Currency Futures: A Comprehensive Bibliometric Analysis and Future Research Directions (1978-2024)

Dixita Barai

Research Scholar, Department of Commerce, Rama Devi Women's University
Bhubaneswar, Odisha, PIN: 751022
Email Id: dixitabarai@rdwu.ac.in

Dr. Gouri Prava Samal

Assistant Professor, Department of Commerce, Rama Devi Women's University
Bhubaneswar, Odisha, PIN: 751022
Email Id: gouripravasamal@rdwu.ac.in

Abstract: *The study aims to comprehensively review currency futures literature to pinpoint key research areas, identify existing gaps, and suggest avenues for future exploration. The study analysed 285 Scopus publications (1978-2024) using bibliometric techniques. Performance analysis and science mapping were conducted with VOS viewer and R-Studio Software, examining publication trends, author collaborations, and key contributors. Bibliographic coupling identified research clusters, while the thematic map tracked topic evolution. Research on currency futures has seen varying publication and citation activity, with a significant citation spike in 1993 attributed to new modelling techniques and news impact. The "Journal of Futures Markets" stands as the leading publication, while the USA, India, and China are key contributors. Analysis of research clusters through bibliographic coupling revealed six distinct areas and identified gaps for future study. Furthermore, thematic mapping illustrated the changing focus and development of research topics within the field. This study is the first comprehensive bibliometric analysis of currency futures research, offering a holistic view of the field's evolution. It provides a valuable resource for understanding the historical, current, and future landscape of currency futures markets. For investors, this research aids in identifying key measures and influential factors to consider for decision-making. For policymakers, the varied impacts of interventions on market participants should be considered while formulating the policies. Also, academician leaders can foster multi-countries publications' collaboration among authors by creating a strong research ecosystem and providing ample facilities and opportunities.*

Keywords: *Bibliographic Coupling, Bibliometric Analysis, Currency Futures, Foreign Exchange, Thematic Mapping.*

Introduction

The foreign exchange rate reflects the value of one country's currency compared to another. The exchange rate is determined by relative prices in the respective countries, and thus, the exchange rate is calculated by comparing the price levels of the two nations (Cassel, 1916). During international financial transactions, there are two risks faced by the participants, i.e., interest rate risk and foreign exchange risk (Bouet & Dupuy, 1993). And the risk is generally the volatility of the exchange rates which eventually affects the international trade, growth of the economy,

trading volume, and many more (Ozturk, 2006). This gives rise to the use of currency derivatives to hedge the risk of traders or investors who are dealing in foreign currencies. *Currency derivatives are financial contracts or instruments whose value is based on the exchange rate of one currency relative to another. These derivatives are used by individuals and businesses to hedge against or speculate on changes in exchange rates. The primary types of currency derivatives include: forward, futures, options, and swaps contracts.* This brings an impetus for emerging currency futures to hedge against adverse exchange-rate movements (Sangha, 1995). *And based on the lower partial moments, the hedging effectiveness of currency futures is always considered to be better than currency options* (Lien & Tse, 2001). *Research shows that export businesses using both currency futures and options to manage risk, generate the highest profits and financial stability. Using only currency futures is the next best option, while not hedging at all results in the lowest profits and stability* (Yu, Li, & Wan, 2019). *Both currency futures and currency options can be valuable tools for managing currency risk or speculating exchange rate movements, and the choice between the two depends on an individual's or organization's specific needs and risk tolerance.* Currency futures have emerged as one of the most significant instruments in global financial markets, providing a standardized and regulated avenue for hedging, speculation, and arbitrage. Unlike forward contracts, currency futures are exchange-traded derivatives that facilitate transparency, liquidity, and risk management in foreign exchange markets. Since their inception in the early 1970s, these instruments have played a critical role in enhancing market efficiency, promoting international trade, and serving as a tool for managing exchange rate volatility. Over the past five decades, currency futures markets have expanded across both developed and emerging economies, attracting increasing attention from researchers, practitioners, and policymakers. Several reviews and bibliometric studies based on financial derivatives have been conducted, suggesting that over the last four decades, derivatives have become increasingly important in finance. Researchers worldwide have explored various aspects of derivatives and their trading (Sahoo, 2020). Also, Futures and options are now actively traded on many exchanges worldwide (Hull & Basu, 2017). (V.K. & Joseph, 2023) indicate that scientific research in the field of derivatives expanded rapidly, particularly after 2004, and highlight the need for in-depth investigation of specific financial products such as forwards, futures, options, and swaps. Similarly, (Pandey, 2022) reports unprecedented growth in the commodity derivatives market research between 2010 and 2021, while (Singh & Bajwa, 2023) provide bibliometric insights into equity options. Despite this growing body of literature, currency futures—an essential instrument for managing exchange rate risk and supporting international financial stability—remain underexplored from a bibliometric perspective. Most prior studies either aggregate all derivative instruments or focus narrowly on commodities and equity derivatives, thereby overlooking the intellectual structure, thematic progression, and knowledge networks specific to currency futures. Given the increasing role of currency futures in globalized markets, especially amid exchange rate volatility in the post-crisis and post-pandemic periods, a systematic bibliometric analysis is necessary. Such study will consolidate fragmented research, identify influential contributions, reveal emerging trends, and highlight future research avenues, thereby filling a critical gap in the derivatives literature. The study addresses this deficiency by providing, to the best of our knowledge, for the first time, a review and analysis based on bibliometric and science mapping methodologies to answer the following research questions:

RQ1: How has research on currency futures evolved?

RQ2: What are the most influential stakeholders (authors, journals, articles, and countries) in the field?

RQ3: What are the prominent themes prevailing in the domain of currency futures?

RQ4: What are the potential avenues for future research in currency futures?

The study's findings can help scholars in currency futures, in particular, and currency derivatives, in general, by understanding the importance and upcoming research areas. Furthermore, it can help practitioners identify trends and important issues concerning currency futures.

