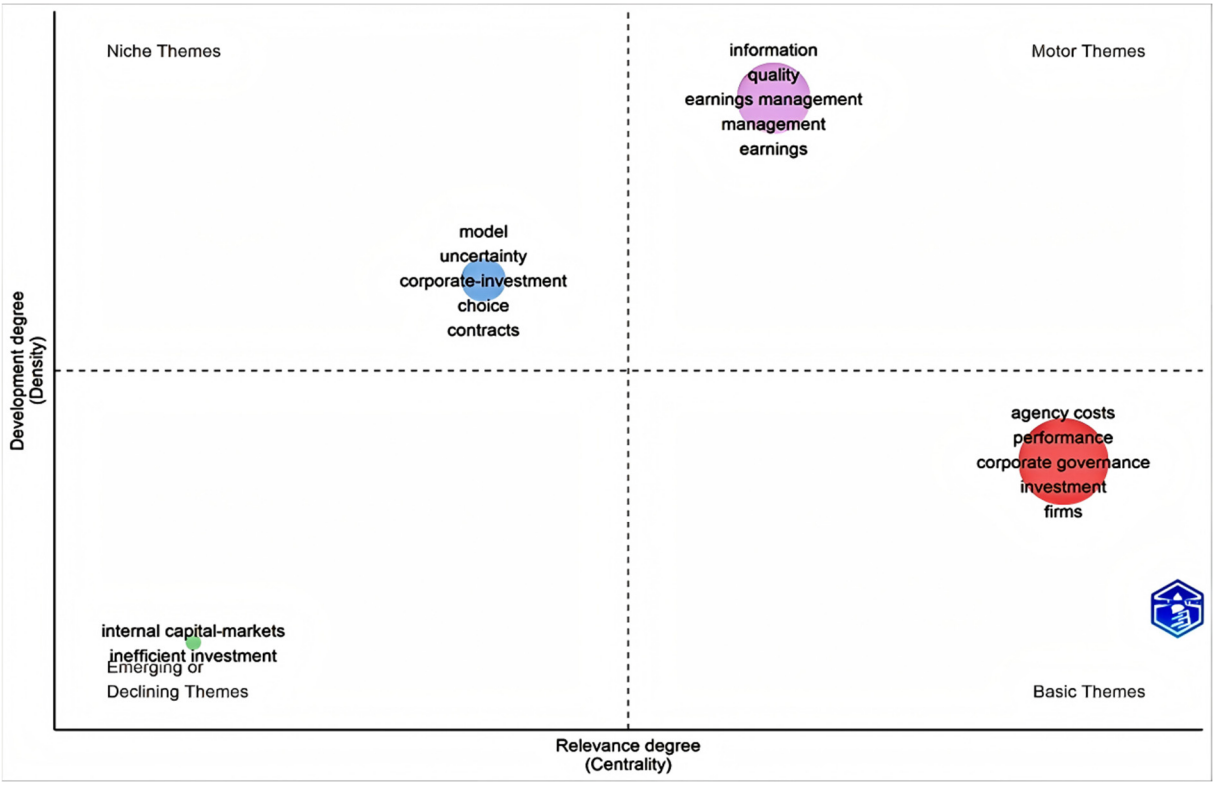

Figure 7. Conceptual thematic map based on the co-occurrences of keywords in IE research (1987–2023).

The upper right quadrant (I) (TP:56, CF:182) includes motor themes, which are both central and well-developed. These themes drive the current research agenda and are pivotal for shaping the future of IE studies. Keywords such as information quality, earnings management, and management dominate this quadrant, indicating that data transparency and financial reporting play critical roles in enhancing investment efficiency. These themes continue to push the boundaries of current research, signaling their importance in future studies.

The upper left quadrant (II) (TP:56, CF:182) are niche themes, which are well-developed but less central to the overall field. Topics such as model uncertainty, corporate investment choice, and contracts are examples. These themes, while specialized, hold potential for future growth as financial markets evolve and new theoretical frameworks are applied to IE.

