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The Relationship between Oil Prices and Exchange Rate: A Systematic Literature Review

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ABSTRACT

Oil is among the enormously vital and most traded commodities globally, involving many forex transactions in the face of various types of shocks attributable to geopolitics, supply, demand, market crisis, etc. This study uses a systematic literature review approach to explore the Literature from the SCOPUS database considering the relationship between oil prices and exchange rates by analyzing the papers from 1998 to 2022 and includes the final 123 papers. This study emphasizes three objectives; Literature developed so far, standard methodologies and findings, and the research gaps which can be pursued in further studies. Findings show that vast literature is developed around these variables and sub-topics in various dimensions, such as the stock market, gold prices, economic growth, etc. Research around the variables has increased in the recent past, indicating the continued relevancy of the relationship. However, it can be due to increased access to higher education and research. This study also finds the gap in the literature and has implications for the policymakers in monetary and fiscal policy planning, as well as investors across the globe in making portfolio management strategies.

Keywords: Oil Prices, Exchange rate, Relationship, Stock Market, Systematic Literature Review
JEL Classifications: E3, F1, D4, G1

1. INTRODUCTION

The exchange rate is one of the essential variables for oil-importing and oil-exporting nations since it is related to the current account deficit, inflation rate, and interest rate, among other factors. The earliest study in the Scopus database that links the variables (oil prices and exchange rate) was conducted by Amano and Van Norden (1998[a]). They explored the relationship between Japan, Germany, and the United States. Similarly, in one more study, the authors emphasized the role of energy prices in determining the exchange rate movement (Amano and Van Norden, 1998[b]). The impulsive nature of oil prices is attributable to various uncertainties such as Covid-19 and changes in the geopolitical scenario, which augments the significance of exploring the association between oil prices and exchange rates.

A significant number of studies have established the relationship between these two variables. However, they are different in various aspects, such as long and short-run relationship, time-varying, extreme dependence, volatility spillover, frequency domain, etc. (Das, 2021; Long et al., 2021; Raju et al., 2021; Bedin et al., 2021). The linkages also vary based on oil exporting and importing countries, the size of the economy, and the recent shift towards renewable energy sources in mobility (Eryiğit, 2012). Alssadek and Benhin (2021) examined the dependence between oil prices and exchange rates in oil-rich countries. Further, Long et al. (2021) investigated the relationship between the Chinese RMB and oil prices.

In recent COVID-19 pandemic dominated the economic policy and financial decisions landscape, therefore the research in the context of crisis. In pursuance of covid related impact on the relationship, Atif et al. (2022) analyzed the relationship between the oil prices and exchange rates in emerging economies, during the pre and post Covid-19 Pandemic. Similarly, Chaudhary and Garg (2022) explored the nexus between oil prices and exchange

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rates during covid-19. Korley and Giourus (2022) found the impact of oil price volatility significant on the exchange rate and other economic determinants in the context of Covid-19 and the 2008 global financial crisis. Li et al. (2022) investigated the impact of oil price returns and volatility spillover on the exchange rates of CAD, JPY, Euro and GBP during the Covid-19.

While analyzing the studies, the following three questions were pursued.

- Research Question 1: What literature has developed around the relationship between oil prices and exchange rates?
- Research Question 2: What are the commonalities among the studies?
- Research Question 3: What are the research gaps that can bepursued in future studies?

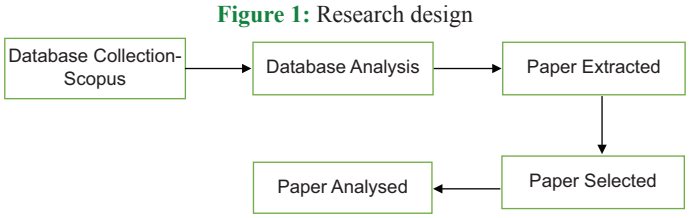
Section 2 of this study includes materials and methods used in conducting the literature review, followed by the results section, which provides further details about the papers, such as the first author's country, publication year, and keyword cluster analysis based on the VOS software. Next, section 4 includes the discussion, which reviews the studies exploring the purpose of this study, followed by section 5, which depicts the conclusion.

2. MATERIALS AND METHODS

Following the systematic literature review approach of Merli et al. (2018) and Sassanelli et al. (2019), the Scopus database was selected, as it contains millions of entries from around 5000 publishers (De Mauro, 2016). Therefore, this study commenced with the extraction of papers from the Scopus database. The extracted database was based on the process illustrated in Figure 1. For an advanced search of the SCOPUS database, the Oil price and currency rate were incorporated after the Keywords. The search led to uncovering 6036 papers, which were then limited to Economics, Finance, Business Management, and accounting. Three thousand three hundred six studies were displayed due to the restriction. The significant fall demonstrates the diversity of articles on other connected topics, such as energy policy, the environment, geopolitics, etc. Additionally, journal publications published in English were chosen. After careful keyword analysis and abstract reading, the final number of selected papers was 103. Based on the Inclusion-Exclusion criteria of the C-I-M-O framework (Denyer et al., 2009), studies that included monetary and fiscal policy, supply and demand, etc., were included. Papers that were not relevant to our purpose of study, such as environmental pollution, renewable energy, etc., were excluded.

After downloading the selected papers, they were arranged according to details such as the first author's country, year of publication, keywords, etc. Then, further research was conducted, as given in the next section (Table 1).

Figure 1: Research design



Source: Complied by the authors

3. RESULTS

As Given in Table 2, most of the papers were published in recent years, particularly in 2022, 2021, 2020, and 2019. However, literature on the topic dates as far as 1998 when Amano and Van Norden (1998) published their study. In the year 2012 also, 12 papers were published. This can be linked to the emphasis on research across countries and the topic's growing significance in a globalized setting.

The Energy Economics Journal is the leading journal in publishing the most articles, with 15, followed by the International Journal of Finance and Economics which published 12 papers, along with the International Journal of Energy Economics and Policy, and Resources Policy, both publishing the Eight papers (Appendix-1).