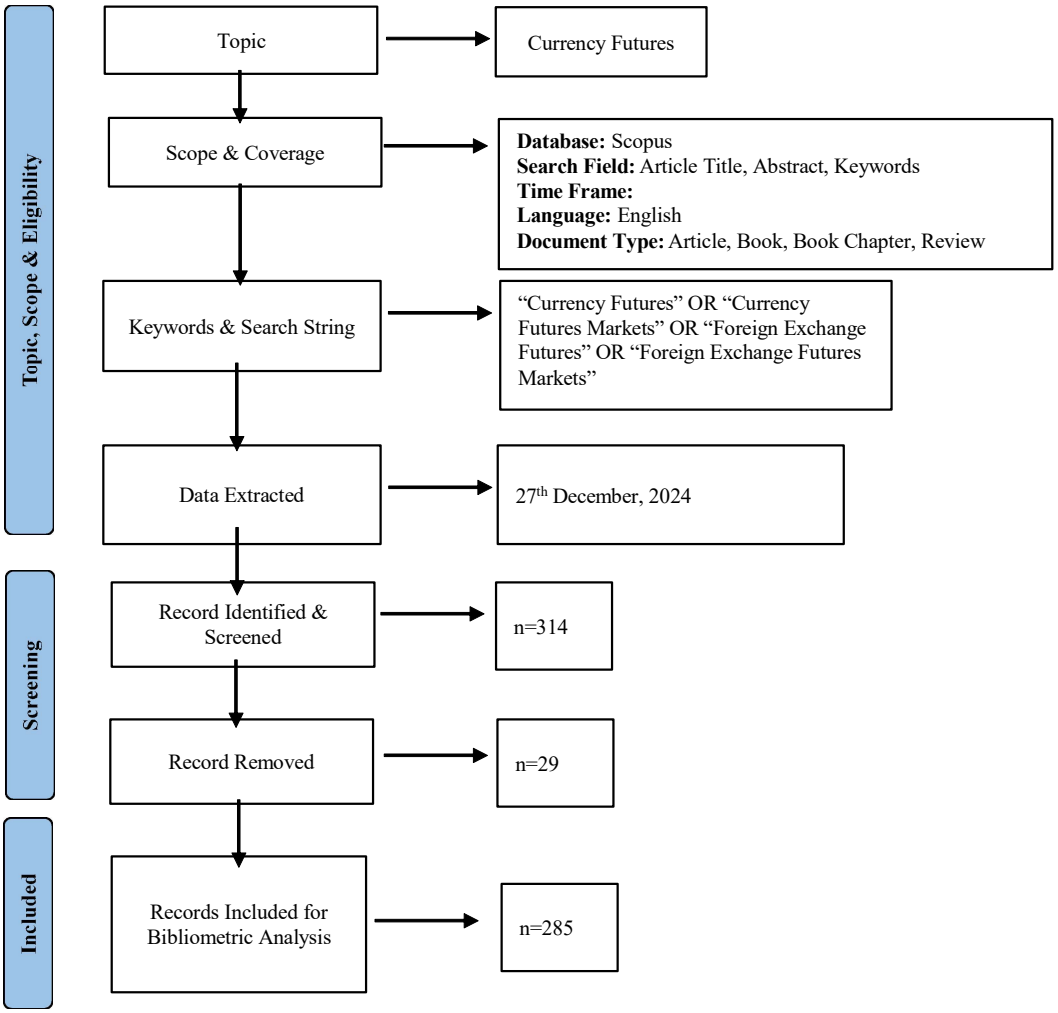
Materials and Methods

Tools and techniques

This study aims to fill the gap by comprehensively examining the significant contributions to the existing body of knowledge on currency futures research. Furthermore, it endeavours to identify prevalent thematic areas, current research directions, and potential avenues for future exploration within this area of study. Therefore, the present study adopts bibliometric analysis to map the state of the art in a given area of scientific knowledge and evaluate the scientific value of literature on a certain subject using a quantitative approach[(Ebrahim, 2021); (Baruah, Raju, & Sachdeva, 2023)]. Bibliometric research was first used by (Pritchard, 1969) and enabled researchers to identify and recognize potential hidden patterns that could help them during the literature review (Kraus, et al., 2022) using Quantitative techniques (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). The Protocol for Scientific Procedures and Rationales for Systematic Literature Reviews (Preferred Reporting Items for Systematic Review and Meta-Analysis-PRISMA) governs decisions and activities pertaining to data collection, filtering, and analytical methodologies (Paul, Lim, O'Cass, Hao, & Bresciani, 2021). A free software called Bibliometrix was used to analyse scientific literature. This R package works within the R programming environment named biblioshiny, known for its powerful statistics, numerical tools, and data visualization (Aria & Cuccurullo, 2017). Further, VOSviewer was used to construct and visualise bibliometric networks and enrich the data presentation (Baliarsingh, Nath, Swain, & Dhal, 2025).

Data collection

For this study Scopus database is used to collect the research papers, as Scopus provides its users with a unique view on the world's research literature, helping them to easily navigate it and quickly reach their desired goal or destination (Meester, Steiginga, & Ross, 2017). Scopus has nearly 25,100 journals, compared to 21,419 journals indexed on WoS. In addition, Scopus provides access to 1.7 billion citations compared to 1.6 billion on WoS (Pranckute, 2021). The articles were collected using the PRISMA review technique, for which an updated protocol was introduced by (Page, et al., 2021) was followed. The PRISMA evaluation process includes three phases such as identification, screening, and inclusion & exclusion criteria (Fig. 1). In order to start with a comprehensive data search, the keywords "Currency Futures", "Currency Futures Markets", "Foreign Exchange Futures", and "Foreign Exchange Futures Market" were searched. The keywords searched in title, abstract, and keywords resulted in 314 documents (as retrieved on 27 December 2024). Following the removal of three duplicate entries, the final corpus consisted of 311 unique documents. Inclusion criterion of publication stage - "final"; language - "English"; document type - "Conference Paper" OR "Article" OR "Book" OR "Review" resulted in the output of 285 documents from the year 1978 to 2024. The resulting dataset was formatted as comma-separated value (.csv) file.