The lower left quadrant (III) (TP:10, CF:29) holds declining themes, characterized by low centrality and density. Topics such as internal capital markets and inefficient investment fall within this category, suggesting that they have either been extensively researched or are losing relevance as the research focus shifts to new areas.

The lower right quadrant (IV) (TP:529, Cluster Frequency: 3242) contains promising themes, which are highly central but less developed. These include foundational concepts like agency costs, corporate governance, and performance. Although these areas have been thoroughly studied and are well-established in IE, their limited recent development suggests an opportunity to explore how they interact with newer themes like sustainability and ESG factors, signaling potential for further research.

The thematic map highlights key shifts in the focus of IE research. Foundational themes like corporate governance remain central, but new areas such as information quality and earnings management are gaining prominence. Emerging themes like model uncertainty point to potential future directions, while declining themes may no longer be at the forefront of academic inquiry. This map offers a comprehensive view of the field's evolution, helping researchers identify gaps in the literature and guiding future research efforts in investment efficiency.

4.3. Trending Themes and Future Research Directions for IE Research (RQ5)

4.3.1. Trends in Research Themes

As investment efficiency (IE) research has evolved, a clear progression emerges, marked by the convergence and divergence of key themes over time. Foundational concepts such as agency costs and corporate governance have consistently served as the cornerstones of IE research, providing a basis for expanding into more complex topics like information quality and earnings management. The evolutionary trend graph (Figure 8) highlights the chronological development of these themes, showcasing how IE research has transitioned from fundamental topics

to more specialized inquiries. New themes, such as model incompleteness and diversity, indicate the field's shift towards more comprehensive frameworks that better capture the complexity of financial markets and investment decisions. This combined analysis of the thematic map and evolutionary trends reveals the dynamic relationship between enduring concepts and emerging research frontiers. While foundational themes remain central, new areas are gaining prominence, reflecting the intellectual growth of the field. This shift from microeconomic factors to broader concerns, such as market dynamics and governance, points to future research opportunities that will continue to shape the discipline.

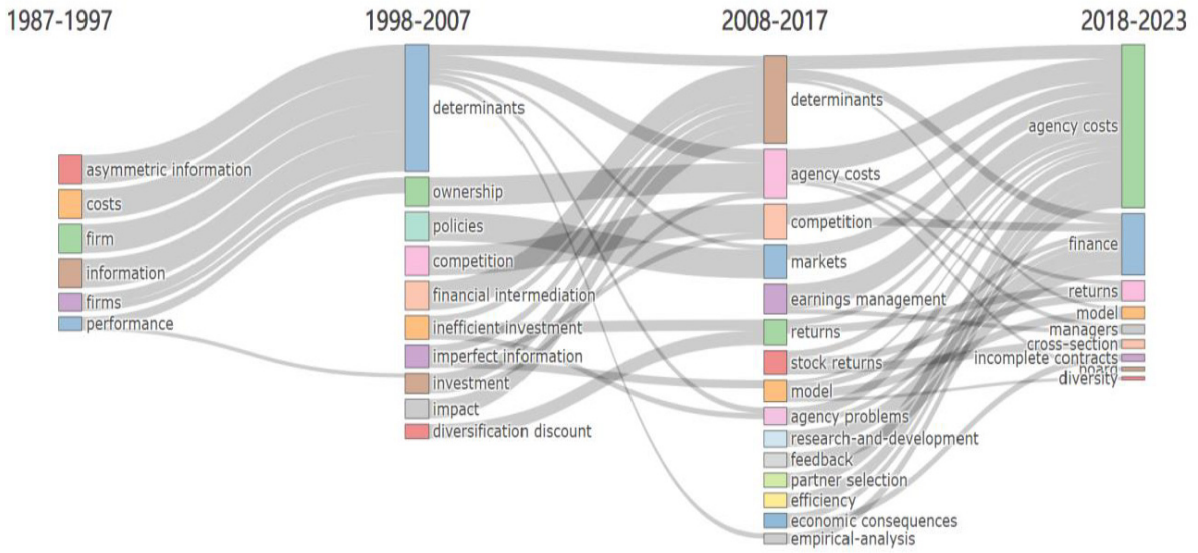

Figure 8. Thematic evolution of IE research Sankey diagrams (1987–2023).