Based on the first author's country(Appendix-2), China, the USA, and Canada contributed the most to the number of

Table 1: Overview of research

Research step	Number of papers
Research keywords "Oil prices and Exchange rate	7045
Filter to "Economics, Econometric and Finance, Business Management and Accounting"	3905
Publication type "Article"	3423
Publication stage "Final"	3223
Publication source "Journal"	3006
Language English	2908
Keyword analysis	595
Abstract reading	123

Source: Authors own work

Table 2: Year-wise publications

Year	Number of articles published
2022	19
2021	19
2020	19
2019	15
2018	4
2017	2
2016	4
2015	5
2014	2
2013	2
2012	12
2011	9
2010	1
2009	8
2008	0
2007	2
2006	1
2005	2
2004	2
2003	2
2002	0
2001	0
2000	1
1999	0
1998	1

research papers, with China publishing most 18, whereas the US and Canada publishing seven each, which translates to 26% of all the selected papers—followed by Malaysia, the UK, India and Russia, publishing 6, 6, 5, and 4 papers respectively. Further, research on this topic is pursued in the European countries of Germany, France, and Norway, each having published three papers. Research papers also find their origin in countries of the Indian subcontinent. The origin of papers can be categorized into oil-importing and exporting countries. China, India, Pakistan, Bangladesh, Japan, etc., are among the significant oil-importing countries, whereas UAE, Qatar, Saudi Arabia, USA, Mexico, Canada, etc., are among the major oil-exporting countries.

A keyword analysis is the primary aspect of a systematic literature review, representing the links between the keywords. Further VOS-based analysis shown in Figure 2 represents the links between the keywords in the cluster. The bigger the node, the more significant the no of occurrences of keywords, whereas curved lines show the linkage between the keywords.

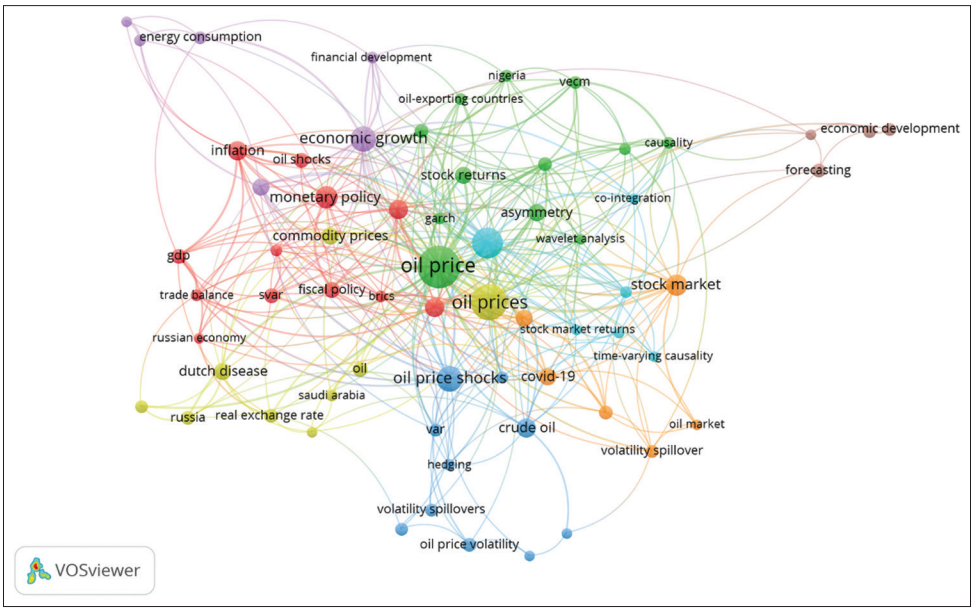
As shown in Figure 2, the keyword Oil Prices/Oil Price is the most occurred keyword in the cluster. The words, "oil price", "oil prices" and "oil price shocks", "crude oil" can be observed. It can be noted that the oil prices keyword occurs most with the Economic growth, exchange rate, and fiscal policy in the Figure 2. It generally indicates the direction and association between the variables. Similarly, the occurrence of exchange rates is most with the oil price shocks followed by crude oil and economic growth. Another cluster also indicates the co-occurrence of the stock market and its association with the oil market. Co-occurrence of the stock market is also observed with oil prices and exchange rates. Similarly, the Authors keyword indicates the co-occurrence between oil price and exchange rate. Clusters in the image are associated withthe short-term and long-term association through Granger causality and cointegration.

4. DISCUSSION

4.1. Association between Oil Prices and Exchange Rates

Many sub-topics are centered around the association between oil prices and exchange rates. Following the first research question, we explore that what are the main topics developed around the variables? Early researchers Amano and Van Norden (1998) investigated the link between oil prices and exchange rates in the background of oil price shocks. Amano and van Norden (1998[a]; 1998[b]) studied the post-Bretton-wood period and the role of oil prices in determining the real exchange rate. Finally, Sadorsky (2000) explored the relationship between energy futures of oil, gasoline, and heating with the trade-weighted index of the exchange rate. Results based on the Granger Causality indicate the long-term impact of oil price shocks on energy futures. Further, Yousefi and Wirjanto (2003) applied the exchange pass-through methodology to check the impact of changes in the exchange rate on the trade balance in three oil-exporting countries. Saudi Arabia, Iran, and Venezuela. The authors found that Venezuela and Iran increase the prices of oil in response to a decrease in the exchange rate whereas Saudi Arabia does not increase the oil prices in such cases. Yousefi and Wirjanto (2004) analyzed the impact of significant currencies on oil prices in OPEC countries through the US dollar. Chen and Chen (2007) explored the relationship between actual oil prices and the real exchange rate in G7 countries using panel data from January 1972 to October 2005. The authors found that oil prices are linked with the exchange rate in the long term and have significant predictability over a more extended period. Lizardo et al. (2010) studied the movement of the US dollar against various currencies from the 1970s to 2008. Authors found the oil exchange rate relationship significant as rising oil prices lead to the appreciation of the oil-exporting countries and depreciation and importing countries. By applying the two-step regression approach, Huang and Tseng (2010) Investigated the impact of the exchange rate on crude oil prices. Havenga et al. (2011) analyzed the impact of oil prices and exchange rates on the logistic costs of South Africa.

