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A Review Study of Commodity Derivative Market with reference to Macroeconomic Determinants and Weather Conditions

Deepak[1], Ruchita Verma[2]*

[1,2] Central University of Punjab, India

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Abstract: The present study aims to conduct a bibliometric analysis of the commodity derivative market from journals in the Scopus database from 2007 to 2024. The study uses bibliometrics, performance analysis, science mapping, content analysis, and text mining of 754 articles extracted from the Scopus database to discover the research gap and models for future research. The R-studio, VOS-viewer, and SDG mapper tools have been used to analyze the articles of the Scopus database. The result of the study states that the journal "*Energy Economics"* has the highest no. of Citation per publication (CPP) ratio, the *Lippe D.* has the prominent authors with the highest no. of documents in the commodity derivative market, and the United Nations has the highest no. of publications in the field of commodity derivative market. Based on TE plot and text mining techniques, the result also states Sustainable Risk Management Integration through the commodity derivative market that classifies the 17 SDGs into three categories: Fundamental Priorities (SDG 7, 13, and 2), Supportive Pillars (SDG 8, 12, 9, 15, 17, 4, 3) and Niche Concerns (SDG 6, 16, 11, 10, 1, 5, 14).

Keywords: Sustainable Risk Management Integration, Commodity Derivative Market, Macroeconomic Determinants, Weather Condition, Bibliometric, Text Mining

Introduction

Commodities play a vital role in human sustenance and well-being. Recent geopolitical tensions have significantly increased the prices of essential commodities, putting substantial upward pressure on global inflation (World Bank, 2024). The world is experiencing high commodity price inflation due to various factors, including the COVID-19 pandemic, slow economic growth in China (Oxford Analytica, 2023), and weather-related disruption. Additionally, geopolitical conflicts in regions such as Ukraine and Russia and conflicts in the Middle East (Giovannetti et al., 2023) have further exacerbated the situation. Various studies revealed a strong relationship between commodity prices and the achievement of 17 Sustainable Development Goals (Shen et al., 2024; Viana et al., 2022; Yang et al., 2020; Laborde et al., 2019; Li et al., 2023; La Barbera et al ., 2023; Zhang et al., 2023; Trollman et al., 2023; Gustafson, 2013; Suppan, 2008).

The United Nations adopted the Sustainable Development Goals (SDGs) in September 2015 to address global issues and advance sustainable development. The main goals are promoting prosperity for everybody, safeguarding the environment, and ending poverty by 2030. Global commodity prices

* Corresponding Author: ruchitaverma@cup.edu.in

are interlinked with the SDGs 2030, creating a complex network of interconnections among the various goals. The trade of commodities and high prices lead to food insecurity, which affects the disadvantaged populations of developing countries, directly undermining SDG 2(Zero Hunger) (Cogneau & Jedwab, 2012; Mekasha et al., 2022) and SDG 3(Good Health and Well-Being). High commodity prices also affect the economic growth of both commodity-importing and commodity-exporting countries (SDG 8), eventually increasing the inequality between the nations (SDG 10). Growing prices can exacerbate national inequality (SDG 10), particularly for low-income households. Unsustainable production and consumption patterns might result from rising or falling agricultural commodity prices (SDG 12). Higher prices also lead to the overuse of land and marine resources, harming environmental SDGs like SDG 15 (life on land) and SDG 14 (life below water).

So, managing commodities trade and its price helps to reduce and eradicates poverty (SDG1) (Jena et al., 2012; Weinhold et al., 2013; Castiblanco et al., 2015; Alwarritzi et al., 2016; Choi & Kim, 2016; Mitiku et al., 2017; Vanderhaegen et al., 2018), reduced hunger and increase the food security (SDG2) (Santika et al., 2019; Arnould et al., 2009; Dib et al., 2018; Azhar et al., 2017), ensure good health and well-being(SDG3) (Eakin et al., 2006; Le et al., 2020), sustain economic growth by the way of per capita income, improve productivity and resource efficiency(SDG8) (Bacon et al., 2008; Permani, 2011; Gehl Sampath & Vallejo, 2018; Ferreira & Harrison, 2012; Gebreselassie &Ludi, 2007; Taherzadeh & Caro, 2019; Maydana et al., 2020), reducing inequality(SDG10) by increasing export of agricultural commodity (Christiaensen et al.,2011) and reducing unemployment (Nkamleu & Kielland, 2006; Ohimain et al., 2014; Manggala et al., 2018), sustainable consumption and uses of resources (SDG12) (Goodarzi et al., 2019; Puspitasari et al., 2019; Uehara, 2020), and better life on land and below water(SDG 14 & 15).

Various economists recommend the commodities futures market as a viable and possible substitute for price stabilization and manage price risks (Raju & Karande, 2003; Rout et al., 2021; Sarris, 2010; Sarris et al.,2010; Tangermann, 2011; Rajib, 2015; Trollman et al., 2023). The commodity futures market exchanges agricultural and non-agricultural commodities and their derivative products (Garg et al., 2023). It is primarily used to hedge commodity price risks (Cheng et al., 2015; Cui xiaozhong et al., 2022a). An essential feature of hedging is that the trader synchronizes his activities in two markets. One is generally the cash or spot market, and the other is generally the futures market (Johnson, 1960). In the future market, the contract has been signed for buying and selling commodities at a future date and price (Da Fonseca & Xu, 2019). A commodity derivative market deals with trades in different commodities, such as agricultural commodities (Sobti, 2020; Nath & Lingareddy, 2008), gold, metal, and oil (Fekete, 1992).

Research in commodity derivative markets has been available for the last three decades. There are several reasons why researchers show interest in commodity derivative markets, such as risk management, price discovery, market efficiency, investment opportunities, global economic events, and geopolitical and weather-related events. These reasons attract research in the fields of commodity derivative markets. Therefore, the present study has to conduct a comprehensive bibliometric analysis of the field of commodity derivative markets. It is used to analyze the contributions of authors, journals, affiliations, countries, research topics, and trends in the respective field (Merediz-solà & Bariviera, 2019; Mongeon & Paul-Hus, 2016; Baker, 2021; Nandan & Soni, 2023). Additionally, the study has examined research in derivative markets, futures markets, agricultural markets, and commodity markets, affected by macroeconomic determinants, economic growth, weather conditions, and climate change.

Research Objective

We frame the following research objectives for the current study

1: To examine the most prominent journals, articles, authors, and countries that contributed the most prominent and significant research on the impact of the macroeconomic determinants and weather conditions on commodity derivative market research.

2: To identify the trends in interlinkage among macroeconomic determinants, weather conditions, and commodity derivative market research.

3: To examine the emerging themes associated with the impact of macroeconomic determinants, weather conditions, and commodity derivative market research.

4: To measure the percentage of the SDGs highly associated with the impact of macroeconomic determinants and weather conditions on commodity derivative market research.

5: To provide future directions in macroeconomic determinants, weather conditions, and commodity derivative markets with the relevant SDGs.

Research Methodology

The present study used bibliometric analysis and text-mining techniques to analyze the data. Bibliometric methodology involves quantitative tools to analyze bibliographic data (Broadus, 1987). Although this approach has been around for a long time, it became more popular with the advent of large-scale bibliographic databases (Zupic & Čater, 2015). The methodology consists of two main components: performance analysis and science mapping (Cobo et al., 2011). The performance analysis states research entities' productivity and impact, such as authors, institutions, and countries. The science mapping explores the relationships between research elements and the intellectual structure of a field. Moreover, text mining describes the procedures and methods used to analyze text data.

The study started with a systematic literature review defined in step 1. The central theme of the current study is to understand how the main elements of commodity derivative and commodity derivative markets are affected by the macroeconomic determinants and weather conditions. An extensive review was conducted to understand the issues given above. In step 2, the search strategy has been defined. The first stage is determining the search, root, and linking terms. The terms have been identified from the exploratory and empirical research. Root terms of the commodity derivative market have been measured based on previously available literature (Kumar et al., 2024; Tröster & Gunter, 2023; Mbarki et al., 2023; Bublyk et al., 2022; Schofield, 2021; M & Mishra, 2020; Rout et al., 2019; Ndawona et al., 2019). However, linking terms have to be identified based on the research, showing the factors that affect the prices of the commodity derivative market.