Figure 8 illustrates the temporal evolution of keywords across four distinct periods:

1987–1997: Early IE research focused on fundamental concepts like information asymmetry, costs, and firm performance, emphasizing how individual firms' investment decisions influenced market efficiency.

1998–2007: The focus shifted to ownership, policies, and competition, with growing interest in institutional factors and regulatory influences on IE. The diversification discount and inefficient investments due to imperfect information gained prominence.

2008–2017: Research expanded to include agency costs, corporate governance, and earnings management. This period also introduced new models addressing agency problems and developing a more quantitative approach to financial relationships.

2018–2023: Recent research continues to focus on agency costs and finance but introduces emerging concepts like model incompleteness, managerial diversity, and cross-sectional analysis, reflecting a deeper understanding of managerial decisions and firm heterogeneity.

The evolution from firm-level analysis to a broader macro perspective highlights the increasing sophistication of IE research, now addressing regulatory, governance, and model complexity. The recent emphasis on diversity and model incompleteness suggests that future research will continue refining existing theories, expanding to include a wider array of factors influencing IE.

4.3.2. Future Directions of Research

Future research in investment efficiency (IE) should focus on the following key areas:

Green Finance and Investment Efficiency. Future studies must move beyond general sustainability discussions to explore green finance, focusing on green bonds, carbon credit markets, and clean energy investments. Comparative analysis of green versus traditional investments in mitigating financial risks and enhancing long-term returns is crucial. Additionally, the effects of government regulations and incentives on IE should be evaluated [54,55].

Quantitative Investing and AI-Driven Models. Technological advancements in quantitative investing and AI-driven decision-making are reshaping investment efficiency [21,56]. Future research should investigate how machine learning algorithms and predictive analytics optimize capital allocation and reduce inefficiencies. The impact of algorithmic and high-frequency trading strategies on market efficiency and IE should also be explored, alongside the ethical and regulatory implications of AI in finance.

Blockchain and Decentralized Finance (DeFi). Blockchain technology and DeFi are transforming global finance by enhancing transparency and reducing transaction costs [57,58]. Research should focus on how these technologies address issues like information asymmetry and agency costs in IE. Further studies could explore blockchain governance mechanisms and the role of smart contracts in improving investment decisions, particularly in emerging markets.

Cross-border Investment and Regulatory Harmonization. With increasing globalization, research should investigate how cross-border regulations influence investment efficiency, particularly regarding capital allocation and market volatility [59,60]. The harmonization of financial regulations across regions, especially in light of digital globalization and decentralized markets, is another critical area for future research.

Robust Investment Models for Crisis and Volatility. Given recent global crises, such as the COVID-19 pandemic, research should focus on developing robust investment models that can account for market volatility, technological disruptions, and political instability. The application of scenario analysis and stochastic modeling will be essential to improve the resilience of investment strategies under uncertainty [61].

5. Conclusions

5.1. Key Points

This section summarizes the main findings of this study, addressing each research question (RQ) and providing a comprehensive overview of the development, influence, and future directions of investment efficiency (IE) research.

Research Development in Investment Efficiency (RQ1): IE research has grown significantly since its inception. From 1987 to 2002, annual publications were minimal, but interest surged from 2003 onward, driven by technological advancements and evolving financial markets. Notable peaks occurred in 2007 and 2016, with 2023 reaching a record 189 publications, influenced by global financial crises, sustainable investing, and the increasing importance of ESG factors.

Influential IE Studies (RQ2): Critical studies in IE focus on corporate governance, financial reporting, and policy uncertainty, published in leading journals like the Journal of Financial Economics and Accounting Review. These works demonstrate how governance structures and high-quality financial reporting reduce information asymmetry and enhance capital allocation efficiency.