Figure 2: Keyword co-occurrence analysis



Source: Authors' own work using Vos software

Chang et al. (2011) tested the exchange rate relationship through PPP in major oil-exporting countries.

Polemis (2012) Explored the impact of spot prices of gasoline on the exchange rate in the short run. Ito (2012) explored the relationship between oil prices, exchange rate inflation, and GDP in Russia by using the vector autocorrelation model. The author uses data from 1995 to 2009. Results of the analysis indicate that a 1% increase in oil prices leads to the growth of the Russian GDP by 0.44%. Similarly, the rising oil prices had a significant impact on the real exchange rate, which causes the real effective exchange rate to appreciate. The direction of the relationship between oil prices and the exchange rate is generally studied from the oil prices to the exchange rate. However, Novotný (2012) explored the relationship in the inverse direction from exchange rate to oil prices. By the application of Granger Causality on monthly data ranging from 1982 to 2010. Results suggest that a 1% increase in the dollar value results in a 2.1% increase in oil price. This link is prevalent in dollar-based countries. Saleh and Othmanová (2012) examined the impact of the US dollar on crude oil prices using the Granger causality, regression model, and structural models. The study found the significant impact of the US dollar on crude oil, particularly in the previous two decades.

Further, the author has linked this growth to investment in alternative instruments and low-interest rates in global markets. Nakajima and Hamori (2012) Investigated the relationship between oil prices electricity prices and exchange in Japan. The authors applied the granger causality in mean and granger causality in variance. Results indicate that exchange rate and oil prices do not affect the power market. Cifarelli and Paladino (2012) studied the impact of Oil prices on stocks, bonds, and exchange rates by applying the DCC GARCH Model. Adams and Gerner (2012) check the processing performance of oil forwards contracts using WTI Brent gasoline and heating oil prices with the stock exchange and exchange rates. Reboredo (2012) Applied correlations and copulas to find the relationship between oil prices and exchange rates. Ahmad and Hernandez (2013) examine the long-run link between oil prices and the exchange rate between 12 of the world's largest oil producers and consumers by using the momentum threshold autoregressive model M-TAR and the threshold autoregressive model TAR to monthly data from 1970 to 2012. Results found a long-term relationship in six countries, whereas an asymmetric adjustment is found in four countries, including the UK, Nigeria, and Brazil. Furthermore, these countries show a higher adjustment during a positive shock than adverse shocks, whereas the eurozone shows higher adjustment during a negative shock than a positive shock. Using monthly data, Beckmann and Czudaj (2013) focused on the nonlinear relationship between oil prices and the nominal exchange rate between oil-exporting countries. The authors apply the Markov-switching vector error correction model and found that causality runs from exchange rates to oil prices, whereas nominal oil prices impact the nominal exchange rate.

Further, it was found that the relationship is not constant and varies in different regimes. Mohammadi and Jahan-Parwar (2012) analyse the long and short-run relationship between oil prices and exchange rates in oil-exporting countries. Aziz and Bakar (2011)analyzed the impact of oil prices on the interest rate and exchange rate of net oil importing and exporting countries. The author found that there was a long-term impact of oil prices on the exchange rate of oil-importing countries, whereas, contrary to various studies, there was no relationship between oil prices and the exchange rate of oil-exporting countries. Finally, Bouoiyour et al. (2015) analyzed the nexus between oil prices and the real exchange rate of Russia on a well-specified horizon, frequency by frequency basis. The authors found on a short scale that oil prices and exchange rates are significantly linked.

Further in results, GDP, terms of trade, and productivity differential were also attributed to the relationship. Bayat et al. (2015) explored the linear causality, nonlinear causality, frequency domain causality, and volatility spillover between crude oil prices in the exchange rate in Poland, Hungary, and the Czech Republic by employing monthly data beginning from December 2011, corresponding to the beginning of flexible exchange regime. Frequency domain causality results indicate that Oil prices affect the real exchange rate in Poland and the Czech Republic. In contrast, no impact of oil price fluctuations is found in Hungry despite being dependent on energy imports. Wu (2012) utilized GARCH-based copula models to investigate the dependence structure between oil prices and the US dollar exchange rate. Ghalayini (2011) investigated the relationship between oil prices and the Yen and Euro exchange rates relative to the US dollar. Finally, Basher et al. (2016) discovered a considerable exchange rate appreciation in oil-exporting nations due to oil supply shocks.

Many similar studies were conducted during the last few years; Altarturi et al. (2018) explored the relationship by applying partial coherence and higher-order coherence of wavelets to determine the nonlinear causality between oil prices, gold prices, and real exchange rate. The authors found that in the short run USD exchange rate affects the prices of oil and gold negatively, whereas, in the long term, oil prices negatively impact the exchange rate. Further, oil and gold prices are significantly linked and correlated. Anh et al. (2019) investigated the impact of world crude oil prices on Vietnam's real effective exchange rate from 1986 to 2019. The authors divided the period into four parts corresponding to the different regimes of Vietnam's monetary policy by applying the autoregressive distributed lag model. The author found that there is a long-term cointegration in all the periods, though the short-term impact was found only in 2 quarters from 2016 to 2019. Finally, Hadi et al. (2019) analyzed the impact of crude oil prices on the exchange rate of Malaysia and Brunei on the data from 1988 to 2018 by applying Granger causality and a two-step cointegration test. Results indicate a long-term relationship between oil prices in the exchange rate of Brunei and Malaysia. In the short run, a unidirectional causality was also found between oil prices and the exchange rate of both currencies running from oil prices to exchange rates.

