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SYSTEMATIC MAPPING OF THE FOREIGN EXCHANGE RATE-STOCK MARKET RELATIONSHIP USING BIBEXCEL AND VOS VIEWER

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Abstract: Empirical research work has been done to comprehend the relationship between foreign exchange rates and the stock market. This review article provides a proper framework for the published work in this research area. The published research work is collected from the Scopus database, and bibliometric analysis is done using Bib Excel and VOS viewer. Apart from getting bibliometric results of the collected data, the findings of most cited papers are also piled up. The mixed findings of the published articles confirm the existence of a significant relationship between the stock market and foreign exchange rate. Still, the robustness of connection is highly dependent on the economic particulars of any country. It is also analyzed that the relationship appears more potent in the crisis period. This systematic analysis facilitates researchers to focus on this research area to get a more specific conclusion in this research area.
Keywords: Foreign exchange rate, Stock market, Bibliometric, Bib Excel, VOS viewer, Systematic analysis
JEL Codes: G19

1. Introduction

Stock market and foreign exchange rate are always considered as evocative of the economic development of a country. Due to globalization, expansion in transnational trade, and the flexible foreign exchange rate in economically rising countries, the stock market, and foreign exchange rate became interdependent. It turned into a concern for researchers and financial economists to explore the interconnection between the stock market and exchange. The info provided by this relationship is frequently used to forecast the future trends of fundamentalist investors and financial economists. The retrospect of literature examined the dynamic link between the stock market and foreign exchange rates in theoretical and empirical ways.

Theoretically, the interconnection of the stock market and foreign exchange rate and is explained by two models, namely (Figure 1), flow-oriented model (Fischer, 1980) and stock-oriented models — portfolio balance model (Branson, 1979 and Frankel, 1983) and monetary model (Gavin, 1989). According to the flow-oriented model, any change in foreign exchange rates affect trade balances and international competitiveness, influencing output and real income, hence the stock prices. On the contrary, the monetary model states, the variations in stock prices affect aggregate demand through wealth and liquidity effects, thereby influencing money demand and foreign exchange rates. The portfolio balance model is based on the fact that the stock prices are always determined by the current values of the future cash flows, so any variation in the underlying currency value plays a substantial role in share price movements. This model concludes, the stock market is sensitive and affected through variation

in foreign exchange rates. It concludes stock market is influenced by foreign exchange rates directly.

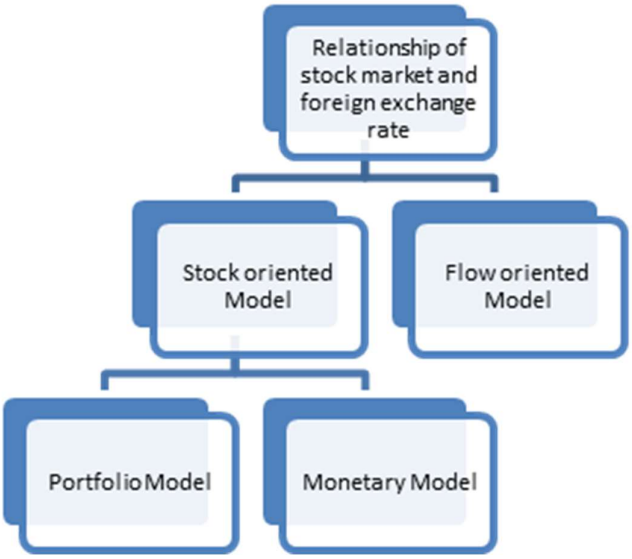


Figure1: Theoretical Models: Relationship of Stock Market and Foreign Exchange Rate

For the past three decades, the interconnection of the stock market and the foreign exchange rate has been analyzed empirically in various ways. The findings of the research work are relatively varied concerning significance, duration, and direction of the impact on each other. Most empirical studies found a significant relationship between the stock market and foreign exchange rate (Soenen & Hennigar, 1988; Phylaktis and Ravazzolo, 2005; Ning, 2010; and Seong, 2013).

Some previous studies also revealed that the interconnection of the stock market and foreign exchange rate is not persistent for a long time (Komain, 2012; Kutty, 2010; and Zhao, 2010). In contrast to these studies, some studies found evidence of long-term association in the stock market and foreign exchange rate (Yau and Nieh, 2009; Diamandis and Drakos, 2011; and Singh, 2015). Some researchers focused on the connection between the stock market and foreign exchange rate (Khan and Ali, 2015 and Aydemir and Demirhan, 2009).

