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A Bibliometric Review of Palm Oil Price Volatility and Its Macroeconomic Impacts in Southeast Asia

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ABSTRACT

Palm oil plays a pivotal role in the economic landscape of Southeast Asia, particularly in countries like Indonesia and Malaysia where it significantly contributes to GDP, employment, and trade revenues. However, the volatility of palm oil prices presents persistent challenges, affecting macroeconomic stability, food security, and policy planning. This study presents a comprehensive bibliometric analysis of the scholarly literature on palm oil price volatility and its macroeconomic impacts, focusing on Southeast Asia from 2000 to 2024. Using the Scopus database and VOSviewer software, the analysis reveals key thematic clusters centered on economic costs, price dynamics, biofuel policy, and financial spillover effects. The results show a growing interdisciplinary trend, with research expanding from core economic modeling toward sustainability and energy policy frameworks. Overlay and density visualizations indicate a temporal shift in research focus from volatility analysis to broader systemic and policy-related issues. Despite the increasing depth and diversity of the literature, significant gaps remain, particularly in addressing the socio-environmental dimensions and the real-world impacts on smallholder farmers and national policy. This review not only maps the intellectual structure of the field but also offers critical insights for future research and evidence-based policymaking in the global palm oil economy.

Keywords: *Palm Oil, Price Volatility, Macroeconomic Impact, Southeast Asia, Bibliometric Analysis*

1. INTRODUCTION

Palm oil has emerged as one of the most economically significant and politically sensitive commodities in Southeast Asia. As the region's dominant agricultural export, particularly in Indonesia and Malaysia, palm oil plays a pivotal role in national revenues, employment, rural development, and foreign exchange earnings [1], [2]. Its versatility—ranging from use in food products, cosmetics, biofuels, to industrial lubricants—has driven exponential global demand. The expansion of oil palm plantations over the past few decades has transformed the agrarian economies of Southeast Asia, lifting millions out of poverty, but not without ecological and socio-political costs [3], [4]. In this context, understanding the dynamics surrounding palm oil pricing is not merely a concern for traders and corporations, but a matter of national economic stability.

The volatility of palm oil prices has been a recurring concern in global commodity markets. Influenced by a variety of global and regional factors—such as crude oil prices, weather patterns, export policies, and international trade tensions—the fluctuation in palm oil prices has proven to be both unpredictable and impactful [5]. For example, the COVID-19 pandemic saw unprecedented price swings that affected the incomes of smallholder farmers and disrupted national economic planning. Further compounding the issue are global discourses on sustainability and deforestation, which have led to boycotts and stricter import regulations from key markets such as the European Union [6]. This has increased the uncertainty surrounding palm oil's long-term price outlook.

Southeast Asian economies are particularly vulnerable to palm oil price shocks due to their heavy reliance on the commodity. In Indonesia and Malaysia, palm oil constitutes a significant share of GDP and exports [7]. As such, price volatility has far-reaching macroeconomic consequences, influencing inflation rates, currency values, and fiscal policies. For instance, when palm oil prices

fall, national revenue from export duties and levies declines, which can exacerbate fiscal deficits [8]. Additionally, fluctuations can lead to currency depreciation in commodity-dependent economies, impacting import costs and the balance of payments. Conversely, high palm oil prices can contribute to food inflation, straining household purchasing power, especially among lower-income groups [9].

The scholarly attention to palm oil price volatility has increased over the past two decades. Researchers have explored its relationship with global market dynamics, price transmission mechanisms, and its interactions with other commodities such as crude oil and soybean oil [10]–[12]. Additionally, the impact of policy instruments, including export bans, biodiesel mandates, and subsidies, has been studied for their role in either stabilizing or destabilizing the market [13]. However, the literature remains scattered across various disciplines—agricultural economics, environmental studies, finance, and international trade—which poses a challenge for building a coherent understanding of the issue. A bibliometric approach can help map this complex body of knowledge and identify key themes, influential authors, institutional networks, and gaps that merit further investigation.