Further, Hajiyev and Rustamov (2019) explored the relationship between oil price shocks on various macroeconomic variables in Azerbaijan. The authors used the cointegrated vector

autoregressive and error correction models to determine the relationship between oil price shocks and inflation, exchange rate, and money supply. Similarly, Hasanov et al. (2017) explored the impact of oil prices on macroeconomic variables in three oil-exporting countries Kazakhstan, Russia, and Azerbaijan. Finally, Ji et al. (2020) explored the dynamic impact of supply-based oil shocks on the exchange rate in net oil importing and exporting countries. Results based on the structural autoregressive model show that oil price shocks have a higher depreciating impact in oil-exporting countries than in oil-importing countries.

Mikhailov et al. (2019) studied the impact of oil prices on the macroeconomic variables of Russia. The authors applied the Granger causality and vector autoregression model to data ranging from 2014 to 2016. findings show the impact of oil prices and Russia's GDP and the exchange rate. Similarly, Suliman et al. (2020) analyzed the same in the case of Saudi Arabia in the data period from January 1986 to March 2019. The autoregressive distributed lag and error correction model indicate strong long-term cointegration. Though the relationship is unidirectional in the long run, it is bidirectional in the short run. Kim et al. (2020) investigated the relationship between Korean and Japanese foreign exchange markets by applying the Markov Regime Switching Models from January 1991 to March 2019. The authors divide the period into two regimes- the regime of high volatility and low volatility based on the Asian Financial Crisis of 1997 and the Global Financial crisis of 2008. Results indicate that the resistance of the Japanese market is higher during both regimes against the oil price shocks as compared to the Korean foreign exchange market. Melo-Becerra et al. (2020) studied the impact of oil price shocks on public debt and actual exchange rates in Colombia. Using the dynamic vector autoregressive method, it was determined that positive oil price shocks do not affect the real exchange rate. In contrast, adverse oil price shocks affect the exchange rate and public debt. Haug and Basher (2019), based on the logistic and exponential model for transition adjustments of the real exchange rate, which captures asymmetric and symmetric, respectively, investigated the impact of oil price shocks on the real exchange rate.

Hung (2019) investigated the relationship between oil prices and the exchange rates of three countries, China, India, and South Korea, using the Copula GARCH approach on data from 2008 to 2018, and discovered a significant dependence between the variables. Nouira et al. (2019) conducted a study on the impact of oil price shocks on exchange rates in MENA countries (Egypt, Jordan, Morocco, Qatar, Saudi Arabia, Tunisia, and UAE), using the asymmetric generalized impulse response function on time series data from 2001 to 2017. According to the findings, there is significant volatility spillover from oil prices to exchange rates in several MENA countries. In addition, results indicate significant volatility spillover from oil prices to exchange rates in selected MENA countries.

Vochozka et al. (2020) investigated the impact of international crude oil prices on the EUR/USD exchange rate by using neural networks and found that Brent crude oil prices significantly impact the Euro-USD exchange rate and therefore can be predicted accurately. Ehikioya et al. (2020) investigated the relationship between oil price fluctuations and real exchange rates in sub-Saharan African countries on the data from 2004 to 2017 by employing the Johnson cointegration and vector error correction model. The authors found a dynamic relationship between oil prices and the exchange rate in sub-Saharan countries, Nigeria, Angola, Equatorial Guinea, Gabon, and the Republic of Congo. Finally, Alam et al. (2020) Examined the relationship between oil prices and the Indian rupee concerning the US dollar by applying cointegration and vector error correction methods. The authors found long- and short-term causality between oil prices and exchange rates.

Numerous studies have been conducted considering oil prices and exchange rates in 2021. Jin and Xiong (2021) found a robust negative relationship between exchange rate and oil prices in oil-exporting countries during the oil price crash and weaker during other periods. By applying the vector error correction model Razek (2021) investigates the relationship between behavioural exchange rate and international competitiveness in Saudi Arabia. The author concludes that the competitiveness of Saudi Arabia is determined by exogenous factors, particularly the demand for oil. Cakan (2021) explored the relationship between the Turkish stock market and oil prices by controlling the different variables, such as interest-rate nominal exchange rate, and checked the impact of oil prices on the firms. The findings indicate that oil prices negatively influence small and mid-size firms, whereas large firms are affected positively. Liu (2021) explored the relationship between oil prices and exchange rates in seven oil-importing countries by applying time-varying copulas to check the dependence between the variables. Finally, Bedin et al. (2021) explored Russia's GDP and exchange rate dependence on oil prices by applying the Markov switching vector error correction model. The author uses data from 1999 to 2008 in different and well-defined regimes. Results indicate the slow GDP adjustment and faster real exchange rate adjustment in response to the oil price shock. Harding et al. (2021) examined the effect of gas and oil discoveries on the real exchange rate. The author found that 10% of the country's GDP value impacts the real exchange rate by 1.5% of the discovery of oil and gas reserves.

In the same year, other similar studies are also available. Mukhtarov et al. (2021) examine the impact of oil price shocks on the exchange rate, total debt turnover, and GDP per capita in Azerbaijan by applying the structural vector autoregressive method to the data from 1992 to 2019. Authors found that oil-exporting countries' oil price shock affects GDP per capita and total trade turnover positively, whereas the exchange rate is affected negatively. Sohag and Mariev (2021) examine the relationship between oil prices and the exchange rate in Russia by applying the quintile-on-quintile approach. Findings indicate that oil prices appreciate the Russian currency. Villarreal-Samaniego (2021) applied the autoregressive distributed lag(ARDL) to examine the impact of the COVID-19 pandemic and oil prices on the exchange rate of two oil-importing and three oil-exporting countries. The author found that there is a linkage between fatality rates and the exchange rate of the three countries whereas a negative relationship was found between oil

prices and the exchange rate of the five countries. Chowdhary and Garg (2022) studied the changed dynamics of crude oil prices and exchange rates during the Covid-19 pandemic. The authors found an intensified relationship between crude oil and exchange rates.