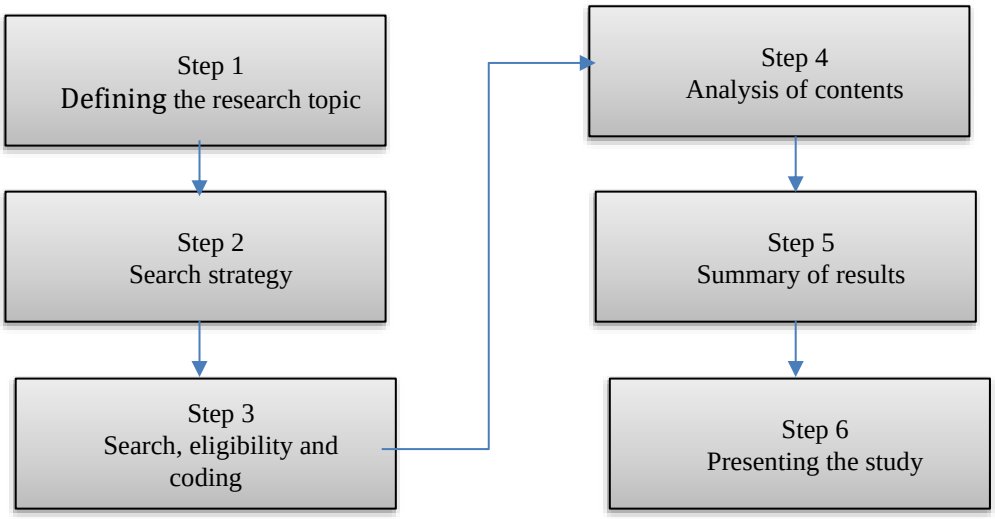
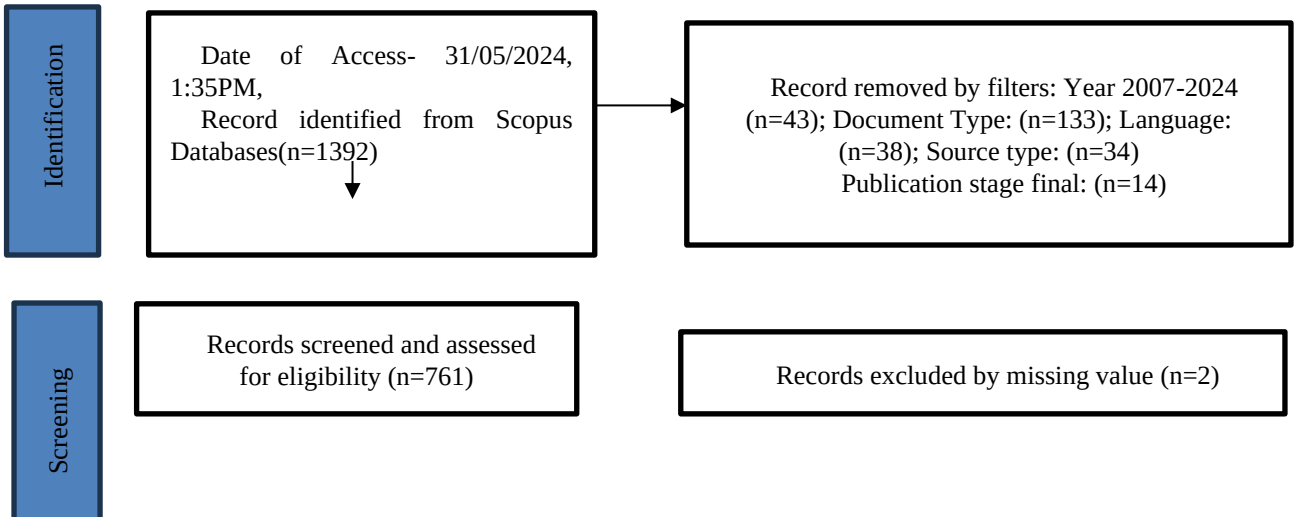


Figure 1: Work Method

Table 1: Multi-Level Keyword Search Strings

Search Term	
Root Term	Linking Term
"Metal" OR "Cooper" OR "Steel" OR "Iron" OR "Lead" OR "Nickle" OR "Zinc" OR "Bullion" OR "Platinum" OR "Gold" OR "Silver" OR "Energy" OR "Biofuels" OR "Gas" OR "Oil" OR "Crude" OR "Coal" OR "Agricultur*" OR "Crops" OR "Cocoa" OR "Coffee" OR "Corn" OR "Cotton" OR "Oats" OR "Soyabean" OR "Wheat" OR "Rice" OR "Sugar" OR "Mustard seed" OR "chana" OR "Maize" OR "Food" OR "Fruit" OR "Vegetables" OR "Pulses" OR "Cereals" OR "Commodit*"	"Spot price" OR "Futures Price" OR "Option Price" OR "Option pricing" AND "Weather" OR "Cooling degree days" OR "Humidity" OR "Heating degree days" OR "Precipitation" OR "Rain" OR "Climate change" OR "storms" OR "droughts" OR "floods" OR "GDP" OR "Gross domestic product" OR "Economic growth" OR "Inflation" OR "Import" OR "Export" OR "Trade" OR "Stock market" OR "Exchange rate" OR "Interest rate" OR "Foreign direct investment"

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach has been used in the study (Fig. 2). It is frequently used in social science and humanities research (Elshater & Abusaada, 2022; Huymajer et al., 2022; Rathee et al., 2023). It is a systematic review technique for collecting, identifying, selecting, critically evaluating, and analyzing relevant research (Kisley et al., 2015; Page et al., 2021; Copeland, 2023). The current study used both bibliometric and PRISMA techniques to analyze the data. After the global recession in 2007, prices in the commodities and indexes were highly volatile (Matesanz et al., 2014; Gomez et al., 2011). Similarly, we selected the research conducted in the period from 2007 to 2024. Many other studies also selected the base period of 2007 for analysis (Puma et al., 2015; Matesanz et al., 2014). The bibliometric metadata related to commodity derivatives has been extracted from the Scopus database (Nica & Chirita, 2024; Pandey, 2021; Agbo et al., 2021). The Scopus database is selected based on the recommendation of Visser et al. (2021). The Scopus database is frequently recommended for bibliometrics analysis (Donthu et al., 2021; Paul et al., 2021) and is recognized as a high-quality source for bibliometrics data (Baas et al., 2020).



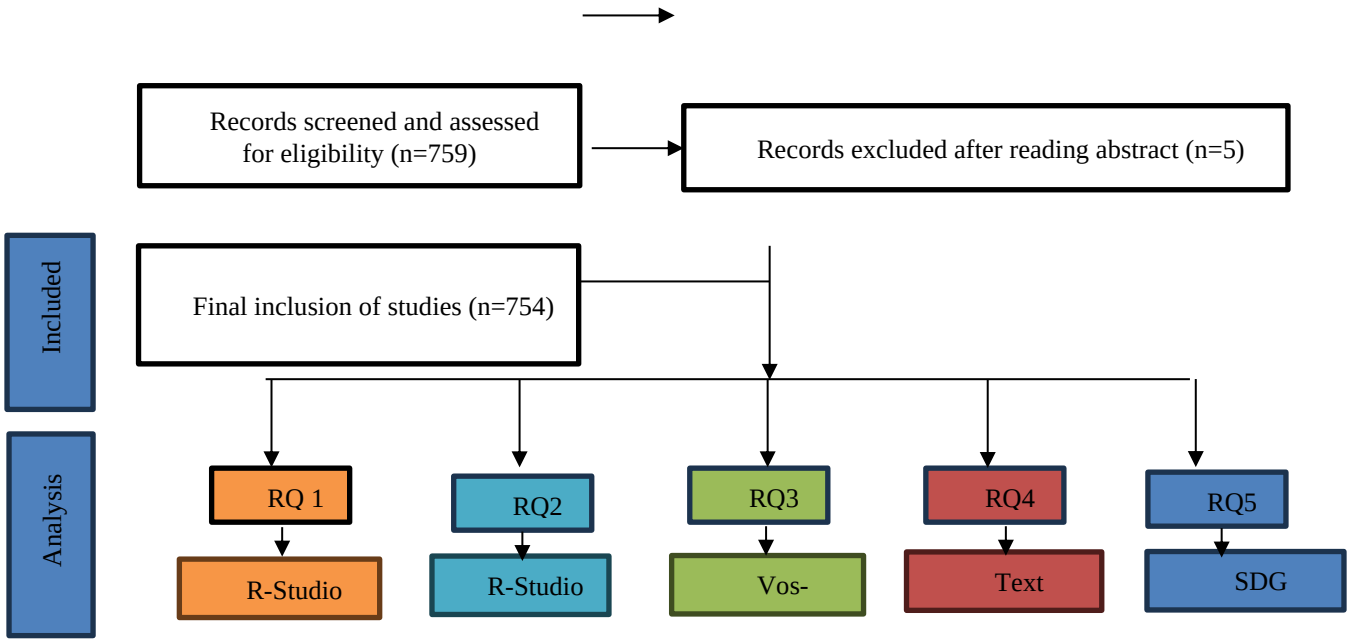


Figure 2. Data collection flow diagram using PRISMA approach for Scopus database.