Source: *Author's Own Work*

Figure 1: PRISMA Flowchart

Data analysis and interpretation

Bibliometric Analysis techniques are categorized into two parts, i.e., (1) Performance Analysis and (2) Science Mapping. The former examines the contributions of research constituents, and the latter examines the relationship between research constituents (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). Therefore, the paper considers both the analysis, for which the tools used for performance analysis are annual scientific production, corresponding authors' countries' collaboration, and the most prominent stakeholders (journals, authors, and articles) in the field of currency futures research constituents. Science mapping, specifically bibliographic coupling, delineates thematic clusters, informing future research directions.

Results and Discussion

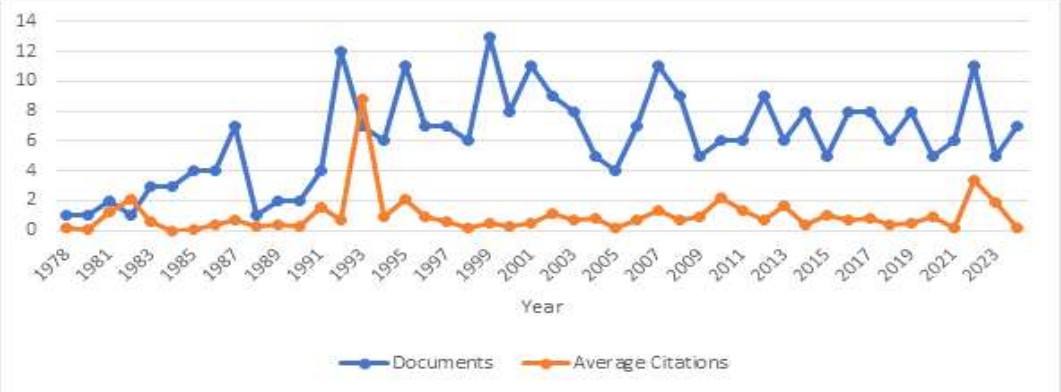
Descriptive analysis of literature

Fig. 2 presents a summary of research publications indexed in the Scopus database, spanning from 1978 to 2024. Where 69 authors have contributed single-authored works, the field also

demonstrates a healthy annual growth rate of 4.32% and average publication age of 20.4 years, indicating a mature and well-established body of knowledge. The average citation counts of 24.06 per document further underscore the field's scholarly impact. A total of 456 authors have contributed to a diverse range of document types, predominantly articles (259), followed by conference papers (17), reviews (6), and books (3), published across 135 sources. This breadth of publication outlets highlights the multifaceted nature of scholarly communication within this domain. Collaboration is a key characteristic, as evidenced by a 19.65% international co-authorship rate and an average of 2.06 authors per document.

***Source**: Biblioshiny Web Application*

Figure 2: Descriptive Bibliometric Analysis



***Source:** Authors Own Work*

Figure 3: Annual Scientific Production And Citation (from 1978 to 2024)

Fig. 3 illustrates the annual publication trend of research articles on currency futures, alongside average citation counts. The publication frequency demonstrates a fluctuating pattern. The first article in the Scopus database that discussed currency futures is on the pricing and the alignment with the interest rate parity theory of currency futures in 1978 (Panton & Joy, 1978). Regarding citations, a notable surge occurred in the year 1993, with 1,958 citations attributed to only seven publications, contrasting sharply with the preceding year (1992), which saw 12 articles garnering a mere 276 citations. This disparity suggests a correlation between impactful contributions to the field and heightened citation volume.

Most prominent stakeholders

In this section, micro-level (e.g., authors), meso-level (e.g., universities/affiliations), and macro-level (e.g., countries) competitiveness in scientific production on currency futures is explored, as referred by various studies like (Nelhens, 2022) (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021).

Most cited journal

Table 1 presents a comprehensive analysis of the top ten journals specializing in currency futures research, ranked according to their H-index, a metric reflecting both the quality and impact of published research. The *Journal of Futures Markets* leads in both H-index and publication volume, followed by the *Journal of International Money and Finance* and the *Journal of Banking and Finance*, while the *Journal of Financial and Quantitative Analysis* demonstrates the highest citation count.

Table 1: Most Cited Journal

Source	Publisher	H-Index	Total Citations	Total Documents	Average Citations	PY-Start
Journal of futures markets	Wiley	20	1038	48	21.63	1981
Journal of international money and finance	Elsevier	7	601	12	50.08	1987
Journal of banking and finance	Elsevier	6	207	8	25.88	1995
Journal of financial and quantitative analysis	Cambridge	6	1388	6	231.3	1987
Journal of international financial markets, institutions and money	Elsevier	6	115	6	19.17	1999
International review of financial analysis	Elsevier	5	70	7	10	1997
Financial review	Wiley	4	56	6	9.333	1986
Global finance journal	Elsevier	4	33	9	3.667	1995
Review of quantitative finance and accounting	Springer	4	89	5	17.8	1994
Applied economics letters	Taylor & Francis	3	221	7	31.57	1996

Source: *Author's Own Work*

Most cited articles

A review of the most cited articles (refer to Table 2) reveals that the major researches focus on predicting the volatility of the foreign exchange futures market (Ederington & Lee, 1993) (Jorion, 1995) and a few delve into the hedging strategies of currency futures while considering the dynamic conditional correlational model (Ku, Chen, & Chen, 2007) and constant correlational GARCH model (Lien, Tse, & Tsui, 2002). And among the ten most cited articles in the field, the work by (Kroner & Sultan, 1993) stands out with an impressive 1,023 citations. This particular study has been widely referenced for its seminal contribution to the understanding of time-varying currency distribution and the formulation of dynamic hedging strategies applicable to currency futures.