Bibliometric analysis has proven to be a robust method for synthesizing large volumes of academic literature. It offers valuable insights into the evolution of research trends, authorial impact, journal concentration, and geographic distribution of scholarly activity [14]. In the context of palm oil price volatility, a bibliometric review can help trace how academic focus has shifted over time—from purely economic concerns to encompassing environmental and socio-political dimensions. It also reveals how Southeast Asian scholars and institutions contribute to the global discourse and where there may be underrepresentation. Understanding these patterns is essential not only for academics but also for policymakers who rely on credible evidence to guide economic strategy and regulatory reform.

Despite the abundance of literature on palm oil economics and volatility, there remains a lack of consolidated knowledge on how this body of research has evolved, particularly in relation to its macroeconomic implications in Southeast Asia. The fragmentation across disciplines, inconsistent terminologies, and varying regional focuses make it difficult to draw comprehensive conclusions. Without a clear understanding of the research landscape, policymakers and scholars may overlook critical findings or fail to address emerging challenges effectively. Therefore, a systematic mapping of the literature is urgently needed to illuminate key research trajectories, influential contributors, and knowledge gaps related to palm oil price volatility and its macroeconomic impacts. This study aims to conduct a comprehensive bibliometric analysis of scholarly literature concerning palm oil price volatility and its macroeconomic impacts in Southeast Asia.

2. METHODS

This study employed a bibliometric analysis approach to systematically map and evaluate the body of scholarly literature on palm oil price volatility and its macroeconomic implications, with a particular emphasis on Southeast Asia. Bibliometric analysis enables the visualization and quantification of publication trends, intellectual structures, and thematic developments within a given research domain [14]. The method was selected to address the fragmented nature of previous studies across various disciplines, allowing for a comprehensive understanding of the evolution of knowledge in this field. The analytical framework combined performance analysis (e.g., publication output, citation count, most active authors, and journals) and science mapping (e.g., co-authorship networks, co-citation patterns, and keyword co-occurrence) to identify influential research clusters and emerging themes.

The dataset was derived from the Scopus database, given its broad coverage of high-impact peer-reviewed journals and bibliometric compatibility. A structured search query was developed using relevant keywords and Boolean operators, including terms such as *"palm oil"*, *"price volatility"*, *"macroeconomic"*, *"Southeast Asia"*, *"inflation"*, and *"economic impact"*. The time frame for the literature search was set from 2000 to 2024 to capture the evolution of research over the past two decades. Only articles written in English and published in academic journals were included, excluding conference papers, book chapters, and non-peer-reviewed materials to ensure the credibility and comparability of findings. After applying inclusion and exclusion criteria, 218 documents were identified and exported in CSV and RIS formats for further analysis. For data processing and visualization, the software VOSviewer (version 1.6.20) was used to generate bibliometric maps based on co-authorship and keyword co-occurrence analyses.