Results and Discussion

The top ten most referenced articles in commodities derivative markets are displayed in Table 2. "The Stochastic Behavior of Commodity Prices: Implications for Valuation and Hedging" by Schwartz (1997), published in The Journal of Finance, is the most crucial publication with 1240 citations. This essay examines basic ideas in risk management and pricing. "Do healthier foods and diet patterns cost more than less healthy options?" is another commonly referenced study. Rao et al. (2013) published "A systematic review and meta-analysis" in BMJ Open, which has 478 citations. It is unclear, though, how directly it relates to commodities derivatives. Studies on the dynamics of oil prices and precious metals (Sari et al., 2010), the use of sophisticated mathematical techniques in finance (Geman & Yor, 1993), and oil price forecasts (Alquist et al., 2013) are some other noteworthy publications.

Table 2: Top 10 articles in the field of commodity derivative market

Sr. No.	Author(s)	Articles	Journal	Total citations
1	Schwartz E.S. (1997)	The Stochastic Behavior of Commodity Prices: Implications for Valuation and Hedging	*The Journal of Finance*	1240
2	Rao M.; Afshin A.; Singh G.; Mozaffarian D. (2013)	Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis	*BMJ Open*	478
3	Sari R.; Hammoudeh S.; Soytas U. (2010)	Dynamics of oil prices, precious metal prices, and exchange rate	*Energy Economics*	379
4	Geman H.; Yor M. (1993)	Bessel processes, Asian options, and perpetuities	*Mathematical Finance*	351

5	Alquist R.; Kilian L.; Vigfusson R.J. (2013)	Forecasting the price of oil	*Handbook of Economic Forecasting*	296
6	Singleton K.J. (2014)	Investor flows and the 2008 boom/bust in oil prices	*Management Science*	294
7	Chevallier J. (2009)	Carbon futures and macroeconomic risk factors: A view from the EU ETS	*Energy Economics*	261
8	Tully E.; Lucey B.M. (2007)	A power GARCH examination of the gold market	*Research in International Business and Finance*	260
9	Casassus J.; Collin-Dufresne P. (2005)	Commodity futures and interest rates imply stochastic convenience yield.	*Journal of Finance*	249
10	Mohammadi H.; Su L. (2010)	International evidence on crude oil price dynamics: Applications of ARIMA-GARCH models	*Energy Economics*	243

Source: Authors compilation

The impact of macroeconomic factors on carbon futures (Chevallier, 2009), the use of statistical models like GARCH and ARIMA in analyzing commodity prices (Tully & Lucey, 2007; Mohammadi & Su, 2010), and studies examining investor behavior during market booms and busts (Singleton, 2014) are also heavily featured. The multidisciplinary character of research in this topic is shown by the publication of these publications in esteemed journals such as the Journal of Finance, Energy Economics, and Mathematical Finance.

Table 3: Top 10 author(s) in the field of commodity derivative market

S.N.	Author(s)	Affiliation	Total Documents	Total citations	TC/TP
1	Lippe D.	Petral Worldwide Inc., Houston, United States	4	2	0.5
2	Watkins C.; Mcaleer M.	School of Economics and Commerce, University of Western Australia, Australia	4	47	11.75
3	Fernandez V.	Business School at Universidad Adolfo Ibañez	3	34	11.33333
4	Han L.; Liang R.; Tang K.	Beihang University, Beijing, China	3	18	6
5	Kim S.-J.; Sheen J.	Technology Management Economics and Policy Program, Seoul National University	3	11	3.666667
6	Rahn G.	Vattenfall Trading Services GmbH, Hamburg, Germany	3	1	0.333333

7	Xu X.	Department of Economics, North Carolina State University, United States	3	115	38.33333
8	Drachal K.	Faculty of Economic Sciences, University of Warsaw, Poland	2	22	11
9	Andriosopoulos K.; Nomikos N.	ESCP Europe Business School, London, United Kingdom	2	11	5.5
10	Askari H.; Krichene N.	International Business and International Affairs, George Washington University, United States	2	113	56.5

Source: Authors compilation

The top 10 authors in the subject of commodities derivative markets are highlighted in the table 3, along with information on their publication output, citation count, and average citations per publication (TC/TP). With average citations of 38.33 and 56.5 per publication, respectively, Askari H. & Krichene N. from George Washington University and UCLA and Xu X. from North Carolina State University are the most influential authors, demonstrating their substantial influence. With an average of about 11 citations per publication, Watkins C. and McAleer M. from the University of Western Australia and Fernandez V. from Universidad Adolfo Ibañez similarly have moderate to strong influence. While Lippe D. from Petral Worldwide Inc. and Rahn G. from Vattenfall Trading Services have less influence and fewer citations per publication, authors like Han L., Liang R., and Tang K. from Beihang University and Andriosopoulos K. and Nomikos N. from ESCP Europe Business School exhibit moderate impact.

Table 4: Top 10 countries in the field of commodity derivative market

S.N.	Country	Total Publication	Total citations	TC/TP
1	United States	294	8828	30.02721
2	China	201	2910	14.47761
3	United Kingdom	96	1801	18.76042
4	France	43	1463	34.02326
5	Australia	77	1386	18
6	Canada	47	1037	22.06383
7	Germany	59	945	16.01695
8	Turkey	18	751	41.72222
9	Spain	31	727	23.45161
10	Norway	26	576	22.15385

Source: Authors compilation

The research impact of the top 10 nations in the commodities derivative markets sector is shown in Table 4, which is ranked by total publications, total citations, and average citations per publication (TC/TP). With 294 publications and 8828 citations, the United States dominates the field, demonstrating its significant impact and prolific productivity. With 201 articles and 2910 citations, China comes in second, making a substantial contribution but having a lower average effect (14.48 TC/TP). With 1801 citations, the UK retains a high average impact (18.76 TC/TP) despite having fewer publications (96). With 43 publications and 1463 citations, France has the most significant average citations per publication (34.02 TC/TP), demonstrating their fundamental research. Canada has a

considerable research influence with 47 publications and 1037 citations (22.06 TC/TP), whereas Australia displays a balanced profile with 77 publications and 1386 citations (18 TC/TP). With 59 articles and 945 citations (16.02 TC/TP), Germany has a modest effect. Despite only having 18 articles, Turkey has the most significant average impact (41.72 TC/TP), with 751 citations, demonstrating incredibly significant research. Norway (26 publications, 576 citations, 22.15 TC/TP) and Spain (31 publications, 727 citations, 23.45 TC/TP) have a high research impact.

Table 5: Top 10 Journals in the field of Commodity Derivative Market

Journal Name	ABDC Ranking	Publisher	Total Publication	Total citations	TC/TP
1. Energy Economics	A*	Elsevier B.V.	69	3429	49.69565
2. Oil And Gas Journal	-	PennWell Publishing Co.	44	5	0.113636
3. Resources Policy	B	Elsevier Ltd	39	943	24.17949
4. Energy Policy	A	Elsevier Ltd	31	724	23.35484
5. Journal Of Futures Markets	-	John Wiley and Sons Inc	30	734	24.46667
6. Australian Commodities	C	Australian Bureau of Agricultural and Resource Economics	19	5	0.263158
7. Quantitative Finance	A	Routledge	17	223	13.11765
8. Applied Financial Economics	B	Routledge	16	314	19.625
9. Physica A: Statistical Mechanics And Its Applications	-	Elsevier B.V.	16	379	23.6875
10. Applied Economics	A	Routledge	15	109	7.266667

Source: Authors compilation

Canada has a considerable research influence with 47 publications and 1037 citations (22.06 TC/TP), whereas Australia displays a balanced profile with 77 publications and 1386 citations (18 TC/TP). With 59 articles and 945 citations (16.02 TC/TP), Germany has a modest effect. Despite only having 18 articles, Turkey has the most significant average impact (41.72 TC/TP), with 751 citations, demonstrating incredibly significant research. Norway (26 publications, 576 citations, 22.15 TC/TP) and Spain (31 publications, 727 citations, 23.45 TC/TP) have a high research impact. " The Australian Bureau of Agricultural and Resource Economics' "Australian Commodities" has a poor citation effect (TC/TP of 0.26). The citation impacts of "Physica A: Statistical Mechanics and its Applications" (Elsevier B.V.), "Applied Financial Economics" (Routledge), and "Quantitative Finance" (Routledge) range from moderate to high. Of the A-ranked journals, "Applied Economics" (Routledge) has a lower TC/TP ratio, meaning fewer citations per publication.