Key Contributors in IE Research (RQ3): A select group of scholars and journals have shaped the field. The Journal of Corporate Finance leads in productivity, while the Journal of Financial Economics has the highest citation count. Prolific authors include Kim Jeong-Bon and Zhang Yi, with Gary Biddle and Gilles Hilary contributing significantly to corporate governance and financial reporting. Increased international collaborations from 2004 to 2023 reflect the growing global interest in IE research.

Thematic Evolution in IE Research (RQ4): Multiple Correspondence Analysis (MCA) identified three main thematic clusters: corporate governance and reporting quality, capital and earnings management, and financial determinants of IE. These themes highlight the importance of governance and financial management in shaping investment outcomes.

Future Directions for IE Research (RQ5): Future research will likely focus on agency costs and advanced modeling techniques to address global market complexity. The growing influence of ESG factors and policy reforms will drive future studies to explore systemic impacts on IE.

5.2. Discussions

This research contributes a comprehensive, quantifiable analysis of IE trends through bibliometric analysis and a systematic literature review, contrasting with earlier, more narrative-focused studies. Multiple Correspondence Analysis offers a fresh perspective, highlighting the interconnected evolution of core themes like corporate governance, capital management, and earnings management. This holistic approach reveals how these themes have developed, providing a broader understanding of the field's progression. Furthermore, this study provides a deeper analysis of international collaborations, identifying a significant increase in global research partnerships in recent years. Using temporal segmentation, the study showcases the growing density and reach of international networks in IE research, an aspect often overlooked in previous analyses.

5.3. Limitations

This study offers a comprehensive bibliometric analysis of investment efficiency (IE), but several limitations must be acknowledged. First, the reliance on Web of Science data may exclude influential studies from other databases like Scopus and Google Scholar, potentially limiting the scope of the analysis, particularly in niche or emerging fields. Second, the macro-level analysis here may overlook industry-specific nuances and firm-level variations, as IE often depends on sectoral and regional contexts. Additionally, while bibliometric methods effectively identify trends and key contributors, they lack the depth provided by qualitative analyses, which could further explore theoretical and methodological intricacies. Lastly, from 1970 to 2023, the study's timeframe may not fully capture the most recent developments in rapidly evolving areas such as green finance, blockchain governance, and AI-driven investment models, necessitating ongoing updates to reflect current advancements.

Author Contributions

Conceptualization, D.Z.; Methodology, D.Z.; Software, D.Z. and A.N.C.K; Validation, D.Z., W.S.Y. and A.N.C.K; Formal analysis, W.S.Y.; Investigation, D.Z. and W.S.Y.; Data curation, D.Z.; Writing—review & editing, D.Z., S.L.N., A.H.J. and M.F.M.S.; Visualization, D.Z. and M.S.S; Supervision, S.L.N., A.H.J. and M.F.M.S.; Project administration, S.L.N. and A.H.J.; Funding acquisition, S.L.N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

1. Modigliani, F.; Miller, M.H. The cost of capital, corporation finance and the theory of investment. *Am. Econ. Rev.* **1958**, *48*, 261–297.
2. Jensen, M.C. Agency costs of free cash flow, corporate finance, and takeovers. *Am. Econ. Rev.* **1986**, *76*, 323–329.
3. Myers, S.C.; Majluf, N.S. Corporate financing and investment decisions when firms have information that investors do not have. *J. Financ. Econ.* **1984**, *13*, 187–221.
4. Gaviria-Marin, M.; Merigo, J.M.; Popa, S. Twenty years of the Journal of Knowledge Management: A bibliometric analysis. *J. Knowl. Manag.* **2018**, *22*, 1655–1687.
5. Huang, F.; Ge, L.; Wu, S. Minority shareholder protection, corporate governance, and investment efficiency. *Financ. Res. Lett.* **2023**, *58*, 104506.
6. Tian, J.; Sun, S.; Cao, W.; et al. Make every dollar count: The impact of green credit regulation on corporate green investment efficiency. *Energy Econ.* **2024**, *130*, 107307.
7. Wang, M.; Yan, Y. The dark side of investor interactive platforms: Evidence from corporate investment efficiency. *Financ. Res. Lett.* **2023**, *57*, 104264.
8. Tversky, A.; Kahneman, D. Availability: A heuristic for judging frequency and probability. *Cogn. Psychol.* **1973**, *5*, 207–232. https://doi.org/10.1016/0010-0285(73)90033-9.
9. Benlemlih, M.; Bitar, M. Corporate Social Responsibility and Investment Efficiency. *J. Bus. Ethics* **2018**, *148*, 647–671. https://doi.org/10.1007/s10551-016-3020-2.