3. RESULTS AND DISCUSSION

3.1 Network Visualization

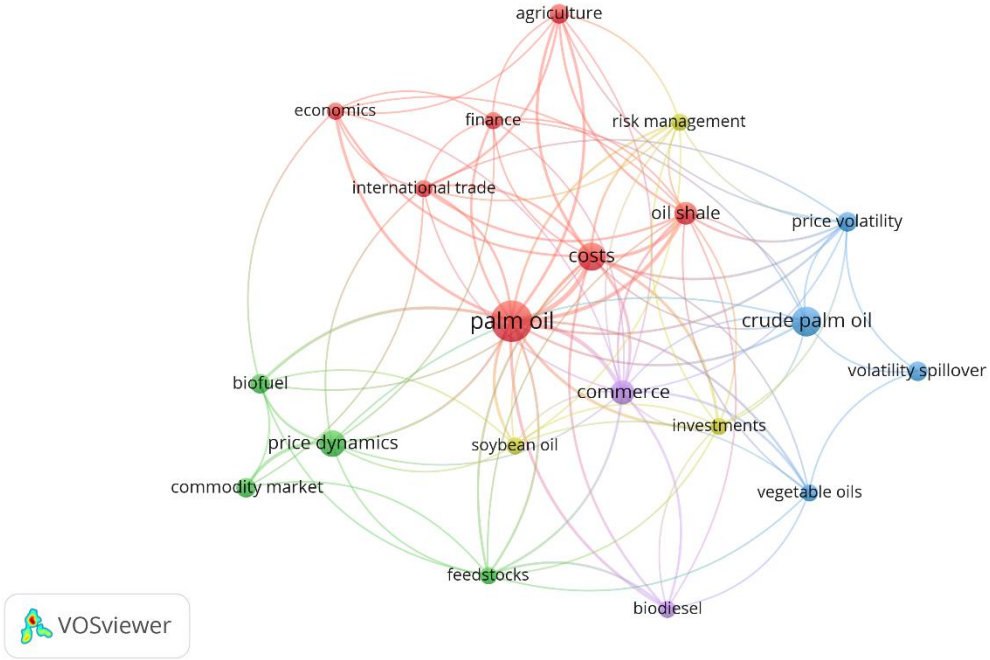

Figure 1. Network Visualization
Source: Data Analysis Result, 2025

Figure 1 above provides an insightful overview of the conceptual structure of research on palm oil price volatility and its macroeconomic implications. At the core of the map, the term "palm oil" emerges as the central and most prominent node, indicating its dominant role across the literature corpus. Its central position and the numerous lines connecting it to various terms signify the high degree of interconnectedness and interdisciplinary nature of palm oil-related research. The close clustering of keywords like *costs*, *finance*, *economics*, *international trade*, and *agriculture* (shown in red) highlights the strong thematic focus on the economic and policy dimensions surrounding palm oil production and trade.

The red cluster, representing economic and trade-related keywords, reflects a concentration of studies that examine palm oil through the lens of financial impacts, cost structures, risk management, and macroeconomic indicators. The strong linkages between "palm oil", "costs", and "finance" suggest a critical interest in how fluctuating prices influence production economics and broader economic stability. This cluster also incorporates "agriculture" and "international trade", reaffirming the role of palm oil as a globally traded agricultural commodity whose volatility impacts

national accounts and export performance, particularly in countries like Indonesia and Malaysia. The blue cluster focuses more explicitly on price volatility and its spillover effects, linking terms such as *crude palm oil*, *volatility spillover*, *investments*, and *vegetable oils*. This indicates a scholarly orientation toward analyzing price behaviors, transmission mechanisms, and the financial volatility associated with palm oil and related commodities. The appearance of "crude palm oil" in proximity to "price volatility" and "volatility spillover" suggests that empirical investigations are often anchored in financial econometrics, examining how shocks in one commodity (e.g., crude oil or soybean oil) might influence palm oil markets through volatility channels.

On the left side of the map, the green cluster includes terms like *biofuel*, *price dynamics*, *commodity market*, and *feedstocks*. This cluster highlights the environmental and energy-related dimensions of palm oil research, particularly the intersection between biofuel policy and market dynamics. As countries increasingly adopt renewable energy policies, the use of palm oil for biodiesel and its linkage with other bio-based feedstocks becomes a crucial area of analysis. This also explains the link to price dynamics and commodity markets, where studies assess how energy markets and sustainability initiatives interact with palm oil supply and pricing structures. maller thematic nodes such as *soybean oil*, *biodiesel*, and *oil shale* bridge various clusters and hint at comparative analyses and energy substitution effects within the literature. These terms show the breadth of interdisciplinary concerns, from commodity substitution, energy transitions, to environmental economics.