Table 6: Top 10 Keywords in the field of commodity derivative market

Words	Occurrences
Volatility	36
Futures	23
Garch	17
Cointegration	16
Commodities	16
Natural Gas	16
Granger Causality	15
Price Discovery	15
Gold	14
Oil Prices	14

Source: Authors compilation

The keyword analysis in above table 6, provides the 2452 authors' keywords with the five minimum occurrences of the keywords categorized in the 74 threshold. The top five keywords are volatility, futures, GARCH, cointegration, and commodities, with a frequency of 36, 23, 17, 16, and 16, respectively. The network analysis has been used to identify the clusters based on the keywords. A total of 7 clusters have been formed. The first cluster has 15 items, followed by the second, third, fourth, fifth, sixth, and seventh clusters, having 13,12,10, 10,9, and 5 items, respectively.

Moreover, overlay visualization network analysis has been used to examine the co-occurrence of the keywords based on different time frames (Fig. 3). The yellow and light green-yellow color shows the keywords used in the current publication. Additionally, document-based trends on the topic should be used to support the result of the overlay visualization. It also shows the trends in inter-relationships among commodity derivative markets, macroeconomic determinants, and weather conditions in different spam of the times.

The thematic map from 2007 to 2024 has been presented in the above figure 5, based on the author's keywords in the documents. It depicts the transition in the commodity derivative market, macroeconomic determinants, and weather conditions in the new periods. The result also states that the theme centered on the “market efficiency of spot and futures markets”. This theme acts as a motor theme within the field of the study. This theme has significant research interest due to the existence of the commodity derivative market.