Table 2: Most Cited Articles

Article and year of publication	**Author(s)**	**Journal**	**Total Citations**	**Types of Research**
Time-varying distributions and dynamic hedging with foreign currency futures (1993)	Kroner K.F.; Sultan J.	Journal of Financial and Quantitative Analysis	1023	Conceptual Research

Time-varying distributions and dynamic hedging with foreign currency futures (1993)	**Kroner K.F.; Sultan J.**	**Journal of Financial and Quantitative Analysis**	**1023**	**Conceptual Research**
How markets process information: news releases and volatility (1993)	Ederington L.H.; Lee J.H.	The Journal of Finance	558	Empirical Research
Predicting volatility in the foreign exchange market (1995)	Jorion P.	The Journal of Finance	363	Empirical Research
The significance of technical trading-rule profits in the foreign exchange market: a bootstrap approach (1993)	Levich R.M.; Thomas III L.R.	Journal of International Money and Finance	262	Empirical Research
On the application of the dynamic conditional correlation model in estimating optimal time-varying hedge ratios (2007)	Ku Y.-H.H.; Chen H.-C.; Chen K.-H.	Applied Economics Letters	208	Conceptual Research
High-frequency covariance estimates with noisy and asynchronous financial data (2010)	Aït-Sahalia Y.; Fan J.; Xiu D.	Journal of the American Statistical Association	176	Empirical Research/Simulation Study
The Short-Run dynamics of the price adjustment to new information (1995)	Ederington L.H.; Lee J.H.	Journal of Financial and Quantitative Analysis	170	Empirical Research
Pricing foreign currency options under stochastic interest rates (1991)	Amin K.I.; Jarrow R.A.	Journal of International Money and Finance	164	Empirical Research
Evaluating the hedging performance of the constant-correlation GARCH model (2002)	Lien D.; Tse Y.K.; Tsui A.K.C.	Applied Financial Economics	131	Conceptual Research
Time-varying risk premia and forecastable returns in futures markets (1992)	Bessembinder H.; Chan K.	Journal of Financial Economics	130	Empirical Research

Source: *Author's Own Work*

Most cited authors

One of the primary goals of bibliometric analysis is to pinpoint the most influential researchers within a specific field. In the context of currency futures, the top authors are identified based on H-index criteria, listed in Table 3. The h-index, introduced by (Hirsch, 2005), measures a researcher's productivity and impact by counting the maximum number of papers (h) that have each been cited at least h times. It balances publication output with citation influence (Bornmann & Daniel, 2007). Author Donald Lien has topped with 7 as h-index and 256 total citations. Following closely behind are Wong KP & Udo Broll, with h-indexes of 6 and 4, respectively.

Table 3: Most Cited Authors

Author	H-index	Total Citations	No. of documents	PY_start
Lien D	7	256	8	2001
Wong KP	6	153	11	1999
Broll U	4	101	5	1992
Kumar S	4	47	5	2014
Fung H-G	3	83	3	1999
Mcaleer M	3	13	4	1999
Quek C	3	42	4	2005
Röthig A	3	18	3	2011
Schneeweis T	3	181	3	1981
Sequeira JM	3	15	5	1997

Source: *Author's Own Work*

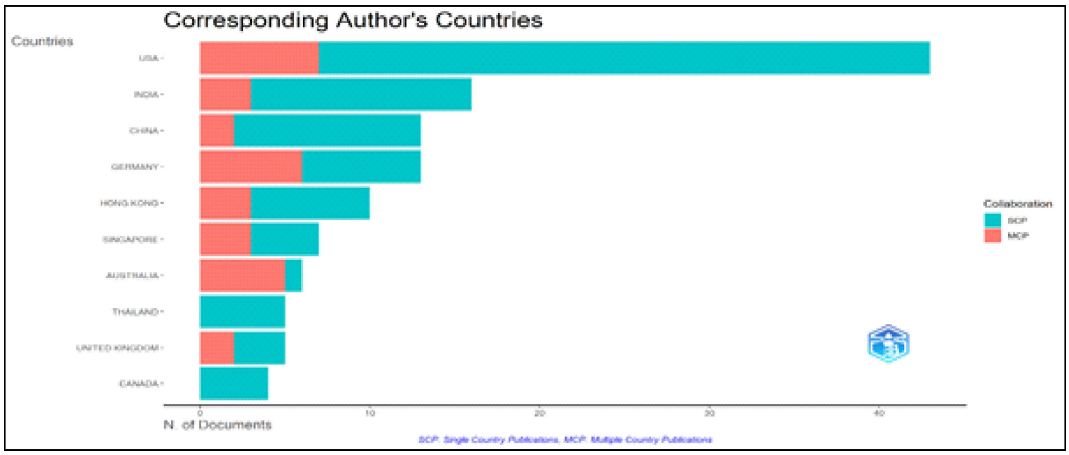
Corresponding author's countries

Fig. 4 presents a comparative analysis of prominent authors in the currency futures domain, categorized by their respective countries of origin. The graphical representation also shows the publications as single country publications (SCP) and multiple country publications (MCP). The top three nations that have published the most articles in the currency futures domain are the USA (43), India (16), and China (13). The analysis reflects that collaboration is high among the authors from the same country, but is limited to the authors from other nations. The scarcity of emerging economies on the list and Thailand's absence from international collaboration indicate potential weaknesses in research infrastructure, funding, and ecosystems for currency futures research in emerging nations. According to multi-country publications, Australia has a high MCP percent (83.3%), indicating that more than 83.3% of the publications involve international co-authors, followed by Germany (46.2%), Singapore (42.9%). Among the developed nations, Canada is behind in international collaborations with no research under multi-country publications, as shown in Table 4. International collaboration in currency futures research, indicative of global interconnectedness, correlates with enhanced research quality and relevance (Green & Johnson, 2015). Disparities exist, with developed nations exhibiting greater productivity and engagement. To mitigate this imbalance and promote inclusive understanding, fostering collaborative partnerships between developed and developing nations is recommended.