10. Hao, W.; Gao, H.; Liu, Z. An Evaluation Study on Investment Efficiency: A Predictive Machine Learning Approach. *Complexity* **2021**, *2021*, 6658516.
11. Ellili, N.O.D. Impact of ESG disclosure and financial reporting quality on investment efficiency. *Corp. Gov. Int. J. Bus. Soc.* **2022**, *22*, 1094–1111.
12. Schembri, L. *Getting Down to Business: Investment and the Economic Outlook*; Deputy Governor of the Bank of Canada: Vancouver, BC, Canada, 2024.
13. Wang, Z.; Chu, E.; Hao, Y. Towards sustainable development: How does ESG performance promotes corporate green transformation. *Int. Rev. Financ. Anal.* **2024**, *91*, 102982.
14. Zhao, L.; Yang, M.M.; Wang, Z.; et al. Trends in the dynamic evolution of corporate social responsibility and leadership: A literature review and bibliometric analysis. *J. Bus. Ethics* **2023**, *182*, 135–157.
15. Durach, C.F.; Kembro, J.; Wieland, A. A new paradigm for systematic literature reviews in supply chain management. *J. Supply Chain. Manag.* **2017**, *53*, 67–85.
16. Mahajan, R.; Lim, W.M.; Sareen, M.; et al. Stakehold. Theory. *J. Bus. Res.* **2023**, *166*, 114104.
17. Mas-Tur, A.; Kraus, S.; Brandtner, M.; et al. Advances in management research: A bibliometric overview of the Review of Managerial Science. *Rev. Manag. Sci.* **2020**, *14*, 933–958.
18. Singh, A.; Lim, W.M.; Jha, S.; et al. The state of the art of strategic leadership. *J. Bus. Res.* **2023**, *158*, 113676.
19. Fama, E.F. Efficient market hypothesis: A review of theory and empirical work. *J. Financ.* **1970**, *25*, 28–30.
20. Jensen, M.C.; Meckling, W.H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. In *Economics Social Institutions: Insights from the Conferences on Analysis & Ideology*; Brunner, K., Ed.; Springer: Amsterdam, The Netherlands, 1979; pp. 163–231. https://doi.org/10.1007/978-94-009-9257-3_8.
21. Shanmuganathan, M. Behavioural finance in an era of artificial intelligence: Longitudinal case study of robo-advisors in investment decisions. *J. Behav. Exp. Financ.* **2020**, *27*, 100297. https://doi.org/10.1016/j.jbef.2020.100297.
22. Friede, G.; Busch, T.; Bassen, A. ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *J. Sustain. Financ. Invest.* **2015**, *5*, 210–233. https://doi.org/10.1080/20430795.2015.1118917.
23. Park, S.R.; Jang, J.Y. The Impact of ESG Management on Investment Decision: Institutional Investors' Perceptions of Country-Specific ESG Criteria. *Int. J. Financ. Stud.* **2021**, *9*, 48.
24. Bilyay-Erdogan, S.; Danisman, G.O.; Demir, E. ESG performance and investment efficiency: The impact of information asymmetry. *J. Int. Financ. Mark. Inst. Money* **2024**, *91*, 101919. https://doi.org/10.1016/j.intfin.2023.101919.