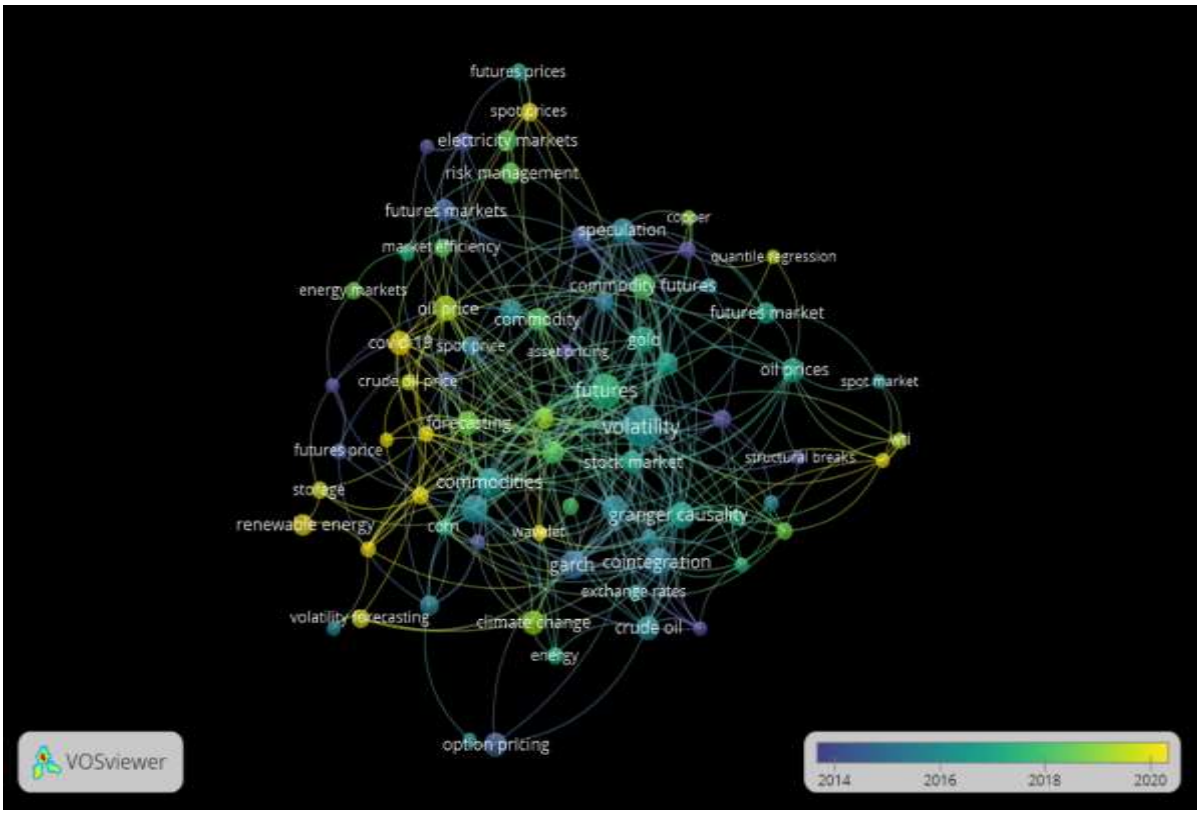


Figure 3: Overlay Visualization of occurrences of keywords through VOSviewer

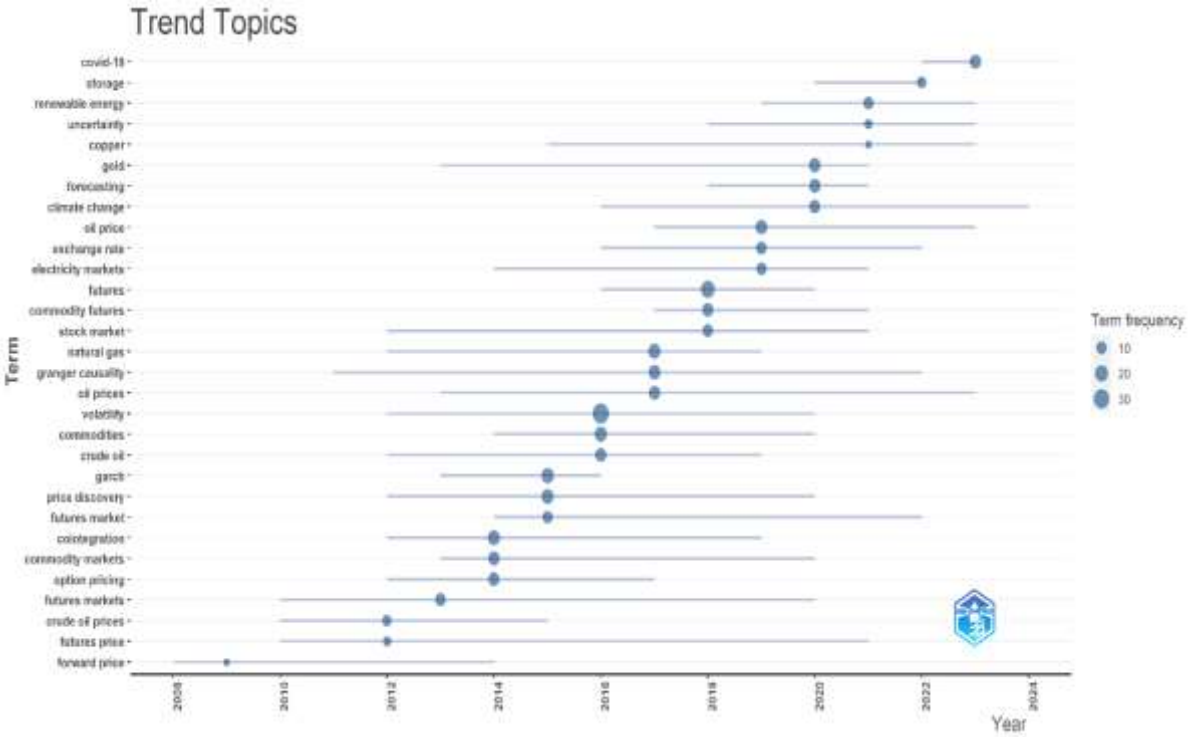


Figure 4: Trending Topics in Commodity Derivative Market

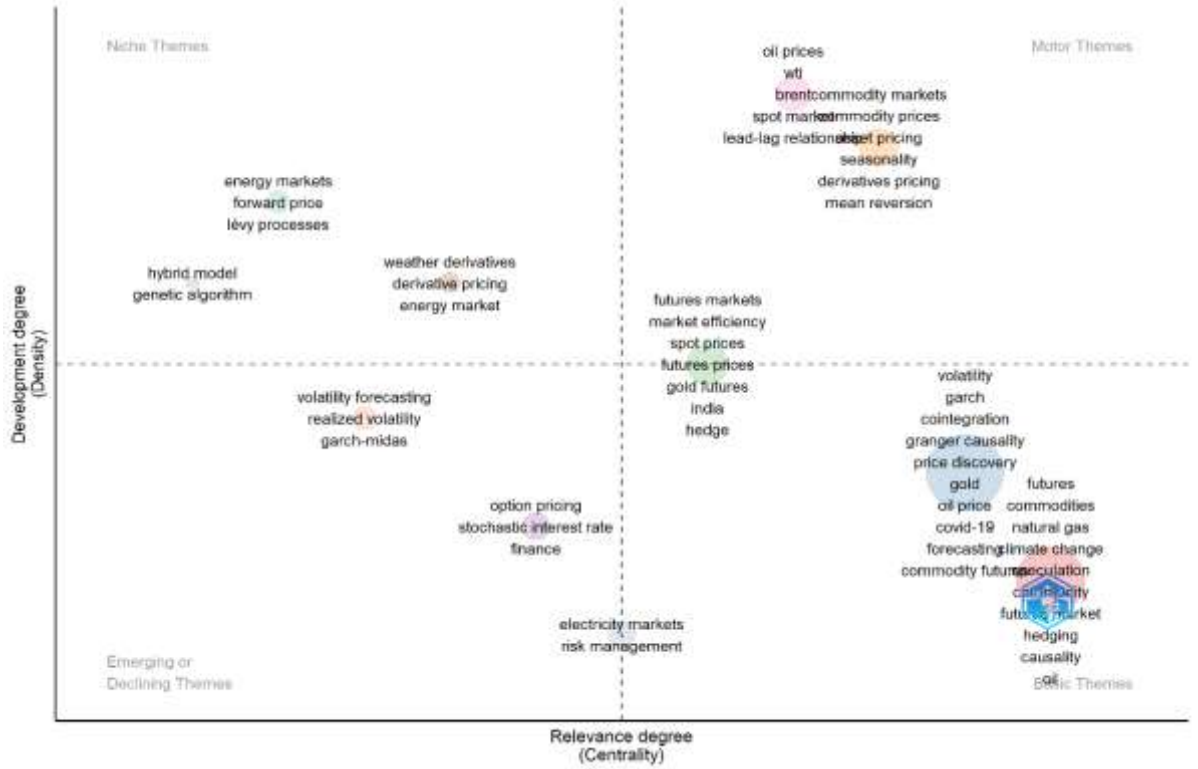


Figure 5: Thematic Map & Evolution and Commodity Derivative Market

In other words, the commodity derivative market is used for risk management and hedging, which means that the commodity derivative provides the hedging opportunity for the spot and futures market that enhances the efficiency of the market. Weather derivatives and algorithmic trading are niche themes within the field, meaning that specialized commodity derivative contracts manage risk due to weather disturbance in agriculture-related commodities by anticipating the prices through technological advancement. Moreover, risk management in the electricity market shows emerging themes within the field. Meanwhile, volatility measurement in energy prices due to COVID-19 and climate change emerges as a primary theme within the field.

Factorial analysis

The factorial analysis (Fig 6) identifies the smallest number of factors representing the relationship between the various other variables. The study employed 8 Multiple Correspondence Analyses (MCA) to identify the association or closeness between the author's keywords and the overall research field.

Multiple Correspondence Analysis (MCA): The Conceptual Structure Map generated using Multiple Correspondence Analysis (MCA) visually separates variables related to energy markets, sustainability, and economic analysis across two dimensions. **Dimension 1 (Dim 1)** highlights the contrast between traditional energy markets on the left—such as oil production, commodity pricing, and forecasting—and modern sustainability concepts on the right, including climate change, alternative energy, and emission control. **Dimension 2 (Dim 2)** introduces further distinction, with broader economic and financial factors like price dynamics and commodity markets positioned higher.

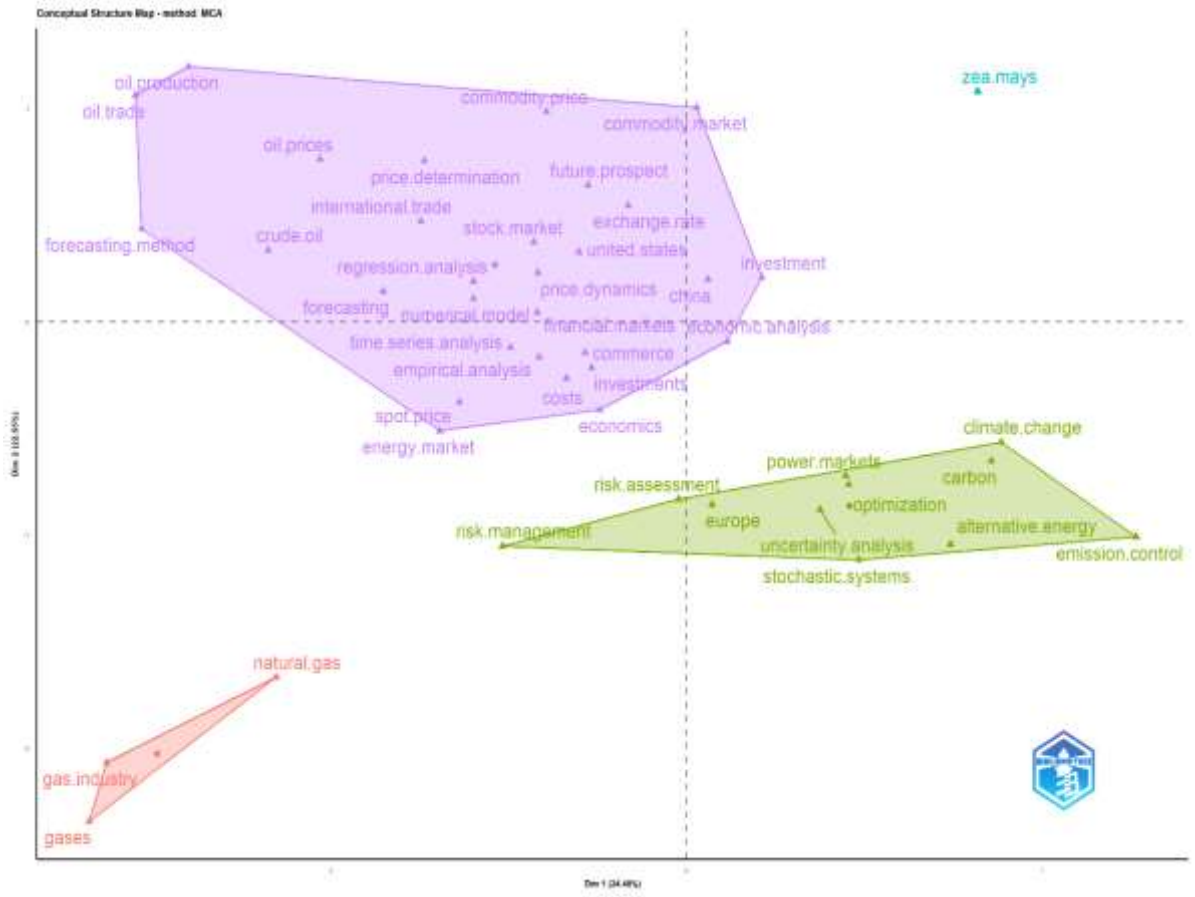


Figure 6: Multiple Correspondence Analysis

At the same time, the gas industry and natural gas, in a more isolated cluster, appear lower. This suggests that natural gas operates independently from traditional oil markets and the sustainability-focused alternative energy discussions. Overall, the map reveals two dominant conceptual spaces: one centered on traditional energy economics and the other on sustainability and climate change, with the gas industry occupying its own distinct niche.

Purple Cluster (Top-left): This cluster focuses on **traditional energy markets**, particularly oil and commodity-related variables. It includes terms like oil production, oil trade, crude oil, oil prices, and forecasting methods. These variables are associated with economic analysis, price dynamics, and global oil and commodity market forecasting.

Green Cluster (Right): This cluster revolves around **sustainability and modern energy trends**, including climate change, alternative energy, emission control, carbon, and risk management. It represents the shift towards renewable energy sources and climate-related policies, reflecting the growing importance of environmental and risk considerations in the energy sector.

Red Cluster (Bottom-left): This smaller cluster is focused on the **natural gas industry**, including terms like natural gas and gases. It stands somewhat isolated, indicating that the gas sector operates separately from traditional oil markets and the sustainability-driven alternative energy discussions.

Blue Term (Top-right): The term zea mays (corn) appears isolated from the other clusters, possibly indicating a specific or niche area, likely related to biofuels or agricultural energy sources, which does not closely align with the dominant energy themes.

Bibliographic Coupling

Cluster 1: Forecasting and Optimization in Energy Markets and Crude Oil Prices

In Cluster 1 (Fig, 7), the most cited work by Mohammadi and Su (2010) examines the effectiveness of various ARIMA-GARCH models in predicting both the conditional mean and volatility of weekly crude oil spot prices across eleven international markets. Another influential study by Zepter et al. (2019) develops a framework for integrating prosumer communities into the existing day-ahead and intraday energy markets. Using a two-stage stochastic programming method, the authors analyze the sequential decision-making process in the wholesale system, factoring in uncertainties in renewable energy generation and spot price fluctuations.