Das (2021) emphasized the time-frequency relationship between the oil prices exchange rate and stock market returns by applying the wavelet analysis technique. Results indicate a strong comovement between oil prices and foreign exchange rates and oil prices - the stock market in India. The author linked the relationship with some macroeconomic events and further found the Volatility spillover from the developed markets to the Indian market. Sheng (2021) explored the linkage between the exchange rate of G10 countries with the newspaper count index of the petroleum exporting countries(OPEC) organization by applying a Bayesian inference methodology and various vector autoregressive models on monthly data from 1996 to 2020.

Chuvakhina et al. (2021) studied the exchange rate movement concerning the dollar in OPEC countries. Candelo Viafara (2021) applied the dynamic factor methodology to check the levels of uncertainty in the Colombian economy. The author used the oil and gas prices and the market rate of the Peso. The developed index shows the increased uncertainty during the Global Crisis of 2008 and the Covid-19 crisis. Wang et al. (2022) explored the ability of oil prices shocks to forecast the exchange rate CNY/USD, using the copulas. Results found the better forecasting ability of bivariate copula as compared to the univariate. Kumar et al. (2022) analysed the impact of domestic and international oil prices on the Chinese exchange rate and found the impact to be significant. Similarly, Mensi et al. (2022) explored the non-linear relationship between oil price, RMB and gold price, by using the Markov-Regime switching model. The study found the existence of non-linear interactions between the variables. Further, impact of oil prices affect the gold prices and Chinese exchange rate (RMB), while the impact of exchange rate on gold is limited. Sun et al. (2022) investigated the impact of oil prices on the exchange rate of countries along the "Belt and Road Initiative". Authors used the empirical mode decomposition to check impact in different time scales. Results found the asymmetric impact on the exchange rates of oil importing and exporting countries.

4.2. Volatility Spillover

In keyword clusters, volatility spillover has occurred frequently. Drachal (2018) investigated the volatility spillover between oil prices, exchange rates, and stock markets in the Czech Republic, Hungary, Romania, and Serbia. Based on the VAR/VECM and GARCH(1,1) models, the author found the spillover effect from oil prices to exchange rates and stock markets. Linkages were highest in the case of the Czech Republic, Hungary, and Romania, whereas impact was weaker in the case of Serbia. Liu et al. (2019) investigated the spillover of international crude oil prices in the primary markets of China - Foreign exchange, commodity market, and the stock market. The Authors adopted a spillover index and conditional autoregressive value at risk model to assess the impact. The results indicate the highest spillover from oil prices to the commodity market. However, the exchange market and stock market were less affected.

Alam et al. (2019) explored the linkages between oil price volatility and six bilateral exchange rates. The authors employed the granger-causality-based wavelet method to check the frequency and time domain causal linkages. Findings indicate that the variables' links are concentrated in the long run. Further, negative volatility dominates positive volatility in the long run, in transmitting shocks. Sanusi (2020) employed the nonlinear ARDL model to investigate the asymmetric transmission of oil price volatility in oil-exporting developing countries. The study uses data from 1995 to 2018. Results show the asymmetric transmission of volatility. An oil price increase does not impact the exchange rate significantly, but a decrease in oil price does. Ji et al. (2020) examined the dynamic impact of oil shocks on the exchange rate in net oil-importing and exporting countries. The results indicate that a decrease in oil prices impacts the exchange rate more negatively in oil-exporting countries than in oil-importing countries.

Further results indicate evidence of a stronger relationship between oil prices and exchange rates after the global financial crisis. Akram (2020) investigated the relationship between oil prices and exchange rates in the case of Norway and Canada. The study found that demand and supply-driven changes in oil prices led to variations in the currency, confirming the case of oil currencies. Olstad (2021) examined the relationship between the volatilities of WTI and Brent crude oil prices and the exchange rate of six net oil importing and exporting countries. The study employed Dig-BEKK on the data from February 1999 to May 2016. The results indicate the correlation between the volatilities of oil prices and the exchange rate of the studied currencies during the global financial crisis and the EU debt crisis. Hameed et al. (2021) explored the relationship between the volatilities of oil prices and the exchange rate of 5 major oil exporting and importing countries. Results indicate more volatility spillover in the case of oil-exporting countries as compared to importing countries. Prior to the mentioned studies, a similar old study was available by Razgallah and Smimou (2011). The authors applied the nonlinear smooth transition framework to find the relationship between the volatility of oil prices and the exchange rate. They found the impact of volatility transmission from oil prices to exchange rates. Wang et al. (2022) studied the volatility spillover between crude oil prices and the stock market of Nigeria (NSE). Okorie and Lin (2022) investigated the dynamic volatility spilloverbetween the oil prices, exchange rates, and gold prices in the BRICS countries. The study found volatility spillover towards gold in India and Brazil, whereas the nexus between oil prices the and exchange rate of China. Chen et al. (2022) explored the asymmetric spillover and dynamic linkages between the WTI crude oil prices and the exchange rate of six currencies, the Japanese Yen, The Euro, the GBP, the Australian dollar, the Swiss Franc,and the Canadian Dollar. Authors found that resource-based and large economies are the transmitters of volatility. Further, this phenomenon time-varying, especially during global economic events/shocks such as Covid-19. Jiang et al. (2022) also found the break in the relationship between the oil prices and exchange rate due to covid-19. Zhang and Qin (2022) studied the bi-directional risk spillover between crude oil and exchange rate in emerging market economies. The study applied the copulas and found the asymmetric bi-directionalspillover, between oil prices and exchange rates. Wang and Xu (2022) also

explored the relationship in emerging economies.

4.3. Stock Market

An important variable that has been repetitively considered with oil prices and the exchange rate is the "stock market." Sadorsky (2005) studied the performance of Various forecasting models by using financial data of crude oil prices, the exchange rate of Canada, 10-year US government bonds, and the S&P 500. Obadi (2006) explored the link between exchange rates, oil prices, and monetary policies in OPEC countries. Nandha and Hammoudeh (2007) analyzed the beta risk and stock returns due to variations in oil prices and exchange rates in 15 countries of Asia Pacific. Thirteen countries were found to be sensitive to oil prices. As per the international factor model, only the Philippines and South Korea are sensitive to oil prices when expressed in domestic currency.