3.2 Overlay Visualization

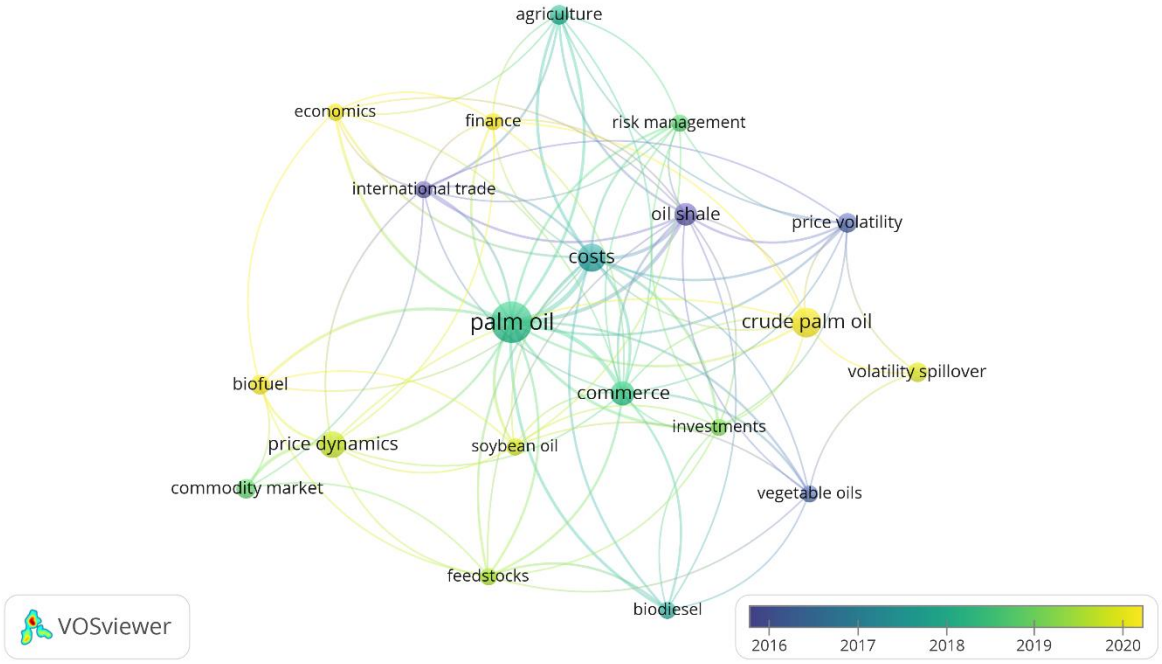

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2025

Figure 2 depicts the temporal evolution of keywords related to palm oil price volatility and its macroeconomic impacts, spanning from 2016 to 2020. The color gradient, ranging from blue (older publications) to yellow (newer publications), reveals how the academic focus has shifted over time. Notably, keywords such as “price volatility,” “volatility spillover,” and “crude palm oil” appear in darker blue tones, suggesting that these topics were more actively studied in earlier years, particularly around 2016–2017. This reflects the initial wave of scholarly attention on volatility

dynamics and commodity pricing models, possibly influenced by major market disruptions and policy shifts during that period.

In contrast, terms like "palm oil," "commerce," "costs," "biofuel," and "price dynamics" appear in green to yellow hues, indicating a more recent concentration of research from 2018 onward. The shift toward these keywords may reflect a growing academic interest in the broader economic implications of palm oil beyond price volatility alone. The emerging emphasis on cost structures, trade implications, and the role of biofuels signals that researchers are increasingly investigating how palm oil interfaces with global sustainability policies, renewable energy markets, and supply chain economics. This evolution suggests a diversification in research scope, from narrow econometric volatility models toward more interdisciplinary and policy-relevant themes. Interestingly, "vegetable oils," "investments," and "risk management" also show a more recent emergence, pointing to new directions in the literature that connect palm oil with alternative commodities, financial instruments, and strategic planning. This suggests that researchers are beginning to frame palm oil within a broader agro-financial context, examining its interactions with other vegetable oils and investment behavior in commodity markets.

3.3 Citation Analysis

Table 1. The Most Impactful Literatures

Citations	Authors and year	Title
35	[15]	Robust optimization for process synthesis and design of multifunctional energy systems with uncertainties
30	[16]	Soft commodities and the global financial crisis: Implications for the economy, resources and institutions
28	[10]	An analysis of price and volatility transmission in butter, palm oil and crude oil markets
27	[17]	Evaluation of performance and exhaust emission of C.I diesel engine fuel with palm oil biodiesel using an artificial neural network
22	[18]	Crude oil volatility and the biodiesel feedstock market in Malaysia during the 2014 oil price decline and the COVID-19 outbreak
20	[19]	The response of exchange rate to coal price, palm oil price, and inflation in Indonesia: Tail dependence analysis
19	[20]	Modeling return and volatility spillovers among food prices in Nigeria
18	[21]	Do uncertainties affect biofuel prices?
18	[22]	The impact of global financial crisis on informational efficiency: Evidence from price-volume relation in crude palm oil futures market
16	[23]	Relationship between exchange rates, palm oil prices, and crude oil prices: A vine copula based GARCH approach