Some of the studies in growing literature even focused on volatility spillover among stock market and foreign exchange rate (Yau and Nieh, 2009; Mun, 2007; and Yang and Doong, 2004). However, none of the previous studies grasp the overall structure of an intellectual landscape and analyze the intrinsic link between some key literature.

The scientific bibliometric analysis is an approach to get deep info of most producing and influencing authors, most contributing countries, most publishing journals, mostly used keywords, etc., in the particular research field. This study aims to statistically analyze the empirical work done in this research area to explore the interconnection of the stock market and foreign exchange rate. This study represents the existing studies systematically to get extensive knowledge of the published work about publication year, author, journal, most productive countries, etc. The main objectives of this study are classified into three points:

(1) To recognize the overall research status in a way, to get in-depth information of development in the publication in past years, most contributing author, most productive country, most frequently used keywords, and finally, most cited papers in this research field.
(2) To visually represent integrated knowledge about the documents co-citation, co-author, and keyword co-occurrence to detect emerging topics for this domain, this article will explore distinct natures of studies comprising diverse research perspectives and links among them.
(3) To compile the findings of the most cited paper in this research area and drive a conclusion regarding the relationship between the stock market and foreign exchange rate.
The remaining paper is structured as follows; section 2, "Data and Methodology," describes the data collection, research tools, and research process and section 3, "Results" of different bibliometric analyses with visual presentations. Lastly, section 4, "Summary and Discussion," encloses the comprehensive summary of the systematic literature analysis.

2. Data and Methodology

2.1. Data

The significance of a systematic literature review is based on the two metrics. First, the published research work and articles should be collected from a reputable database. And secondly, use of relevant keywords to cover substantial published work in the research area. To collect relevant published research work in the required field, two steps are followed.

a. First, to decide which database should be adopted, like Scopus, ISI Web of Science (WoS), or Google Scholar (Olawumi and Chan, 2018). Plus, to decide appropriate keywords to find almost all published articles in the research field. In this study, the research papers are collected from the core collection of the Scopus database. Scopus is a reputable and comprehensive bibliographic database that gives wide-ranging access to journal articles. It is one of the famous scientific citation key data sources in the world.

b. Second to choose appropriate keywords to cover the research area. In this paper, the data is searched using the following keywords —stock market, stock, stock price, stock return, and foreign exchange rate. To cover all articles, we didn't control the time-span ranges of the dataset. The total number of article records obtained through the database search process is 872. After screening the objective and abstract of the research papers, we removed some articles, and the final records for our dataset were reduced to 341. The complete data collection framework of this study is represented in figure 2.