25. Chen, C.-D.; Su, C.-H.; Chen, M.-H. Are ESG-committed hotels financially resilient to the COVID-19 pandemic? An autoregressive jump intensity trend model. *Tour. Manag.* **2022**, *93*, 104581. https://doi.org/10.1016/j.tourman.2022.104581.
26. Paul, J.; Lim, W.M.; O'Cass, A.; et al. Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR). *Int. J. Consum. Stud.* **2021**, *45*, O1–O16. https://doi.org/https://doi.org/10.1111/ijcs.12695.
27. Tricco, A.C.; Lillie, E.; Zarin, W.; et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann. Intern. Med.* **2018**, *169*, 467–473. https://doi.org/10.7326/m18-0850.
28. Hardwicke, T.E.; Wallach, J.D.; Kidwell, M.C.; et al. An empirical assessment of transparency and reproducibility-related research practices in the social sciences (2014–2017). *R. Soc. Open Sci.* **2020**, *7*, 190806.
29. Shokraneh, F. Reproducibility and replicability of systematic reviews. *World J. Meta-Anal.* **2019**, *7*, 66–71.
30. Aria, M.; Cuccurullo, C. bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr.* **2017**, *11*, 959–975. https://doi.org/https://doi.org/10.1016/j.joi.2017.08.007.
31. Kraus, S.; Breier, M.; Lim, W.M.; et al. Literature reviews as independent studies: Guidelines for academic practice. *Rev. Manag. Sci.* **2022**, *16*, 2577–2595. https://doi.org/10.1007/s11846-022-00588-8.
32. Mukherjee, D.; Lim, W.M.; Kumar, S.; et al. Guidelines for advancing theory and practice through bibliometric research. *J. Bus. Res.* **2022**, *148*, 101–115.
33. Merigó, J.M.; Mas-Tur, A.; Roig-Tierno, N.; et al. A bibliometric overview of the Journal of Business Research between 1973 and 2014. *J. Bus. Res.* **2015**, *68*, 2645–2653.
34. Merigó, J.M.; Cancino, C.A.; Coronado, F.; et al. Academic research in innovation: a country analysis. *Scientometrics* **2016**, *108*, 559–593.
35. Gaviria-Marin, M.; Merigó, J.M.; Baier-Fuentes, H.J.T F.; et al. Knowledge management: A global examination based on bibliometric analysis. *Technol. Forecast. Soc. Chang.* **2019**, *140*, 194–220.
36. Donthu, N.; Kumar, S.; Mukherjee, D.; et al. How to conduct a bibliometric analysis: An overview and guidelines. *J. Bus. Res.* **2021**, *133*, 285–296.
37. Donthu, N.; Kumar, S.; Pattnaik, D.J. Forty-five years of Journal of Business Research: A bibliometric analysis. *J. Bus. Res.* **2020**, *109*, 1–14.
38. Ingale, K.K.; Paluri, R.A. Financial literacy and financial behaviour: A bibliometric analysis. *Rev. Behav. Financ.* **2022**, *14*, 130–154.