Their focus is on the role of peer-to-peer (P2P) trading in incorporating prosumers into these markets and how residential battery storage enhances demand-side flexibility. Additionally, Schopfer et al. (2018) evaluates how differences in real-world electricity load profiles impact the optimal system design and profitability of photovoltaic (PVB) systems. Safari and Davallou (2018) explore three distinct methods for calculating model weights: equal weights, constant weights using a genetic algorithm (GA), and time-varying weights combining three forecasting models (ESM, ARIMA, NAR) to find the most accurate hybrid model for predicting OPEC and WTI crude oil prices. Lastly, Li et al. (2019) investigates the long-term influencing factors of crude oil prices, such as global oil production and economic activity (using the Dow Jones Industrial Index), to improve price forecasting accuracy.

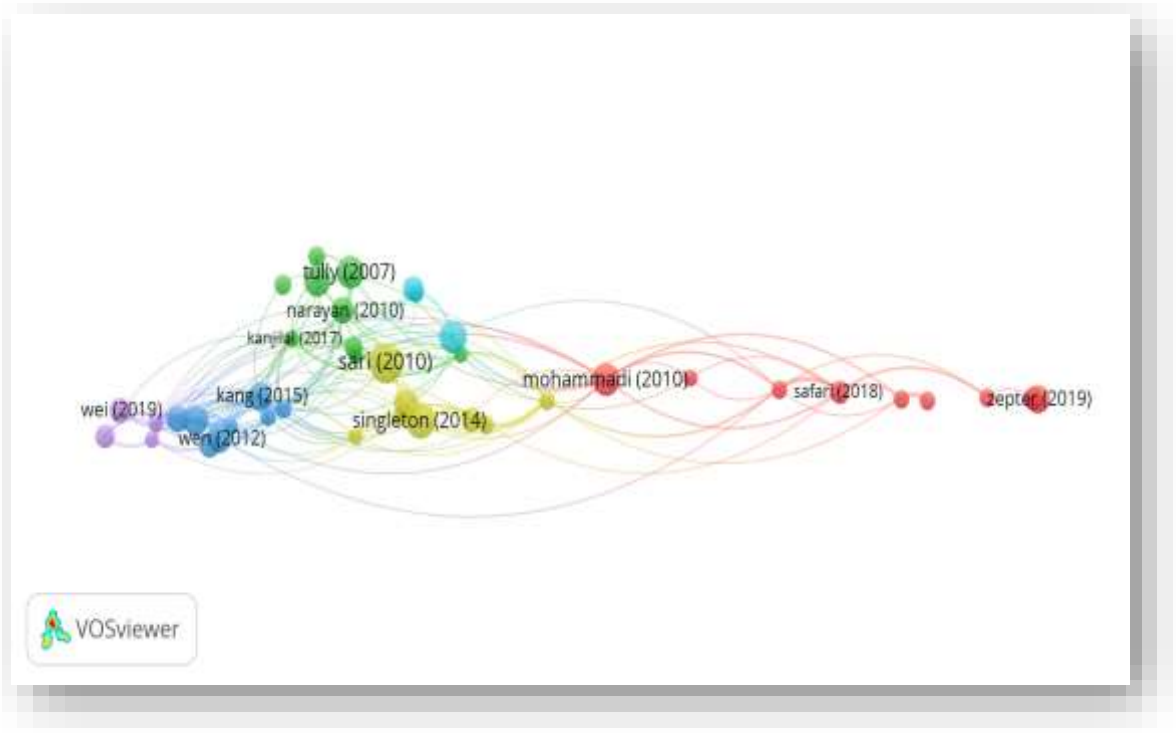


Figure 7: Document based bibliographic coupling

Cluster 2: Macroeconomic Factors and Intermarket Dynamics in Gold and Oil Prices

In Cluster 2, the most cited research by Tulley and Lucey (2007) explores the macroeconomic factors influencing gold prices through the asymmetric power GARCH (APGARCH) model developed by Ding et al. (1993). Their study focuses on both cash and futures prices of gold and examines significant

economic variables over the 1983–2003 period, with particular attention to the equity market crashes in 1987 and 2001. Shafiee and Topal (2010) review the global gold market, analyzing historical price trends from 1968 to 2008, and investigate the relationship between gold prices and critical factors like oil prices and global inflation over the past 40 years. They also apply an econometric model to forecast prices of natural-resource commodities. Narayan et al. (2010) examine the long-term relationship between gold and oil in spot and futures markets, emphasizing how rising oil prices can trigger inflationary pressures, leading to increased investment in gold as a hedge. Tang and Chen (2009) study a maximum likelihood estimator for linear drift processes, confirming that the bootstrap method reduces bias and mean square error in parameter estimates for univariate and multivariate processes. Using a two-regime vector error correction model, Kanjilal and Ghosh (2017) investigate the dynamic connection between global crude oil and gold prices. Their findings show that the threshold cointegration model outperforms the linear one, highlighting distinct long-term and short-term relationships between gold and oil across two market regimes.

Cluster 3: Volatility and Spillover Effects Between Energy and Stock Markets

In Cluster 3, Wen et al. (2012) explores whether a contagion effect existed between energy and stock markets during the recent financial crisis using WTI oil spot prices. The relationship between energy prices and stock markets is a crucial issue in energy economics, drawing increasing attention from policymakers, economists, and investors as oil prices have grown in economic significance. Using intraday data, Xu et al. (2019) further investigate this relationship by examining dynamic asymmetric volatility spillovers between oil and stock markets. Their study finds that negative volatility spillovers dominate positive ones for most of the observed period, with strong evidence of asymmetries in volatility shocks between the two markets, as revealed by the AG-DCC model. Dutta (2017) provides additional insights, studying how oil price shocks influence clean energy stock returns. Unlike earlier studies that relied on traditional oil price series, Dutta assesses whether the variance of clean energy stock returns can be explained by the crude oil volatility index (OVX), which measures oil price uncertainty. Finally, Kang et al. (2015) analyze the impact of structural oil price shocks on the covariance between U.S. stock market returns and stock market volatility. By using daily return and volatility data, they construct a monthly covariance to evaluate this relationship.

Cluster 4: Market Interactions and Macroeconomic Influences on Commodities and Exchange Rates

Cluster 4 (Sari et al., 2010) examines the co-movements and information transmission between the US dollar/euro exchange rate, oil price, and the spot prices of four precious metals (gold, silver, platinum, and palladium) and also discovers evidence of significant short-term feedback but a poor long-term equilibrium link. A shock to any other metal prices or the exchange rate has a considerable (although brief) impact on the spot precious metal markets. Wang et al. (2021) also investigates how investor flows and financial market circumstances affect crude oil futures market returns and contend that informational frictions and the speculative activity accompanying them might cause prices to deviate from "fundamental" values, leading to price booms and busts. He et al. (2010) empirically investigates the correlation between crude oil prices and global economic activity. The Kilian economic index measures global economic activity. The Kilian economic index and a trade-weighted US dollar index integrate real crude oil futures prices, and both short- and long-term fluctuations in the index impact crude oil prices. Cointegration theory and the supply-demand framework support these findings. Hammoudeh et al. (2015) examines the impact of the US monetary policy on sectoral commodity prices, including non-fuel commodities, food, beverages, agricultural raw materials, metals, and fuel (energy) commodities, as well as macroeconomic activity.

Commodity Derivative Market and Sustainable Development Goals

The current study used SDG's mapper text mining tools to integrate commodity derivative markets with macroeconomic determinants and weather conditions. This tool determines how commodity derivative market integration with macroeconomic determinants and weather conditions align with 17 SDGs. SDG 2 (Zero Hunger), SDG 13 (Climate Action), and SDG 7 (Affordable and Clean Energy) are highlighted heavily in the figures, together accounting for more than 70% of the occurrences. This implies that the macroeconomic drivers and commodities derivative market analysis revolve around energy, agriculture, and climate resilience. The focus on SDG 7 (40.10% occurrence) highlights how critical energy-related concerns are for sustainable development and economic stability. These concerns include access, price, and policies. The 21.10% incidence of SDG 13 demonstrates a significant emphasis on risk management associated with climate change, particularly concerning commodities used in energy and agriculture. Similarly, SDG 2 (10.40% occurrence) emphasizes the significance of food security and agricultural risk management, which strongly correlate with climate conditions and commodity markets.