In contrast, no sensitivity is found when expressed in dollar terms. By applying the Engel-Granger cointegration tests, VECM, and variance decomposition tests, Seshaiah (2009) investigated the impact of oil prices and exchange rates on the stock market of India-BSE. The author used the data from January 1991 to December 2007 and found that the stock index is cointegrated with oil prices and exchange rates in the long run. Chevillon and Rifflat (2009) examine the determinants of oil prices in OPEC countries, such as OPEC's behavior quotas, market power, and expected demand in OECD countries. Finally, Basher et al. (2012) examined the impact of oil prices on emerging countries' stock markets and exchange rates. Calculating the impulse responses using standard and projection-based methods, the authors found that positive oil shocks negatively impact the stock market and exchange rate in the short run.

Further, Arafaoui and Rajeb (2017) Studied the relationship between oil prices, gold prices, the US dollar, and stock markets. Hong et al. (2018) studied the impact of exchange rate depreciation due to oil prices and its impact on the companies exposed to the exchange rate. The authors found that the exchange rate impacts the Firms negatively by having exposure to foreign sales. Ali and Khan (2019) studied the impact of oil prices on the Indian stock market using dynamic conditional correlation multivariate GARCH and wavelet transformation modelling approach. The author found that during 2007-2008, there was a negative correlation, but after the crisis, there was a positive correlation between the oil price and the exchange rate. Manasseh et al. (2019) applied the EGARCH model to study the oil price and exchange rate dynamics on the economic growth of Nigeria. The results indicate that an appreciation of 10% in oil prices causes a 19% appreciation in the exchange rate in the long run. The results also indicate the positive impact of oil prices and exchange rates on the GDP. Santillán-Salgado et al. (2019) investigated the association between energy prices (Brent oil prices and natural gas) and financial variables (stock market, interest rate, and exchange rate) in the reverse direction, that is, the causal relationship from financial variables to energy prices. The authors used data from four major economic forces, the USA, the EU, Japan, and China. The authors employ the panel vector autoregression analysis. Findings show that crude oil and natural gas prices are negatively impacted by interest rates, whereas exchange rates impact the stock market.

Further, positive returns have a negative impact on the exchange rate. Nurmakhanova (2019) examined the relationship between oil prices, exchange rates, and the stock market in Kazakhstan. The authors used Johansen and Juselius cointegration test and performed it in multivariate and bivariate cases. The study's findings indicate no long-run relationship in the bivariate model, unlike the multivariate model. Further findings show that the oil prices and exchange rate impact the stock market.

Many similar recent studies are also available. Lawal et al. (2020) explore the impact of oil prices and exchange rate's long memory on Nigeria's stock market. Based on the ARMA estimating technique, the results show that the stock market is impacted by the long stock of oil prices and the long memory of the exchange rate. Hanif (2020) examined the relationship between oil prices, stock returns, gold, and the exchange rate in Pakistan. Based on the Johansen cointegration, correlation, and regression analysis of the data from 2009-2020. The result indicates a negative relationship between the exchange rate and stock returns. Nguyen et al. (2020) Examined the impact of oil prices and exchange rates on the stock markets of Vietnam, the VN Index, and the HNX index by applying the GARCH(1,1) model and found the impact to be significant on both markets. Jawadi and Sellami (2021) studied the impact of oil prices on the stock market, exchange rate, and real estate of the United States of America. The study found an impact on the exchange rate and stock market during Covid-19 and attributes this to increased financialization in the USA.

Further, the Authors found a relationship to be negative between oil prices and the exchange rate. Raju et al. (2021) investigated the relationship in the case of India using variance decomposition, Granger causality, and Johansen cointegration. The findings indicate a link between oil prices, exchange rates, and stock markets. Similarly, Long et al. (2021) investigated the symmetric and asymmetric impact of the Renminbi's exchange rate on China's stock market by applying the linear, nonlinear Autoregressive distributed lag model(ARDL). The results indicate that there is no relationship between the exchange rate and the stock market of China. Finally, Liu et al. (2021) Examine the hedging effectiveness of crude oil concerning commonly used currencies in oil-exporting and importing countries by using an asymmetric DCC model and found the effectiveness to be high for oil-exporting countries.Zhang and Baek (2022) Studied the impact of oil price shocks on the exchange rates in select Asian countries. The authors used the Generalized Impulse Response Function (GIRF) and non-linear autoregressive distributed lag (NARDL) to study the asymmetric impact of oil shocks on different currencies and found that positive shocks are more significant than negative ones in determining the currencies in select Asian countries. In a similar way, Singhal et al. (2022) analyzed the relationship in the context of South Africa by applying the DCC-GARCH and Markov regime-switching models.

4.4. Commodity Prices

In another cluster, 'commodity prices' have occurred frequently in studying the relationship between oil prices and exchange rates. Nazlioglu and Soytas (2011) analyzed the impact of oil price change on agricultural commodities through the exchange rate in

Turkey. By applying the Toda-Yamamoto and generalized impulse-response analysis to test the association. The results indicate the neutrality in the impact of oil prices on agricultural commodities as the neither long-term nor short-term relationship is significant. Rafiq (2011) analyzed the role of the exchange rate system in a country exporting a particular commodity. Dauvin (2014) studied the relationship between energy prices and exchange rates in commodity and energy-exporting countries. By applying panel smooth transition regression on the data from 1980 to 2011, the author finds that after a certain threshold, actual effective exchange rates are impacted by the oil prices in energy and commodity-exporting countries.