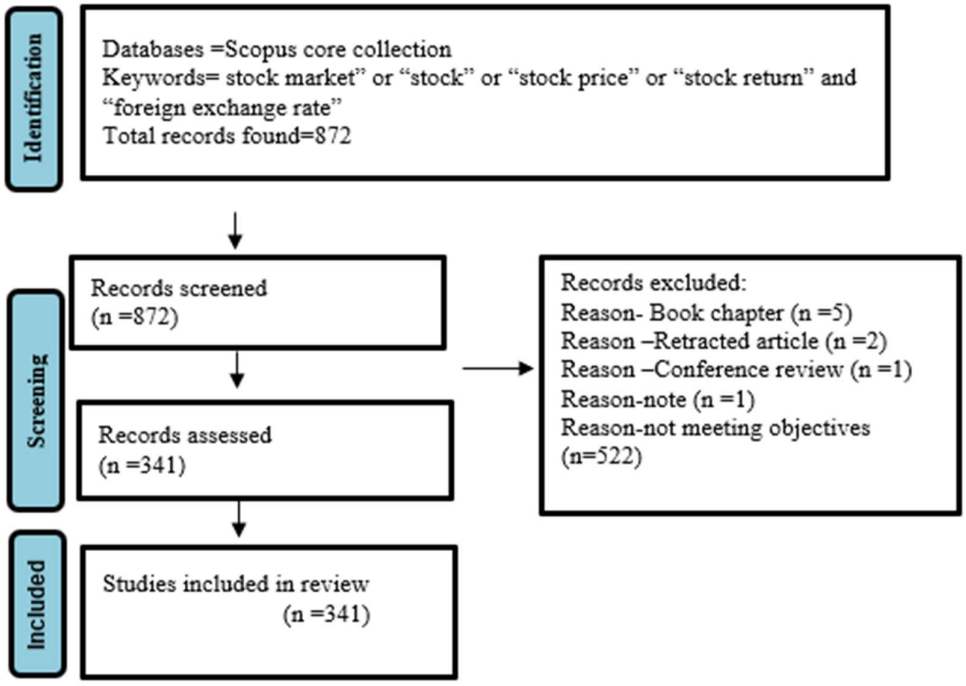


Figure 2: Data Collection Framework

2.2 Methodology

To do systematic scientific mapping of research papers, we used BibExcel and VOSviewer software programs. BibExcel works as a tool for bibliometric analyses to get specific information regarding the research development in previous years and performance of journals, authors, countries, frequently used keywords in an identified research field. And VOSviewer helps in the visual representation of analysis. VOSviewer is used to visualize bibliometric maps. In this study, VOSviewer was used to analyze the co-occurrence of keywords, co-cited authors, and co-cited documents. The complete framework of bibliometric analysis presents in figure 3.

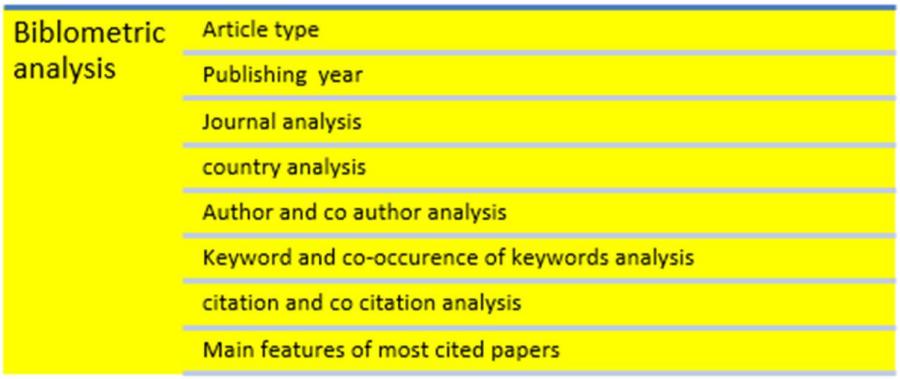


Figure 3: Framework of Bibliometric Analysis

3. Results

3.1 Article Type

Total 872 collected records were collected from Scopus core collection using keywords such as stock market, stock, stock price, stock return, and foreign exchange rate. After screening the

objective and abstract of the collected data, only 341 articles were identified as relevant contributors in analyzing the relationship between the stock market and foreign exchange rate. Types of articles are analyzed with the help of BibExcel. The outcome of analysis shows, among all the publications — 316 are research journals (92.7%), 21 are conference papers (6.2%), and only four are review papers (1.1%) (fig4).

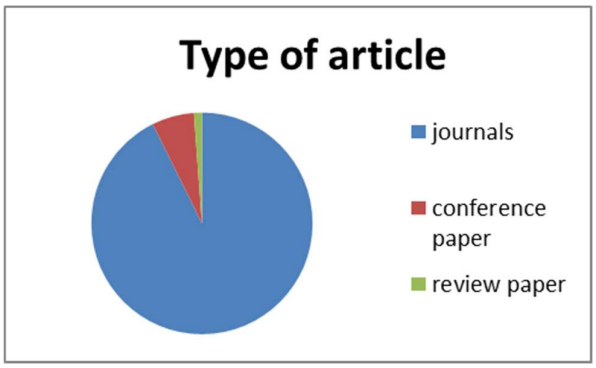


Figure 4: Types of Article

3.2 Publishing Year Analysis

Figure 5 presents a picture of the number of publications done in this research field in the Scopus database. It shows an enormous upsurge in research publication year by year after 2010. In 1996, only one article was published in the research area, which turned into 40 in number in 2020. The progress in the number of publications each year confirms the growing curiosity in this research area.

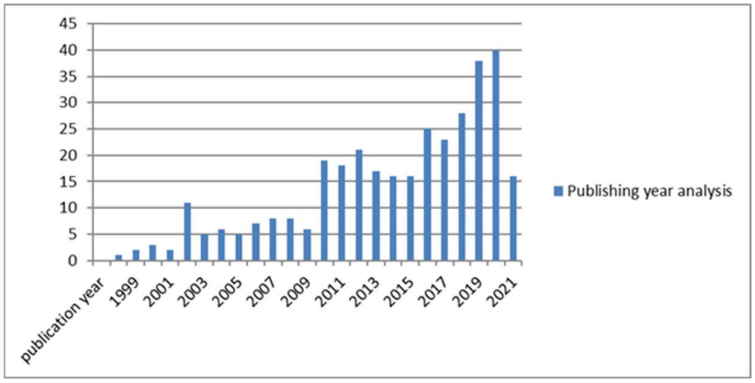


Figure 5: Publishing Year Analysis

3.3 Publishing Journal Analysis

The analysis results show a total of 187 sources of publications of the research papers in this area. Figure 6 displays the top 10 journals in which most articles are published in this research field. Out of 341 articles, 11 articles are published in Applied Financial Economics, nine articles are published in International Review of Economics and Finance, eight articles are published in Applied Economics, eight articles are published in International Journal of Finance and Economics, seven articles are published in Physica A: Statistical Mechanics and its Applications, seven articles are published in Journal of International Financial Markets,