Moreover, with occurrences ranging from 3.90% to 8.90%, moderate representation is shown for SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 9 (Industry, Innovation, and Infrastructure). Based on the data, these SDGs appear to be related to market stability, economic growth, sustainable production methods, and infrastructural development. SDG 8, for example, strongly emphasizes job creation and economic growth, both impacted by stable macroeconomic policies and risk management instruments in the commodities

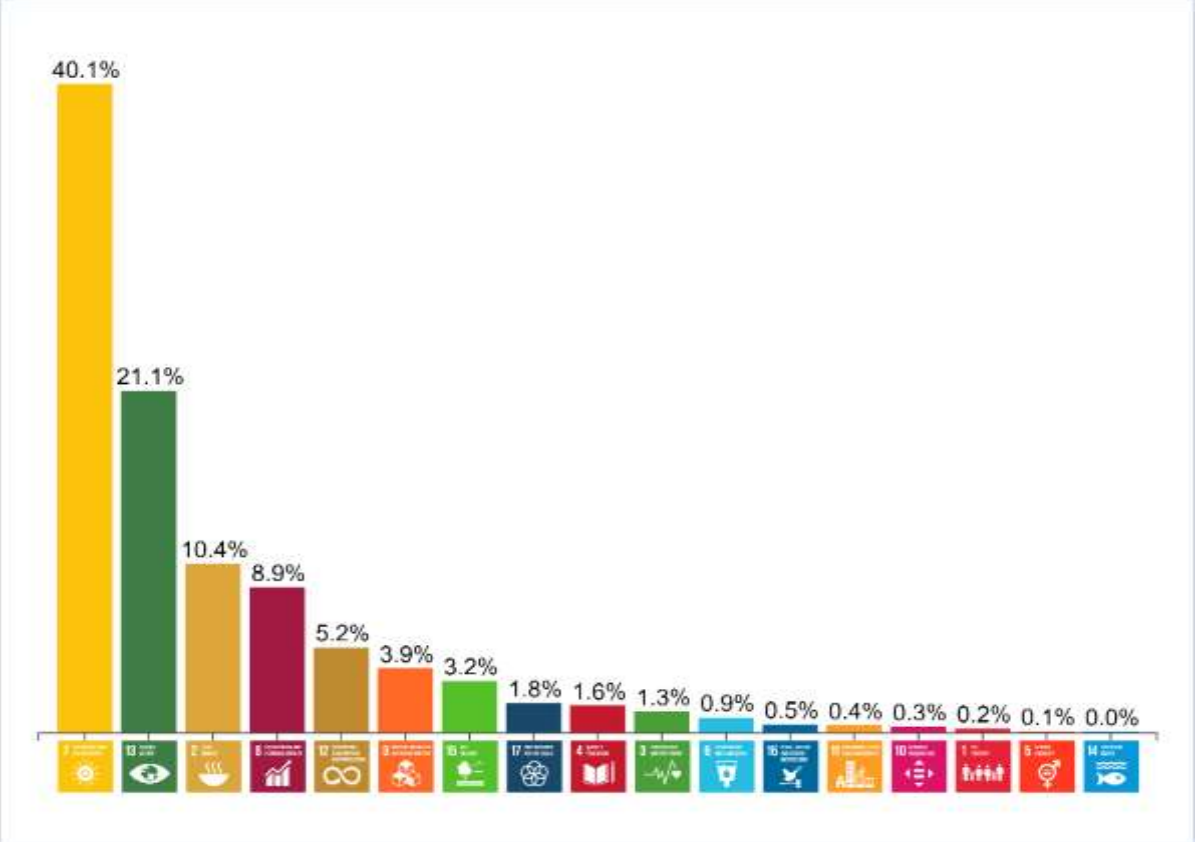


Figure 8: Association of Commodity Derivative Market and Sustainable Development Goals

markets. The emphasis on responsible consumption in SDG 12 is consistent with effective resource management and sustainable trading practices. SDG 9 identifies a link between innovation and industrial growth, strengthened by investments in infrastructure and stable financial markets.

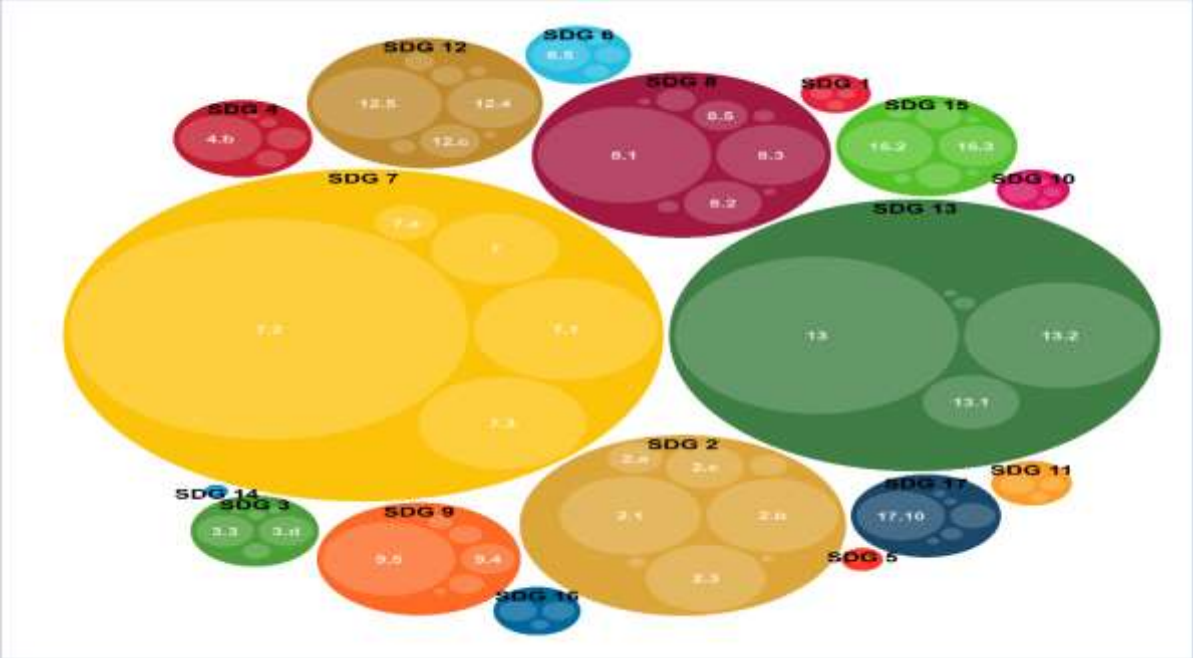


Figure 9: Commodity Derivative Markets and Sustainable Development Targeted Goals

Additionally, SDG 10 (Reduced Inequalities), SDG 14 (Life Below Water), SDG 5 (Gender Equality), and SDG 1 (No Poverty) all indicate fewer than 1% occurrence. The lack of these objectives or their infrequent occurrence indicates that the existing themes place insufficient emphasis on gender concerns, social fairness, and marine sustainability. SDG 5's low incidence, for instance, suggests that gender-specific implications are not sufficiently addressed, while SDG 14's absence shows a failure to integrate ocean sustainability principles. Similarly, the low representation of SDG 1 and SDG 10 implies that, while economic growth may indirectly impact these objectives, poverty reduction, and inequality are not the primary concerns of the topics under analysis. Including social and environmental factors in the study might improve the alignment with more SDGs.

Direction for Future Research

Fundamental Priorities (SDG7, SDG 13, and SDG 2) and Commodity Derivative Market

Global challenges such as Hunger, climate change, and clean energy are the core agenda of SDG target 2030. Oil, gas, and renewable energy are examples of energy commodities (SDG7), including derivatives that help control price volatility and provide a steady energy supply. As investments in renewable energy sources are encouraged by stable pricing, this can help accelerate the shift to cleaner, more affordable energy. The ARIMA, ARCH, and GARCH techniques can be applied to forecast renewable energy sources and measure the volatility of clean energy, which minimizes the risk of price volatility. Climate variability risks can also be hedged through the commodities derivatives market (SDG 13). Food security is maintained by the market, which directly addresses the issues of climate change and extreme weather events by stabilizing prices in agriculture and other climate change-affected industries. The panel data models can be used to examine the empirically dynamic association between the commodity derivative market and climate-related variables (rainfall, HDD, CDD,

humidity) across different regions over time. These techniques can also identify how climate-related variables impact agricultural productivity and food security (SDG 2). Moreover, Farmers and agribusinesses may increase the predictability of their revenue by using derivatives to protect themselves from changes in the price of agricultural commodities. This helps ensure a steady food supply, eliminates financial uncertainty for small-scale farmers, and advances the goal of eradicating hunger (SDG 2). The structure equation (SEM) modeling can be used to study the complex relationship among climate change policies, energy markets, and food security. SEM can also help measure a carbon tax's impact on commodity prices, food availability, and energy consumption.