Table 4: Most Relevant Countries by Corresponding Authors

Country	Articles	Articles %	Single-country publications	Multi-country publications	Multi-country publications (%)
Usa	43	15.1	36	7	16.3
India	16	5.6	13	3	18.8
China	13	4.6	11	2	15.4
Germany	13	4.6	7	6	46.2
Hong Kong	10	3.5	7	3	30
Singapore	7	2.5	4	3	42.9
Australia	6	2.1	1	5	83.3
Thailand	5	1.8	5	0	0
United Kingdom	5	1.8	3	2	40
Canada	4	1.4	4	0	0

Source*: Biblioshiny Web Application*



***Source**: Biblioshiny Web Application*

Figure 4: Corresponding Author's Countries

Thematic analysis

The primary objective of this research is to delve into the foundational concepts and intellectual underpinnings of the currency futures domain. By examining the current state of research, this study seeks to illuminate potential avenues for future exploration within this field. To achieve these goals, a comprehensive methodological approach is employed, encompassing two key techniques: (1) Bibliographic coupling analysis, and (2) Thematic Map.

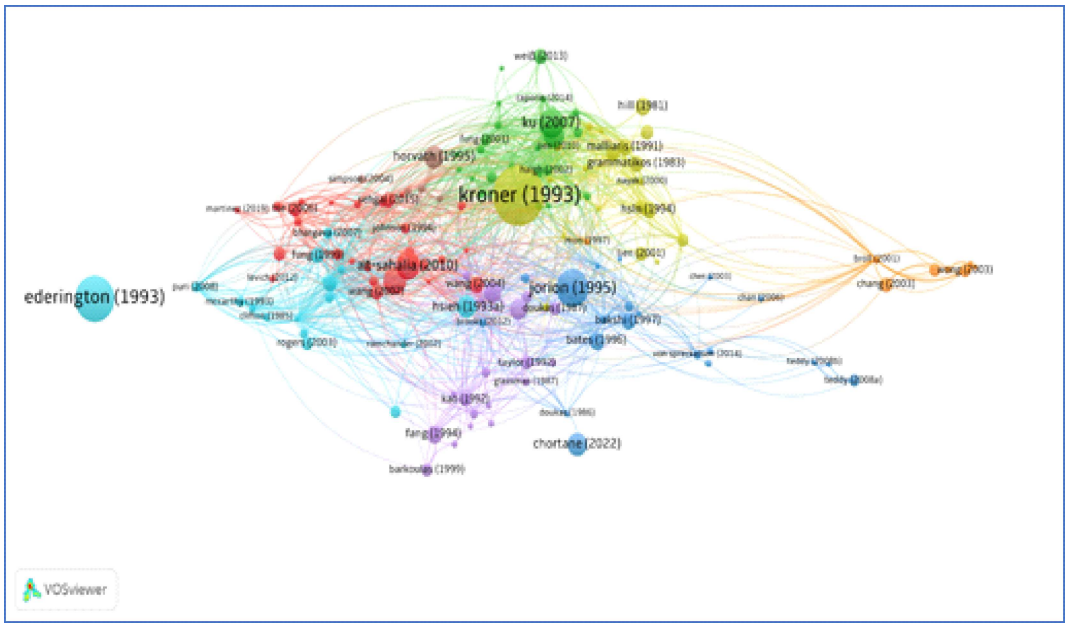
Bibliographic coupling analysis

Fig. 5 presents the bibliographic coupling analysis, which implies that two articles are bibliographically coupled if they both cite one or more documents in their bibliographies (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). By using this approach, it is possible to visualize recent contributions that have not yet had a major impact, thereby reflecting the most current scientific output in the field (Bretas & Alon, 2021). Also, bibliographic coupling is suitable to uncover broad spectrum of themes and the latest developments (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). For the analysis, the network is formed with a minimum number of citations of the documents to be five, which resulted in 162 meets of threshold out of 285 documents, and ultimately, the links were formed for 142 documents. After carefully analysing research contents and topic areas, six research themes are presented in six clusters of different colours.

Cluster 1: Trading activities and traders' positions (red colour)

The studies under this cluster emphasized the relationship or impact of various trading activities or positions on the price discovery of currency futures. (Yu-Lun, Yin-Feng, & Wen-Ju, 2016) and (Chang, Chen, Chou, & Gau, 2013) investigated hedgers' and speculators' positions on price discovery, which concludes a positive and negative impact on it, respectively. (Changyun, 2004) studied the impact of trading activities on returns and found hedgers' and speculators' sentiment to be negatively and positively correlated, respectively. Trading activities are influenced by several factors identified by the existing literature, such as forex counterparty risk, macroeconomic news, monetary policy surprises, and the global financial crisis (Hutchison & Sushko, 2013) (Levich, 2012). Studies under this cluster also examined the new dynamics in trading activities, such as a reduction in tick-size, signifying increased market quality (Martinez &

Tse, 2019), also, currency futures market hedging behavior provides more insight into CBDC-related financial system risk than news-based CBDC uncertainty indices (Dunbar, 2023). However, the studies are silent on exploring the impact of geopolitical events, behavioural aspects on trading decisions, and the long-term impact of traders' sentiment/positions.