Institutions, and Money, six articles are published in Research in International Business and Finance, five articles are published in Savings and Development, five articles are published in Singapore Economic Review, and five articles are published in North American Journal of Economics and Finance.

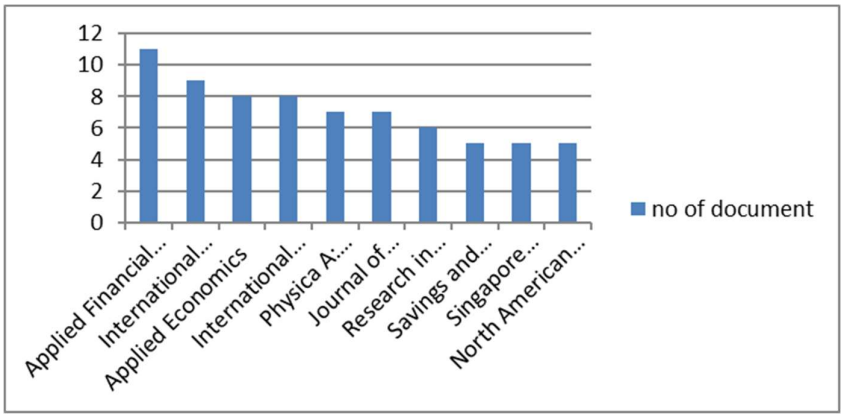
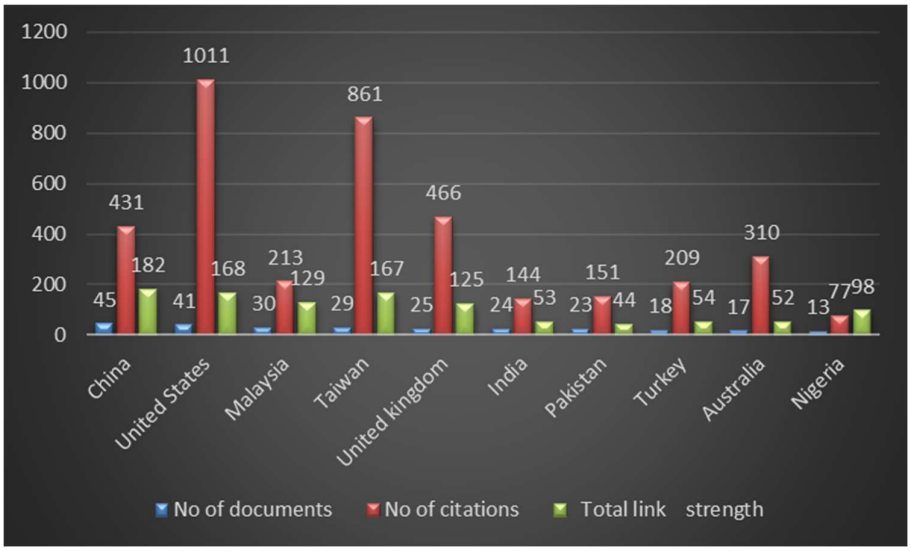


Figure 6: Publishing Journal Analysis

3.4 Publishing Country Analysis

With the help of BibExcel, it is easy to recognize the involvement of individual countries in the research area. There are 63 countries involved in researching the interconnection of the stock market and foreign exchange rates. Figure 7 represents the top 10 countries whose contribution in terms of the number of publications is the most. The result shows that China is the leading contributing country with 45 articles, after that United States (40 articles), Malaysia (30 articles), Taiwan (29 articles), United Kingdom (25 articles), India (24 articles), Pakistan (23 articles), Turkey (18 articles), Australia (17 articles), and Nigeria (13 articles) are contributing countries. It also shows that even though China has made the highest contribution in this research domain, the United States, Taiwan, and the United Kingdom are more cited countries than China.