Further, during the volatile oil prices, currencies follow an oil currency regime, though the terms of trade impact the real exchange rate. Rubino (2020) investigated the impact of oil price volatility on the exchange rate and commodity price relationships in commodity-exporting countries. First, the author checked whether there exists an equilibrium between oil prices and commodity prices through the exchange rate. Krkošková (2020) investigated the dependence between the nominal effective exchange rate of the US dollar and Brent oil prices along with other commodities, such as gold and platinum, agriculture commodities, and industrial metals in OECD countries. Similarly, Alstadheim et al. (2021) explored the impact of monetary policy responses on the exchange rate in small commodity-exporting countries. The authors estimate the model by applying the Markov Regime switching model for Sweden, Norway, the UK, Canada, New Zealand, and Australia. The findings show that policy response and structural shocks are not constant. Further, the authors found that policy responses have been most influential in stabilizing the exchange rate in Norway, a commodity-exporting country.

4.5. Macroeconomic Indicators

Bahmani-Oskooee and Brown (2004) investigated the impact of oil price shocks and exchange rate systems on the stability of international reserves in industrialized countries. Faria et al. (2009) developed a theoretical model to check the impact of oil prices on the exports of China and found a positive correlation between them. Rafiq et al. (2009) studied the impact of volatility in oil prices on various macroeconomic indicators in Thailand. Fezzani and Nartova (2011) investigated the relationship between Iraq's GDP, exchange rate, WTI crude oil prices, and a dummy variable to study political instability. Eryiğit (2012) Studied the dynamic relationship between energy and economic variables.

Alkhater and Basher (2016) investigated the impact of oil prices on the US macroeconomic variables. Further, Habib et al. (2017) studied the impact of oil prices on the macroeconomic variables in the three oil-exporting countries, Azerbaijan, Kazakhstan, and Russia. Finally, Behar and Fouejieu (2018) analyzed the impact of exchange rates on the current account balance and the trade balance in oil-exporting countries.

Moreover, Aimon (2020) studied the impact of rising oil prices in Indonesia by applying a vector error correction model on data ranging from 1982 to 2018 and found a significant impact of consumption on oil imports. The exchange rate also affected oil imports in Indonesia. Similarly, Kaufmann (2020) analyse the role of supply and demand conditions and exchange rates on WTI and Brent crude oil prices. Algaeed (2020) examined the impact of oil prices on government expenditure and the real exchange rate nexus and found an increase in the real exchange rate due to government expenditure and oil price shocks, thereby confirming the Dutch disease phenomenon. Candelo-Viáfara (2021) applied the dynamic factor methodology to check the levels of uncertainty in the Colombian economy author used the oil prices, gas prices, and market rate of the Peso index and found the increased uncertainty during the global crisis of 2008 and the COVID-19 crisis. Various studies have linked the impact of oil prices on the exchange rate with the economic policy by Liu et al. (2020) and Jung (2019) etc.

Palatnik et al. (2019) examined the Dutch disease phenomena in the case of Israel. The author linked the energy export, mainly natural gas, to study the impact on the exchange rate. Its results found that natural gas export-related news does appreciate the Israeli Shekel. Similarly, Alssadek and Benhin (2021) analyzed the Dutch disease phenomena in 36 oil-rich developed and developing countries by investigating the relationship between oil prices and exchange rates. The study found that the rise in oil prices led to the appreciation of the exchange rate, confirming the Dutch disease phenomenon. Sanusi and Kapingura (2022) studied the impact of the nexus of the oil price- euro-dollar exchange on the inflation in the Euro area. Similarly, Antonio and Luis (2022) studied the impact of oil price volatility on the economic activity passing through the exchange rate. Hassan (2022) explored such relationships in south Asian countries.

4.6. Commonality

Common study threads can be found across the variables, data, markets, methodologies, and findings. As the present study is focused on oil prices and exchange rates, it is evident that many papers have focused on oil prices and exchange rates. The stock market's association with oil prices and the exchange rate has been considered in various studies. Volatility spillover from oil prices to the stock market and exchange rate to the stock market and vice versa can also be observed across the studies. Volatility spillover has been studied in a large number of studies, particularly in the case of India and Vietnam (Ali et al., 2019; Drachal, 2018).

Another vital factor studied with the oil prices, and the exchange rate is commodity prices such as precious metals i.e. gold, platinum, etc. (Alstadhiem et al., 2021; Dauvin, 2014; Nazlioglu and Soytas, 2011). It has been the focus of many studies whether the countries are affected by the Dutch disease phenomena, which means focusing on the expected export of one particular commodity, which in this case is oil.

The impact of oil prices and exchange rates on the macroeconomic variables across the countries has also been the focus of various studies. For example, the impact on GDP, export competitiveness, interest rate, and the inflation rate has been studied by various authors (Jin and Xiong, 2021; Sohag et al., 2021).

Regarding the methodologies used, Granger causality is employed by most of the authors, along with Johnson cointegration, to

check the short-term and long-term relationship, respectively. In addition, wavelet methodology has also been studied to check the dependence between the variables in the time and frequency domain, though in only a few cases. The authors have also employed Markov regime-switching model to check the relationships in different contexts, such as different monetary policy designs and various crises, such as the Asian financial crisis and global financial crisis of 2007-2008 (Basher et al., 2016; Kim et al., 2020; Bedin et al., 2021). In addition, the vector error correction model and autoregressive distributed lag have been used in many studies to assess the speed of adjustment and long-term relationship, respectively, based on the various variables in the study (Aimon et al., 2020). Oil-exporting and importing countries have been included among the studied countries and markets. Such relationship has also been studied in a group of countries, such as members of the OPEC, GCC, and OECD countries, though such studies are only a few. However, most of the studies focused on individual countries, such as studying the impact of oil prices on the exchange rate of the Rubel, the currency of Russia, and similarly China, Vietnam, India, etc.