***Source**: VOSviewer Software*

Figure 5. Bibliographic Coupling Of Author's Keywords

Cluster 2: Evolving hedging dynamics (green colour)

This cluster deals with the various dynamics and methodological evolution in measuring the hedging effectiveness and hedge-ratio of the currency futures. Traditional models such as ordinary least squares (OLS) and static hedge ratios have long been employed for managing risk, but empirical studies reveal that time-varying models, including GARCH, BEKK, DCC, and copula-based frameworks, provide more flexible approaches to estimating hedge ratios and volatility spillovers (Weiß, 2013) (Hsu Ku, 2008). Some studies find that GARCH-based hedge ratios fail to outperform simpler OLS approaches (Kharbanda, 2018), while others demonstrate the superiority of DCC-GARCH and copula models in managing time-varying risk (Hsu Ku, Chen, & Chen, 2007) (Kotkatvuori-Örnberg, 2016). Moreover, research on specific markets, such as foreign exchange futures, REIT futures (Lee & Lee, 2012), and agricultural commodities (Cotter, Eyiah-Donkor, & Pot'ý, 2017), highlights the importance of considering market structure, liquidity, and macroeconomic shocks in optimizing hedging strategies. However, the studies are silent on how AI-based models can improve hedge effectiveness by better capturing nonlinearities, regime shifts, and high-frequency trading patterns.

Cluster 3: Currency options pricing model (blue colour)

Currency options pricing models play a crucial role in enhancing price discovery, market activity, hedging strategies, arbitrage opportunities, and product development in the currency futures market. This cluster highlights several dynamics

of currency options pricing and volatility estimation. (Chen & Leung, 2003) findings highlight the potential advantages of using a direct profit forecast (two-step approach) strategy in straddle trading over traditional methods (relying on volatility forecasts) for currency option pricing. Since exchange rates, domestic and foreign interest rates, and risk factor prices are determined jointly, the equilibrium valuation model offers a more comprehensive view of currency dynamics than many existing models, leading to better hedging performance (Bakshi & Chen, 1997). Studies have also considered the psychology dimension of options pricing models, such as associative memory, artificial neural networks, and brain-inspired nonparametric models based on semantic memory, which outperform the commonly known approaches, such as the Black-Scholes formula and the Binomial Pricing Model (Teddy, Quek, & Lai, 2008) (Teddy, Lai, & Quek, 2008) (von Spreckelsen, von Mettenheim, & Breitner, 2014). However, the studies are silent on how extreme events impact the pricing model and the influence of market frictions on arbitrage opportunities.

Cluster 4: Determinants and hedging effectiveness (yellow colour)

Articles in this cluster shed light on the various factors that influence the hedging effectiveness and hedging ratios. (Mallaiaris & Urrutia, 1991) examined the effect of estimation period length on hedge effectiveness and found that shorter hedging horizons are more effective than longer ones. (Lioui, 1998) analyzed the impact of stochastic interest rates on hedging contracts and found that when interest rates are stochastic, the differences between forward and futures contracts become significant. This is because stochastic interest rates introduce complexities that affect the hedging strategies and their outcomes. (Lien & Yang, 2010) indicate that hedging strategies that account for structural breaks lead to lower portfolio variance and improved hedging effectiveness for most currencies examined. (Lien & Yang, 2006) finds significant asymmetric effects of the spread on both return and risk structures in currency spot and futures markets, and the asymmetric effect model outperforms alternative models in terms of hedging performance. Several other factors, like transaction costs, macroeconomic events, post-merger of exchanges, and Covid-19, have also been studied. However, factors like market volatility, varying market conditions, portfolio effect, and changing regulatory environment can also affect the hedging effectiveness and strategies.

Cluster 5: Market efficiency dynamics (light purple)

The articles in this cluster explore the evolving dynamics of currency futures market efficiency. Researchers have found that market inefficiencies are more common than previously assumed, especially during certain periods, such as when short-term speculative bubbles occur or when external interventions, like central bank actions, disrupt the natural market dynamics. Such inefficiencies challenge the efficient markets hypothesis (EMH) (Pukthuanthong-Le & Thomas III, 2008) and call for a more nuanced understanding of how markets operate, particularly in volatile or turbulent periods.

In light of these findings, new models have emerged to better capture the complexities and inherent inefficiencies in currency futures markets. The use of nonlinear and fractal models (Fang, Lai, & Lai, 1994), suggests that market efficiency may vary over time and is more context-dependent than previously thought (Barkoulas, Labys, & Onochie, 1999). Long-term dependencies and scaling laws (Batten, Ellis, & Mellor, 1999) Financial time series data indicate that price movements can exhibit patterns not easily explained by traditional linear models. As a result, future research and practical applications in trading and risk management may benefit from more advanced, adaptive approaches that can account for these inefficiencies. These models, particularly when combined with machine learning and sophisticated statistical techniques (Lee, Enke, & Kim, 2017), offer promising avenues for more accurate market predictions and more

effective risk management strategies in the face of market imperfection and inefficiency. However, it fails to address how external events such as geopolitical events and macroeconomic factors, impact market efficiency. and what is the role of institutional traders and algorithmic trading in influencing market efficiency?

Cluster 6: Volatility and volume relationship (sky colour)