. Figure 7: Publishing Country Analysis

3.5 Keywords and Co-occurrence of Keyword Analysis

Keywords are the phrases that reveal the central theme of the research work. The analysis of keywords helped the researcher to demonstrate the research field's development and structure. The results of the study found a total of 1091 keywords used in this research domain. Figure 8 represents the top 20 most frequently appeared keywords in the research area. It illustrates foreign exchange rate (176 times), foreign exchange rates (120), stock market (119), and stock prices (62) are primarily used keywords. Analyzing the co-occurrence of keywords is a way to find a connection between two keywords. The VOSviewer software helps to investigate the co-occurrence of keywords and represent it visually. Figure 9 shows four clusters of keywords in four different (red, green, blue, and yellow) colors with circles. The sizes of the circles represent the frequency of keywords, and each cluster shows a group of keywords. In the figure, total link strength shows many publications in which two keywords are used together.

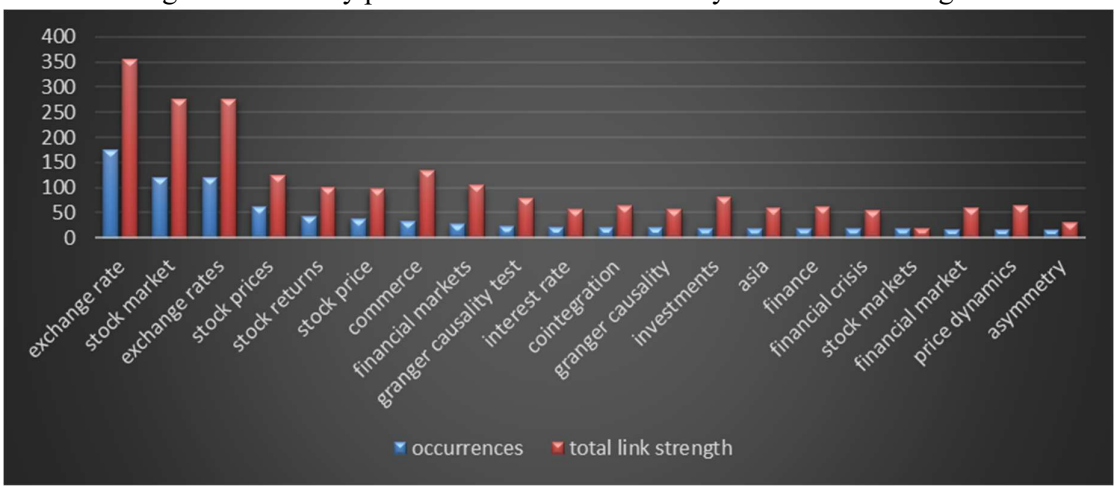


Figure 8: Keyword Analysis

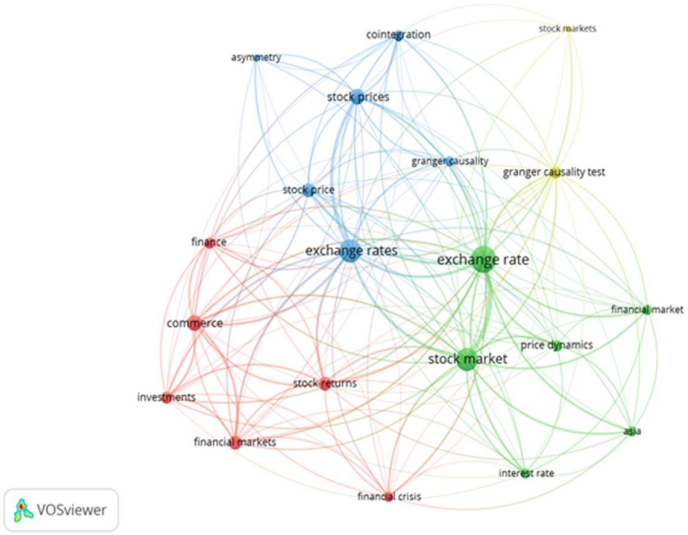


Figure 9: Co-occurrence of Keyword Analysis

3.6 Author and Co-author Analysis

The results show a total of 681 authors contributed to this research area. Figure 10 represents the top 20 most productive authors in the research field with full link strength. The result shows Zivkov D (6 articles) and Hsing Y (6 articles) are the most productive authors in the research area. However, CC Nieh (4 articles) and W Chkili (3 articles) have made less contribution through publication but have more citations than those two authors. From this, it can be suggested that CC Nieh and W Chkili are the most influencing authors in this research domain. VOSviewer helps to represent co-authorship patterns visually. Figure shows 15 clusters in a different color to represent co-operation between authors. It shows GE Chortareas, Andrea Cipollini, and Mamdouh A Eissa worked together in three research papers (cluster1 in red color). It also shows out of seven papers contributed by D Zivkovy; four papers were contributed with CC Nieh (cluster5 in purple color). M Bahmani-Oskooee and S Saha, another group of authors (cluster2 in green color), contributed three papers together.