39. Ogutu, H.; El Archi, Y.; Dénes Dávid, L. Current trends in sustainable organization management: A bibliometric analysis. *Oeconomia Copernic.* **2023**, *14*, 11–45.
40. Biddle, G.C.; Hilary, G.; Verdi, R.S. How does financial reporting quality relate to investment efficiency? *J. Account. Econ.* **2009**, *48*, 112–131.
41. Cuccurullo, C.; Aria, M.; Sarto, F.J.S. Foundations and trends in performance management. A twenty-five-year bibliometric analysis in business and public administration domains. *Scientometrics* **2016**, *108*, 595–611.
42. Greenacre, M.; Blasius, J. *Multiple Correspondence Analysis and Related Methods*; CRC Press: Boca Raton, FL, USA, 2006.
43. Biddle, G.C.; Callahan, C.M.; Hong, H.A.; et al. Do Adoptions of International Financial Reporting Standards Enhance Capital Investment Efficiency? 2016. Available online: https://ssrn.com/abstract=2353693 (accessed on 3 March 2024).
44. Chen, F.; Hope, O.-K.; Li, Q.; et al. Financial reporting quality and investment efficiency of private firms in emerging markets. *Account. Rev.* **2011**, *86*, 1255–1288.
45. Pan, X.; Tian, G.G. Political connections and corporate investments: Evidence from the recent anti-corruption campaign in China. *J. Bank. Financ.* **2020**, *119*, 105108.
46. Heaton, J.B. Managerial optimism and corporate finance. *Financ. Manag. Tampa* **2002**, *31*, 33–45.
47. Harford, J.; Klasa, S.; Maxwell, W.F. Refinancing risk and cash holdings. *J. Financ.* **2014**, *69*, 975–1012.
48. Johnson, S.A. Debt maturity and the effects of growth opportunities and liquidity risk on leverage. *Rev. Financ. Stud.* **2003**, *16*, 209–236.
49. Lara, J.M.G.; Osma, B.G.; Penalva, F. Accounting conservatism and firm investment efficiency. *J. Account. Econ.* **2016**, *61*, 221–238.
50. McLean, R.D.; Zhang, T.; Zhao, M.J. Why does the law matter? Investor protection and its effects on investment, finance, and growth. *J. Financ.* **2012**, *67*, 313–350.
51. Jo, H.; Harjoto, M.A. The causal effect of corporate governance on corporate social responsibility. *J. Bus. Ethics* **2012**, *106*, 53–72.
52. Wang, Y.; Chen, C.R.; Huang, Y.S. Economic policy uncertainty and corporate investment: Evidence from China. *Pac. -Basin Financ. J.* **2014**, *26*, 227–243. https://doi.org/https://doi.org/10.1016/j.pacfin.2013.12.008.
53. Admati, A.R.; Pfleiderer, P. Robust financial contracting and the role of venture capitalists. In *Venture Capital*; Routledge: London, UK, 2022; pp. 175–206.
54. Chen, H.; De, P.; Hu, Y.; et al. Wisdom of crowds: The value of stock opinions transmitted through social media. *Rev. Financ. Stud.* **2014**, *27*, 1367–1403.
55. Raimo, N.; Caragnano, A.; Zito, M.; et al. Extending the benefits of ESG disclosure: The effect on the cost of debt financing. *Corp. Soc. Responsib. Environ. Manag.* **2021**, *28*, 1412–1421.
56. Zong, Z.; Guan, Y. AI-Driven Intelligent Data Analytics and Predictive Analysis in Industry 4.0: Transforming Knowledge, Innovation, and Efficiency. *J. Knowl. Econ.* **2024**, *16*, 864–903. https://doi.org/10.1007/s13132-024-02001-z.
57. Harvey, C.R.; Rabetti, D. International business and decentralized finance. *J. Int. Bus. Stud.* **2024**, *55*, 840–863. https://doi.org/10.1057/s41267-024-00705-7.
58. Ozili, P.K. Decentralized finance research and developments around the world. *J. Bank. Financ. Technol.* **2022**, *6*, 117–133. https://doi.org/10.1007/s42786-022-00044-x.
59. Chen, G.; Dong, J.; Hu, J.; et al. Regulatory, institutional misalignment and cross-border acquisitions: Evidence from an emerging-market country. *J. Int. Bus. Stud.* **2024**, *55*, 172–193. https://doi.org/10.1057/s41267-023-00665-4.
60. Li, W.; Su, Y.; Wang, K. How does economic policy uncertainty affect cross-border M&A: Evidence from Chinese firms. *Emerg. Mark. Rev.* **2022**, *52*, 100908. https://doi.org/https://doi.org/10.1016/j.ememar.2022.100908.
61. Mandal, P.K.; Thakur, M. Higher-order moments in portfolio selection problems: A comprehensive literature review. *Expert Syst. Appl.* **2024**, *238*, 121625. https://doi.org/https://doi.org/10.1016/j.eswa.2023.121625.