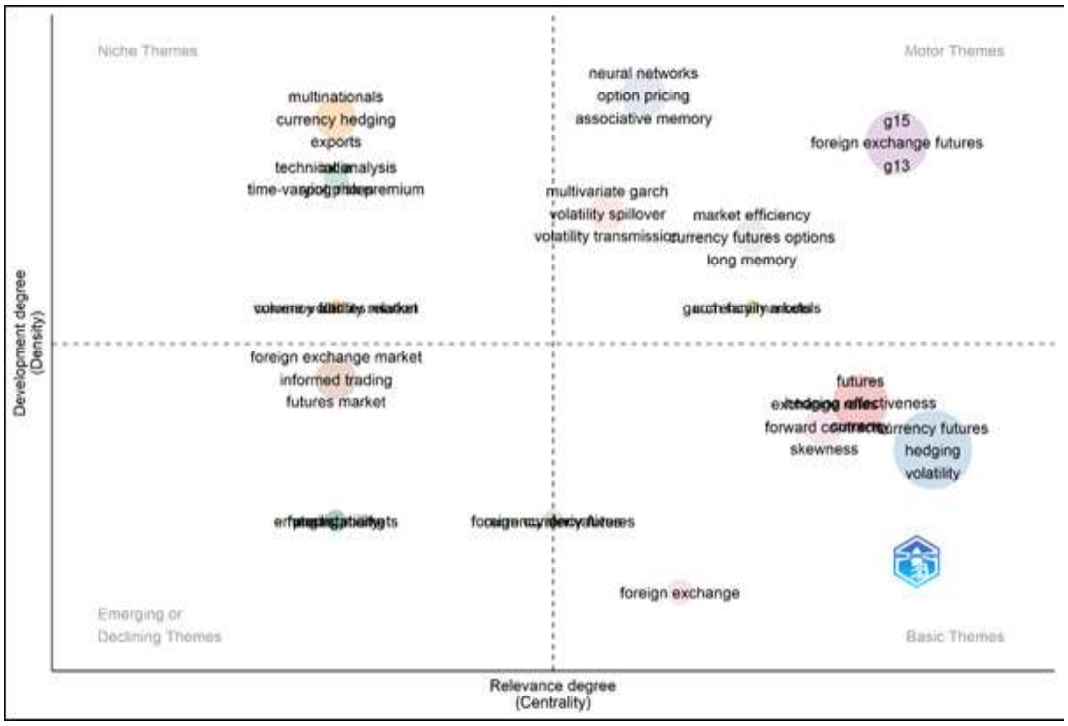
The studies in this cluster discuss the dimensions relating to the volatility-volume relationships in terms of interventions, macroeconomic events, and market depth. (Mougoué & Aggarwal, 2011) (Kumar, 2019) studied the causal relationship between volume and volatility and found a non-linear, bi-directional, and negatively correlated. Additionally, fed and central bank interventions play a significant role in influencing return volatility. Understanding this relationship is essential for market participants to effectively measure and manage currency risk, and from the studies in this cluster, it is found that interventions have been ineffective in the volatility, but interventions have a stronger volume effect; these findings can aid in formulating monetary policy that interventions affect traders differently (Siklos & Rogers, 2003) (Ramchander & Sant, 2002).

Volume and market depth have an asymmetrical lead-lag relationship, and return volatility is influenced by trading volume and market depth (Fung & Patterson, 1999). Volatility remains elevated for fifteen minutes post-announcement (Ederington & Lee, 1993). Traders can utilize findings for informed decision-making in trading. Insights may improve risk management strategies in currency futures. However, it paid little attention in exploring the data in the developing market and the role of market sentiments in intervention outcomes.

Thematic Map

Thematic mapping refers to identifying and analyzing recurring themes or patterns in a body of literature or research (Ahmad, Najam, & Mustamil, 2024). It is an effective technique to map the intuitive plots that provide keyword clustering (Sachdeva, et al., 2024). Author keywords are considered for presenting the thematic map in Fig. 6, as it is more comprehensive in representing the authors' content (Zhang, et al., 2015). It provides the insights, trends, seasonality, and outliers of the study topics (Dzogbewu, Amoah, Jnr , Fianko, & Beer, 2023). The thematic map employs a framework based on two fundamental concepts, centrality and density, represented along the X and Y axes, respectively. Centrality, in this context, quantifies the degree to which a given theme is interconnected with other themes within the research field. Density, conversely, measures the internal cohesion of a particular theme. It reflects how closely related the concepts are within a theme to each other (Dzogbewu, Amoah, Jnr , Fianko, & Beer, 2023). The map has four quadrants, each representing the position of the theme in the current scenario (motor themes, basic themes, niche themes, and emerging or declining themes).

Motor or driving themes are well-organized (Soesanto, Maarif, Anwar, & Yurianto, 2023), important and soundly trending (Li & Song, 2022) located in the upper right quadrant. It covers the popular themes that are relevant and well-developed for organizing the domain's conceptual framework (Sachdeva, et al., 2024). *Basic themes* refer to important research areas but not well established, it are located in the lower right quadrant. This theme possesses fundamental significance for the discipline and intersects with its various subfields, yet remains relatively under-researched. The upper left quadrant is the *Niche theme,* which is well-developed yet exists on the fringes of the research field, often with limited connections to the central topics. The lower left quadrant includes *emerging or declining theme*s that are neither central to the research domain nor well-developed, which require further investigation.



***Source**: Biblioshiny Web Application*

Figure 6: Thematic Map

Themes in the upper right quadrant are known for high centrality and high-density themes. The themes in this quadrant are "neural networks", "multivariate GARCH", "market efficiency", "GARCH family models", and "G15", which are well-developed and provide essential insights in the domain field. The motor theme of "neural networks" with the highest density of twenty-two signifies its relevance in examining options pricing with associative memory and low rank in centrality, which signifies the scope of interconnecting the theme with other clusters in the domain. Themes in the lower-right quadrant are known for high centrality but low density. Hedging effectiveness has the highest rank of centrality, indicating its relevance in the foundational theme. But the density rank is seven suggests significant potential for deeper exploration of this specific cluster.

Themes in the niche quadrant, located in the upper-left quadrant, indicate that topics under this theme are well developed and have high impact on the particular cluster, but interconnectedness with other clusters is limited, suggesting the potential gaps for further research. Therefore, exploring these topics has the potential to significantly benefit the field. And these topics are "multinationals", "technical analysis", "CBDC", and "volume-volatility relation". The fourth quadrant in the lower-left indicates the emerging or declining themes with low centrality and low density. And the emerging themes are related to "foreign exchange market" with the sub keywords of "informed trading" and "futures market". Also, the keywords of "predictability", "futures pricing", and "emerging markets" with the same rank of centrality and density can also be considered as the emerging themes that highlight potential areas of study which could benefit from innovative and creative ideas.