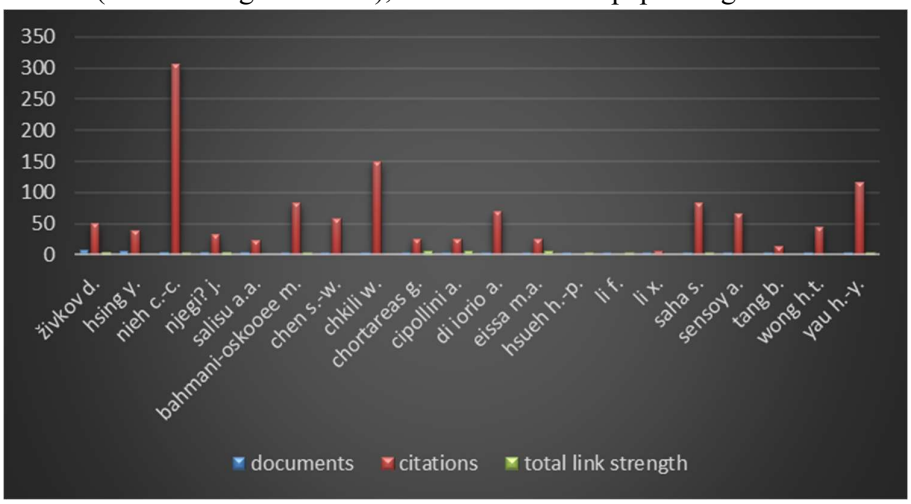


Figure 10: Author Analysis

Figure 11: Network Visualization of Co-author Analysis

3.7 Citation and Co-citation Analysis

Citation analysis is measured as one of the best tools of bibliometric analysis. The number of citations indicates the effectiveness of the published article in the research field. The BibExcel and VOSviewer soft wares are the perfect tools to identify the number of times each article acknowledged. The result shows, 25 research papers received more than 80 citations (represented in tab1). The research paper titled, “Dynamic relationship between stock prices and foreign exchange rates for G-7 countries” is the most cited article with 667 citations.

Co-citation analysis represents the link between research-based articles cited by the same document (Van Eck and Waltman, 2020). In this paper, co-citation analysis is done by employing VOSviewer (figure12). The results show that “Dynamic relationship between foreign exchange rate and stock price: evidence from China” and “Stock prices and foreign exchange rate dynamics” are the most cited papers among these 341 papers.

Table 1: List of Most Cited Papers

Cites	Title
667	"Dynamic relationship between stock prices and foreign exchange rates for G-7 countries"
488	"Dynamic linkages between foreign exchange rates and stock prices: Evidence from East Asian markets"
395	"Dollar foreign exchange rate and stock price: evidence from multivariate cointegration and error correction model"
367	"Dynamic analysis between the US stock returns and the macroeconomic variables"
340	"The relationship between stock prices and foreign exchange rates evidence from turkey"
331	"Dynamic relationship between foreign exchange rate and stock price: Evidence from China"
330	"Foreign exchange rate variability and the riskiness of US multinational firms: Evidence from the breakdown of the Bretton Woods system"
275	"Stock market volatility and foreign exchange rates in emerging countries: A Markov-state switching approach"
260	"Foreign exchange rate movements and stock market return in a regime-switching environment: Evidence for BRICS countries"
253	"The relationship between stock price index and foreign exchange rate in Asian markets: A quantile regression approach"
241	"The comovement between foreign exchange rates and stock prices in the Asian emerging markets"
229	"Bivariate causality between foreign exchange rates and stock prices in South Asia"

218	"Dependence structure between the equity market and the foreign exchange market–a copula approach"
196	"Dynamic linkages among oil price, gold price, foreign exchange rate, and stock market in India"
159	"On the linkages between stock prices and foreign exchange rates: Evidence from the banking crisis of 2007-2010"
157	"Dynamic linkage between real foreign exchange rates and stock prices: Evidence from developed and emerging Asian markets"
155	"Testing for cointegration with threshold effect between stock prices and foreign exchange rates in Japan and Taiwan"
134	"Downside and upside risk spillovers between foreign exchange rates and stock prices"
123	"Multifractal detrended cross-correlations between the Chinese exchange market and stock market"
116	"Do foreign exchange rate changes have symmetric or asymmetric effects on stock prices?"
101	"Japanese currency and stock marketâ€" What happened during the COVID-19 pandemic?"
90	"Volatility spillover effect between stock and foreign exchange rate in oil exporting countries"
87	"Relationship between oil, stock prices and foreign exchange rates: A vine copula based GARCH method"
84	"Foreign exchange rate volatility and stock market development in emerging economies"
80	"Untangling the non-linear causal nexus between foreign exchange rates and stock prices: New evidence from the OECD countries"