Supportive Pillars and Commodity Derivative Market

From life on land (SDG 15) and partnerships (SDG 17) to decent work (SDG 8) and responsible consumption (SDG 12), these SDGs (8, 12, 9, 15, 17, 4, 3) are crucial pillars that promote sustainable development. Commodity derivative markets help companies manage risks successfully, thus promoting economic growth (SDG 8). By giving businesses, the means to safeguard themselves against fluctuations in commodity prices, the derivatives market promotes economic development and decent work by enabling enterprises to plan more confidently. The Cointegration and ARDL methods can explore the long-run relationship between macroeconomic variables and the development of commodity derivative markets. It helps to identify how fluctuation in commodity derivative market prices affects economic growth and employment. Additionally, derivatives of commodities may help promote more conscientious use of resources. By pricing externalities like carbon emissions in commodity contracts, markets may encourage cleaner production practices and support sustainable patterns of production and consumption (SDG 12). The input-output model, VECM and ECM, can measure the long- and short-run dynamics associated with commodity derivative market development and macroeconomic variables. It helps to identify how external shocks affect consumption patterns and economic stability.

Moreover, International collaboration and coordination are necessary for global commodities derivative markets. How derivative markets operate encourages collaborations across countries, businesses, and financial institutions, strengthening the international framework for achieving the SDGs (SDG 17). The cross-country panel method can be used to assess how commodity derivative market standards foster partnership among the countries and align with the SDG.

Niche Concerns and Commodity Derivative Market

The certain SDGs (6, 16, 11, 10, 1, 5, 14) may not be the main focus of the commodities derivative market because they address more specialized or localized issues like gender equality (SDG 5), clean water (SDG 6), and inequality (SDG 10). Also, the lack of their infrequent occurrence indicates that the existing themes place insufficient emphasis on gender concerns, social fairness, and marine sustainability. Water resource management is revolutionizing because of the rise of water markets and the usage of derivatives linked to water rights. These advances are crucial for areas to adjust to the increasing issues of water shortage properly. These markets enable the trade and distribution of water rights, resulting in a more effective distribution of this essential resource. The efficacy of different water management programs, particularly those that use water derivatives, can be assessed using probit models. In areas with limited water resources, it examines the likelihood of success for various approaches, offering vital information on creating and executing these policies for the best possible management of water resources. Ultimately, this strategy supports sustainability and increases the adaptability of communities dealing with water scarcity (SDG 6).

Additionally, access to derivative markets must be expanded to enable excluded populations to successfully engage in price risk management. Small firms and individuals can protect themselves against price swings and improve their financial stability by lowering entry barriers. Econometric

methods like logit and probit models may be used to assess how this expanded access affects financial inclusion and income inequality. Using these models, researchers may examine the probability of involvement in derivative markets according to socioeconomic variables, offering valuable perspectives on how access to these markets might result in better economic results for historically marginalized groups. In addition to emphasizing the value of inclusive financial systems, this strategy advises policymakers on the most effective ways to advance equality in the financial services industry (SDG 10).

Closing the gender gap (SDG 5) in economic engagement requires promoting women's involvement in commodities markets. Women with access to financial instruments such as futures contracts are more equipped to handle pricing risks associated with their enterprises, improving their confidence and ability to make financial decisions. Researchers can compare the financial results of women with and without market access before and after the intervention using difference-in-differences (DiD) methodologies to assess the efficacy of gender-focused initiatives. This approach accounts for several contributing elements that show the actual effects of these activities. The results from this research can demonstrate how specific assistance helps women become more financially independent, enhancing their and their families' financial security. These observations can help legislators develop inclusive financial systems that advance gender parity and benefit society.

Implication

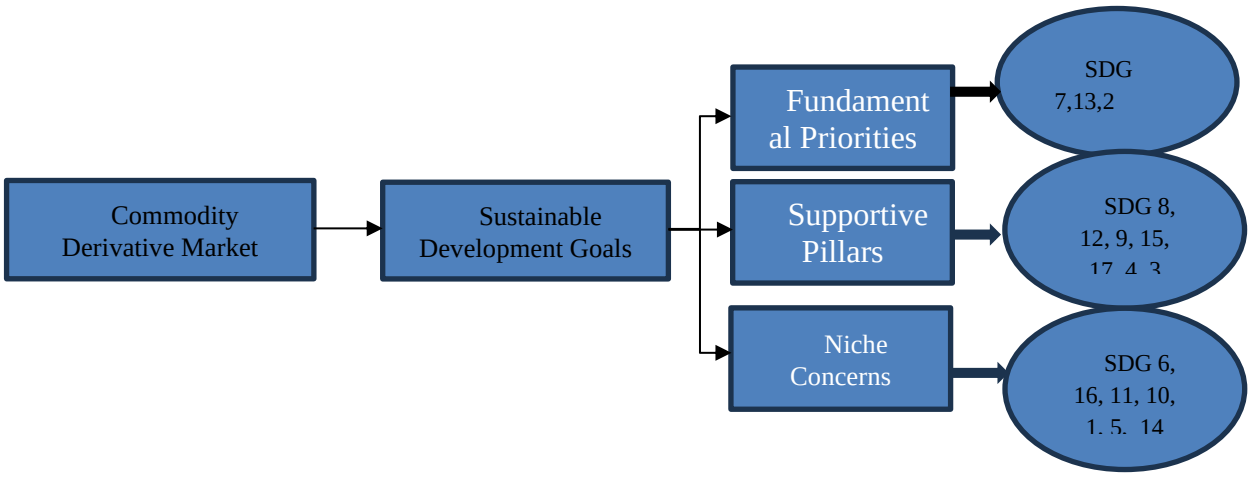


Figure 10: Sustainable Risk management integration model through commodity derivative market

According to the Sustainable Risk Management Integration (SRMI), commodities derivative markets can be deliberately used to promote sustainable practices and stabilize prices to achieve several sustainable development goals (SDGs). The theory's applicability may be seen in developed, developing, and under-developing countries in the same manner but with different commodities. Meanwhile, developing and underdeveloped countries highly depend on agricultural commodities, and developed countries depend on bullion, metal, and energy-related commodities. Therefore, commodity derivatives allow governments to maintain long-term economic stability by stabilizing important markets and guaranteeing food, energy, and health security. Governments may strengthen their institutions by lowering speculative trading and guaranteeing market openness. Researchers may investigate how derivatives improve resilience and market stability, producing information that informs policymakers about the most effective ways to include financial instruments in sustainability plans. By employing derivatives that mitigate climate change, agricultural, and infrastructural risks, investors are urged to practice sustainable investment and allocate funds to initiatives that support the SDGs. By

doing this, they can guarantee steady revenues while encouraging sustainable development and equity. Policymakers may then create regulatory frameworks that link these markets with sustainable outcomes, promoting equitable financial practices, renewable energy investment, and responsible consumption. By combining efforts from many stakeholders, this integrated strategy aims to build a robust, sustainable global economy that aligns with the SDGs.

Conclusions

The present study aims to conduct a bibliometric analysis of the commodity derivative market from journals in the Scopus database from 2007 to 2024. The study uses bibliometrics, performance analysis, and text mining of 754 articles extracted from the Scopus database to discover the research gap and models for future research. The R-studio, VOS-viewer, and SDG mapper tools have been used to analyze the articles of the Scopus database. The result of the study states that the journal of "*Energy Economics"* has the highest no. of citations per publication (CPP) ratio, the *Lippe D.* has the prominent authors with the highest no. of documents in the commodity derivative market, and the United Nations has the highest no. of publications in the field of commodity derivative market. The result also classifies the 17 SDGs into three categories: Fundamental Priorities, Supportive Pillars, and Niche Concerns and Commodity derivative markets. SDG 7 accounted for 40.1% of occurrences, followed by SDG 13,2, 8, and 12, with the % occurrences of the keywords 21.1, 10.4, 8.9, and 5.2, respectively. 86% of the studies comprised SDGs 7, 13, 2, 8, and 12. The study also states that commodity derivative markets significantly contribute to achieving the Sustainable Development Goals through market stabilization, financial risk management, and encouraging sustainable behaviors. To ensure that the advantages of these markets are not outweighed by possible drawbacks like speculation, inequality, or resource exploitation, regulatory frameworks, fair access, and responsible usage are necessary. Econometric techniques offer the means to assess, forecast, and control these risks, directing market and governmental activity toward long-term results. The present study only used the Scopus database; the researcher may add more databases for better results. The present study is limited to 2007 to 2024; adding old literature may give better insight into the commodity derivative market.

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