Practical Implications

The insights gained from researching currency futures offer several practical advantages. For investors, corporations, multinational companies, and exporting firms, this research aids in identifying key measures and influential factors to consider when making investment and hedging decisions. For policymakers, an understanding of currency futures markets is essential for navigating the complexities of hedging effectiveness and the varied impacts of interventions on market participants. This necessitates incorporating adaptive hedging strategies and acknowledging the inherent limitations of relying solely on statistical models. Finally, for researchers, this body of knowledge contributes to a more comprehensive understanding of currency futures markets across historical, current, and future contexts. This, in turn, facilitates the identification of new research avenues, provides access to relevant sources, and ultimately supports both emerging and established researchers in making informed decisions within this field. Also, academician leaders can foster multi-countries publications' collaboration among authors by creating a strong research ecosystem, and providing ample facilities and opportunities.

Conclusions

This bibliometric research provides a comprehensive overview of academic studies on currency futures to identify the key research work published in this domain. To grasp the current state, development trajectory, and potential future directions of this field, the study analysed 285 articles published between 1978 and 2024 sourced from the Scopus database. This body of work has grown at a steady rate of 4.32% annually, with each article having an average of 24.06 citations and an average age of 20.4, indicating the maturity of the works. The research employed two primary techniques, where in performance analysis various aspects of the literature, such as key authors, influential journals, articles, and corresponding author's countries along with collaborative patterns are studies and on the other hand, science mapping was utilized for thematic mapping, and bibliographic coupling to identify clusters of research topics and suggest promising avenues for future currency futures research. The research on currency futures started in the seventies with the fluctuations in the publications, but as far as citation of the article is considered, only in 1993 was there a sudden increase in citations. Additionally, one of the main objectives of bibliometric analysis was to identify the leading author, journal, article, and country, which revealed that *'Journal of Futures Markets'* with 48 articles is the leading journal based on h-index, and *'Journal of Financial and Quantitative Analysis'* is the leading journal based on total citations. (Kroner & Sultan, 1993) stands out in the most cited articles. The USA, India, and China emerge as the dominant countries in the field, with developed countries producing more research and engaging more frequently in international collaborations, potentially leading to richer and more diverse research outcomes.

The study also presents the bibliographic coupling, a method for identifying clusters based on citing references. This analysis generated six clusters, which are represented by the software in different colours. The clusters deal with several aspects and dynamics of currency futures and suggest the future scope of research and possible research questions to be addressed. Trading activities impact on hedgers and speculators' positions, evolution in the hedging dynamics from traditional methodology to incorporation of advanced technology of AI and machine learning, the crucial role of currency options pricing model in the currency futures market dynamics, determinants like transaction cost, macroeconomic events, structural breaks and period length impact on hedging effectiveness, market efficiency dynamics, volatility and volume relationship, and lastly, several entities' (MNFs, exporting firms and banks) hedging strategies. Also, a thematic map is considered to evaluate the trend of themes in currency futures and evolution. It suggests that the research relating to associative memory, informed trading, market

efficiency, and neural networks to be considered as emerging topics in the field where researchers should investigate various aspects, especially in emerging economies/markets, export business, and multinationals. Moreover, researchers should focus on predictability in currency futures pricing and different technological aspects in informed trading, which may increase the likelihood of currency futures transition.

While this study offers valuable insights, it has certain limitations. Primarily, the data was sourced solely from Scopus, a comprehensive database, but not exhaustive in terms of currency futures literature. Consequently, the research scope could be expanded by incorporating publications from other databases like Web of Science and PubMed. Additionally, the study's inclusion criteria are English only. Essentially, the study's findings, though informative, might be more comprehensive if it drew from a broader data pool and employed a variety of analytical approaches.

Future research directions

Building on the analysis and insights discussed above, a set of key research questions has been identified and are outlined in Table 5. These questions stem from the findings and observations, aiming to address gaps and guide future investigations in this area.

Table 5: Future Research Directions

A. Key themes	Research gaps	Future research questions
1. *Trading activities and traders' positions*	a) Lack of research in external events.	a) How do geopolitical events affect trading activities and positions? b) How to identify and utilize arbitrage opportunities? c) How do position limits differentially affect the trading behavior of small and large traders in futures markets?
2. *Evolving hedging dynamics*	a) Lack of studies in exploring the behavioural aspects of hedging. d) Lack of practical implementation of models	a) How do structural breaks, regime shifts, and market anomalies impact the hedging effectiveness of different models? b) How can behavioural biases affect hedging strategies? c) How do algorithmic trading and AI-driven hedging strategies impact hedge ratios, market stability, and volatility spillover?
3. *Currency options pricing model*	a) Limited research on long-term performance of pricing models b) Lack of research in the formulation of a more comprehensible options pricing model	a) How do options pricing influence trading behaviour in currency futures over the long term? b) What are the trade-offs between model comprehensibility and predictive accuracy? c) How can integrating macroeconomic indicators into options pricing models improve their robustness?

4	*Determinants and hedging effectiveness*	**a) Limited research in exploring determinants of hedging effectiveness** **b) Need to use updated and recent years' data**	**a) How do varying market conditions affects hedging effectiveness?** **b) How do market volatility and a changing regulatory environment impact hedging effectiveness?** **c) How can the integration of currency futures with other financial instruments improve hedging**
5	Market efficiency dynamics	a) Lack of research on market efficiency dynamics	a) What role do algorithmic and high-frequency trading play in influencing market efficiency? b) How do specific regulatory measures (e.g., position limits, margin requirements, circuit breakers) affect the speed and magnitude of price adjustments in futures markets? c) How do external events, such as geopolitical events and macroeconomic factors, impact market efficiency? d) What is the role of arbitrageurs and speculators in maintaining price stability and market efficiency?
6	*Volatility and volume*	a) Lack of dynamic research for the volatility-volume relationship	a) How do institutional characteristics affect the trading volatility and volume relationship? b) What is the role of structural breaks in volatility-volume?
A.	*Methodology*	a) Lack of studies incorporated the advanced methodologies	a) Incorporation of AI, Machine Learning, and advanced econometrics models required for optimal hedging
B.	*Context*	a) Predominantly, research is conducted from the context of developed nations	a) Substantial research is required from emerging and developing nations

***Source**: Author's Own Work*

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