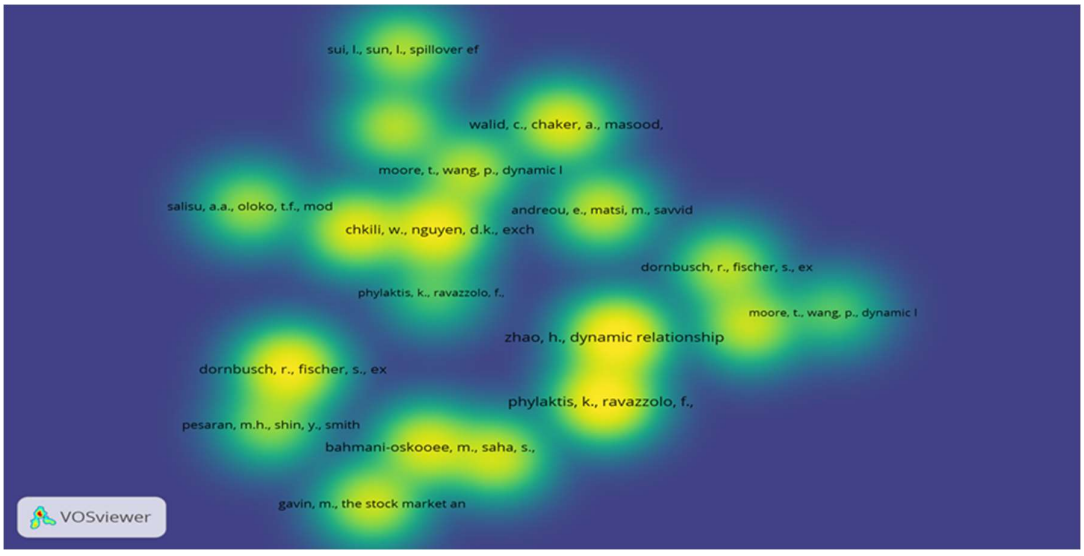


Figure 12: Density Visualization of Co-citation Analysis

3.8 Main Features of Most Cited Papers

For an in-depth understanding of the interconnection of the stock market and foreign exchange rate, it is vital to give proper consideration to the findings of the research work in this domain. Table 2 provides a brief overview of the research papers listed in table 1. It includes the author's name, year of publication, research methodology, countries involved, and findings of these papers.

Table 2: Main features of Most Cited Papers

Authors	Year	Research methodology	Countries	Findings
CC Nieh, CF Lee	2001	Johansen Multivariate Maximum Likelihood co integration test and Vector error correction model	G-7 country	No long-run relationship exists.
MS Pan, RCW Fok, YA Liu	2007	Granger causality tests, a variance decomposition analysis, and an impulse response analysis	Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand	The relationships vary amongst different economies with regard to foreign exchange rate regimes, scope of equity market, trade size.
H Zhao	2010	Vector auto regression and autoregressive conditional MGARCH models	China	No long-run relationship but the bidirectional volatility spillovers exist.
CH Lin	2012	Autoregressive distributed lag (ARDL)	Asian emerging markets	Co movement between these variables become stronger during crisis period and spillover exists from stock market to foreign exchange rates.
C Ning	2010	Copulas model	US, UK, Germany, Japan, France	Significant symmetric relationship exists
IC Tsai	2012	Quantile regression	Asian countries.	Significant relationship exists but path and significance of the relationship depend on the market conditions.
A Jain, PC Biswal	2016	Dynamic conditional correlation (DCC)-	India	Significant positive co exists.