4.7. Identification of Research Gap and Recommendations for Future Studies

The third objective of the study is to identify the research gap and recommendations for future studies that can be pursued in this area of research. It can be observed that the impact of oil prices is not studied in countries such as Iraq and Iran, which are major oil-exporting countries, either on their exchange rate or macroeconomic variables such as interest-rate inflation rate and gross domestic product. Further, only a few studies have focused on the impact on the exchange rate considering the exchange rate system it can be understood from the Literature that the impact of oil prices on the exchange rate has not been studied by considering the Exchange rate system in the oil-importing and exporting countries. While doing this research, we also observed that no study has been conducted in the context of BRICS countries though they are the world's major economies now. In addition, oil supply disruptions have been due to various geopolitical Tensions and supply chain Hindrances. Studying the relationship in the background of such challenges can be an important area of research. Another area of research can comprehensively study the different variables considering all of the mentioned gaps.

5. CONCLUSION

Crude oil is among the tremendously imperative and highly traded commodities globally. Therefore, the exchange rate is tremendously vital among the macroeconomic variables for oil-importing and exporting countries since it is linked with various factors, such as current account deficit, inflation rate, and interest rate. Based on the systematic literature approach, this study explores the relationship between oil prices and the exchange rate. Choosing the Scopus database for its large size, 123 papers, based on inclusion and exclusion criteria, were found suitable to review out of 7045 papers. Beginning with the discussion, the study reviews the Literature to explore the theoretical and empirical understanding of the relationship, followed by the common threads across the study and research gaps.

The first purpose of the study is to provide a comprehensive understanding between the oil prices and exchange rates along with other variables. Volatility spillover in stock markets emerges as a standard linkage between oil prices and exchange rates. The study covered sub-topics related to oil prices and exchange rates, such as GDP, interest rate, inflation rate, and various other macroeconomic variables. It included the stock markets in the context of various countries. The relationship between gold and commodities was also observed.

Further, the second purpose is based on the commonality across the studies. Long term relationship between the oil prices and exchange rate and causality running from oil prices to exchange rate were the most common findings, along with the volatility spillover in the stock market. Johansen cointegration, Granger causality, and Markov regime-switching models were the standard methodologies, along with the VECM, wavelets, copulas, etc. The third question focuses on the research gap and areas where further research can be pursued. It has been observed that the linkages between oil prices with exchange rates or other macroeconomic variables have not been studied in several oil-exporting countries, such as Iraq and Iran. Only a few studies have considered the exchange rate system. There have been interruptions in the supply chain of oil owing to an assortment of geopolitical tensions. Studying the relationship in the backdrop of such challenges can be a vital area of future research.

The implications of this study are wide-ranging, concerning policymakers and investors alike. This study compiles the findings, methodologies, and gaps in the literature in various scenarios. Policymakers may find this study useful in the formulation of policies concerning monetary and fiscal policy, particularly in oil-dependent economies. The exchange rate market has seen unpredictable scenarios such as the fall in the Turkish Lira due to inflation and Russian Rouble due to the Ukraine crisis. Forex-related uncertainties continue to pressure the economies, such as Sri Lanka and Pakistan. Inflation across Europe continues to shape the monetary policies across the developing economies. Similarly, stock market volatility spillovers from the oil prices and another market itself are frequent, particularly during a crisis. This study gives a comprehensive understanding for seasoned, as well as amateurs investors in making investing strategies for portfolio management.

The fact that only one database was used to analyse the previous research is one of the limitations of the study. In the future, more databases, either alone or in conjunction with the one that was used, could be used in order to expand the research. In addition, the upcoming studies can make use of a greater number of variables.

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APPENDIXES

Appendix 1: Name of Journal and Number of Published Papers

Name of journal	Number of publications
Energy Economics	15
International Journal of Finance and Economics	12
International Journal of Energy Economics and Policy, Resources Policy	8
Energies	5
Applied Economics	4
International Research Journal of Finance and Economics, Economies	3
Applied Financial Economics, Cogent Economics and Finance, Journal of International Money and Finance, Research in International business and finance, Journal of Asian finance Economics and Business, AIMS Energy, Panoeconomicus	2
Lecturas de Economia, Financial Innovation, Energy Strategy Reviews, American Business Review, Borsa Istanbul Review, Estudios Gerenciales, Journal of Business Cycle Research, Finance Research Letters, Economic Journal	1
Journal of economic structures, Ekonomski Pregled, Energy exploration and exploitation, Jurnal Ekonomi Malaysia, Journal of competitiveness, Journal of international studies economics of energy and environment policy, Prague Economic papers, Revista de Economia del Rosario	1
Economic Annals-21, Quarterly review of economics and finance, Finance: Theory and practice, International Journal of financial research economies, International Journal of engineering and business management, Finance: theory and practice, International Journal of financial research economies, International Journal of engineering and business management	1
Ekonomska Istrazivanja, European Journal of management and business economics, World economy, Asian Academy of Management Journal of accounting and finance	1
International economics, Journal of international financial markets institutions and money, Middle East Development Journal	1
Annals of regional science, Ekonomicky Casopis, International Journal of Energy Sector Management, Journal of policy modelling, International Journal of finance and economics, European Journal of economics finance and administrative Sciences, Journal of economics and finance, Empirical economics	1
Economic Analysis and Policy, Asian Journal of Economic Modelling, Applied economic letters, Corporate ownership and control, Applied financial economics, European Journal of social sciences, Applied financial economics, Pacific Basin Finance Journal, China Economic Review, Applied Econometrics and ınternational development, Research in International Business and Finance, Computational Economics, Applied Economics, Review of International Economics, Journal of Mines, Metals, and Fuels	1

Source: Authors own work

Appendix 2: First Author's Country

Name of country	Number of publications
China	18
USA, Canada	7
UK, Malaysia	6
India, Russia	5
Taiwan	4
France, Germany, Norway, South Africa, Japan, Nigeria, Saudi Arabia, Tunisia, Vietnam, Spain, Czech Republic, Bangladesh	3
Colombia, Poland, Lebanon, Mexico, South Korea, Oman, Slovakia, Qatar, UAE, Australia, Azerbaijan, Greece	2
Indonesia, Israel, Italy, Kazakhstan, Pakistan	1

Source: Authors own work