		GARCH model and Non-Linear Causality test		
G Cao, L Xu, J Cao	2012	MF-DCCA method	China	Cross-correlations are sensitive to foreign exchange rate.
C Walid, A Chaker, O Masood, J Fry	2011	Two regime Markov switching-EGARCH model	Hong Kong, Singapore, Malaysia and Mexico	Asymmetric and regime dependent relationship exists
K Kim	2003	Johansen's cointegration	United States	Negative relationship exists.
W Chkili, DK Nguyen	2014	Markov regime-switching model VAR models	BRICS	Unidirectional significant impact on foreign exchange rate from stock market except south Africa.
JC Reboredo, MA Rivera-Castro, A Ugolini	2016	VaR and the CoVaR m copulas	emerging	Positive relationship and bidirectional spillover risk effects exist.
O Ratanapakorn, SC Sharma	2007	Vector error correction model	United States	Long run positive relationship exist.
T Moore, P Wang	2014	Dynamic conditional correlation (DCC) bivariate GARCH model	Indonesia, Malaysia, South Korea, the Philippines, Singapore, Thailand and US	Significant dynamic relationship exists but degree of relationship depends on the maturity of financial market.
GM Caporale, J Hunter, FM Ali	2014	Bivariate UEDCC-GARCH models	US, the UK, Canada, Japan, the euro area, and Switzerland	Significant granger causality exists but direction of causality varies among countries also interaction increased during crisis period.
R Smyth, M Nandha	(2003)	Engle–Granger two-step and Johansen cointegration methods	Bangladesh, India, Pakistan and Sri Lanka	No long-run relationship but unidirectional causality exists.

O Aydemir, E Demirhan	2009	Toda-Yomamoto (TY)	Turkey	Bidirectional causal relationship exists.
HY Yau, CC Nieh	2009	threshold error-correction model (TECM)	Japan and Taiwan	Long-term and asymmetric causal relationships exist
PK Narayan, N Devpura, H Wang	2020	GARCH-M model	Japan	Negative relationship exits and the relationship has become stronger during COVID-19
AY Mikhaylov	2018	FIGARCH model	Russia and Brazil	Bidirectional volatility spillover effect exists.
M Bahmani-Oskooee, S Saha	2016	Non-linear ARDL approach and error-correction modeling	Brazil, Canada, Chile, Indonesia, Japan, Korea, Malaysia, Mexico, U.K.	Short run asymmetrical effects on stock market from foreign exchange rates exists.
M Hajilee, OM Al Nasser	2014	Bounds testing approach and error-correction modeling	12 Emerging economies	Both short- and long-term effect on stock market development from foreign exchange rate volatility exists.
SW Chen, TC Chen	2012	Vector error correction model, the bounds testing methodology and linear and non-linear Granger causality	12 OECD countries	Both short- and long-term bidirectional relationship exists.
R Aloui, MSB Aïssa	2016	A vine copula based GARCH method	United States	A significant and symmetric relationship exists.

4. Summary and Discussion

Analyzing the interconnection of the stock market and the foreign exchange rate has become a matter of interest for researchers, economists, and financial investors, as understanding the dependence structure of these markets assist in identifying the behavior of these markets. Based on theoretical and empirical studies, this piece of research intends to deliver a gist of the

existing literature on the nexus between stock-exchange markets through systematic literature review analysis.

To certify the integrity and eminence of the scientific analysis, the leading data is obtained from the Scopus core collection. Two kinds of bibliometric analysis tools, BibExcel, and VOSviewer, are employed to perform bibliometric analysis on the collected data, to form the corresponding knowledge map based on article type, publishing year, keyword and co-occurrence of keywords, publishing journal, most productive country, most productive author and co-author, most cited research work and co-citation analysis, which are intended to provide references and basis for future research in the field.

Results show that publication in the research area is increasing year by year, with a rapid surge in publications since 2015. Keyword and co-keyword analysis show a list of words used as keywords, which gives dimensions to the research domain. The results of other bibliometric analysis show in the table3.

Table 3: Result of Scientific Bibliometric Mapping

Most publishing journal	"Applied Financial Economics"
Most producing country	China
Most cited country	USA
Most productive author	Zivkov D and Hsing Y
Most cited author	Nieh c.-c
Co-author-most linked	chortareas g.,cipollini a. and eissa m.a.
Most cited paper	"Dynamic relationship between stock prices and foreign exchange rates for G-7 countries"
Most cited reference	"Dynamic relationship between foreign exchange rate and stock price: evidence from china"
Most co-cited papers	"Dynamic relationship between foreign exchange rate and stock price: evidence from china" and "stock prices and foreign exchange rate dynamics"

The findings of the most cited research paper in this area provide mixed conclusions about the nexus between the stock market and foreign exchange rates. It can be concluded that the strength and direction of this relationship are primarily dependent on the economic conditions of a country. Also, the connection gets stronger during a crisis period.

This scientific bibliometric analysis gives a deep understanding of the published work analyzing the relationship between the stock market and foreign exchange rates. It can be used as reference points by researchers and/or other stakeholders interested in gaining more knowledge in the research field. The mixed findings of the published area compel further consideration and more recent data and new econometric tools.

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