Source: Scopus, 2025

3.4 Density Visualization

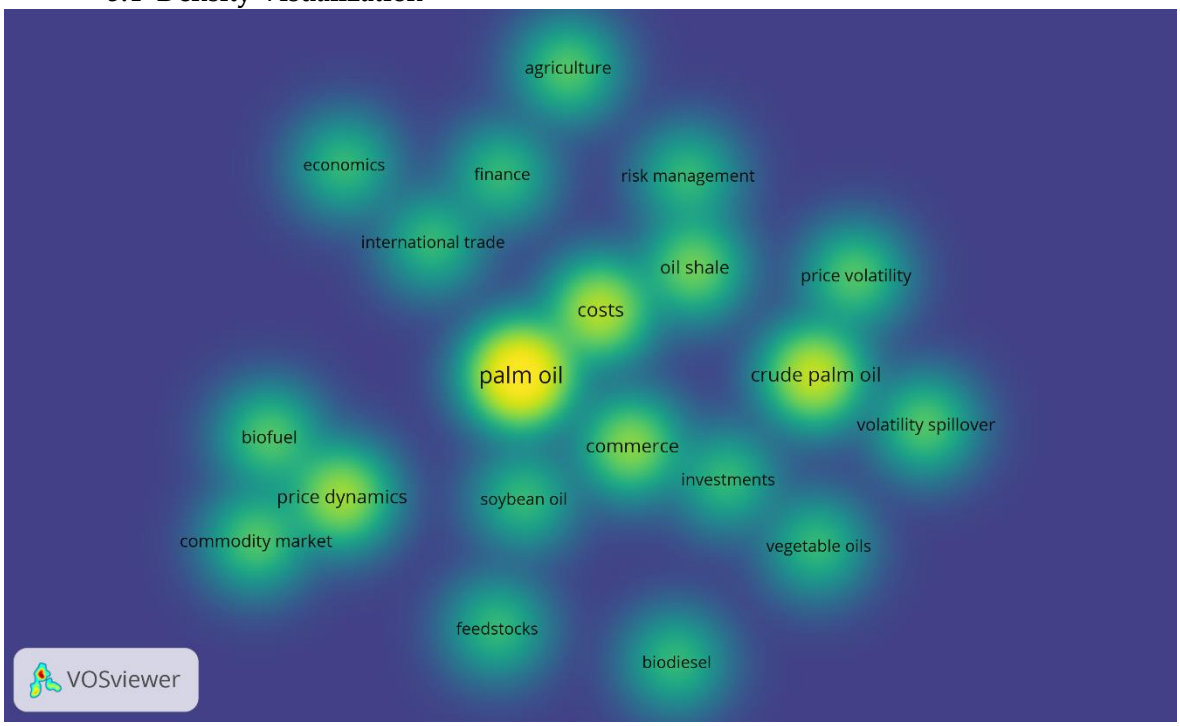

Figure 3. Density Visualization

Source: Data Analysis Result, 2025

Figure 3 provides a heatmap representation of the intensity and frequency of keyword occurrences within the literature on palm oil price volatility and its macroeconomic impacts. The term "palm oil" stands out as the most prominent and densest node, represented by the bright yellow region at the center, indicating that it is the most frequently discussed topic in this research field. Surrounding terms such as *costs*, *commerce*, and *crude palm oil* also show moderate-to-high density, suggesting they are consistently discussed in close connection with the main subject. This concentration of activity around central economic terms confirms the dominance of market, production cost, and trade issues in palm oil-related scholarly discourse. In contrast, peripheral terms such as "biofuel," "price dynamics," "volatility spillover," and "vegetable oils" show lower-density (green) regions, signifying less frequent but still notable attention in the literature. These keywords reflect specialized but emerging subtopics within the broader field, including the role of palm oil in renewable energy policies and its interaction with other global commodity markets. The relatively even spread of green zones across diverse themes like *international trade*, *agriculture*, and *risk management* suggests that research in this area is multidisciplinary, though still centralized around a few economic and market-driven concerns.

3.5 Co-Authorship Network

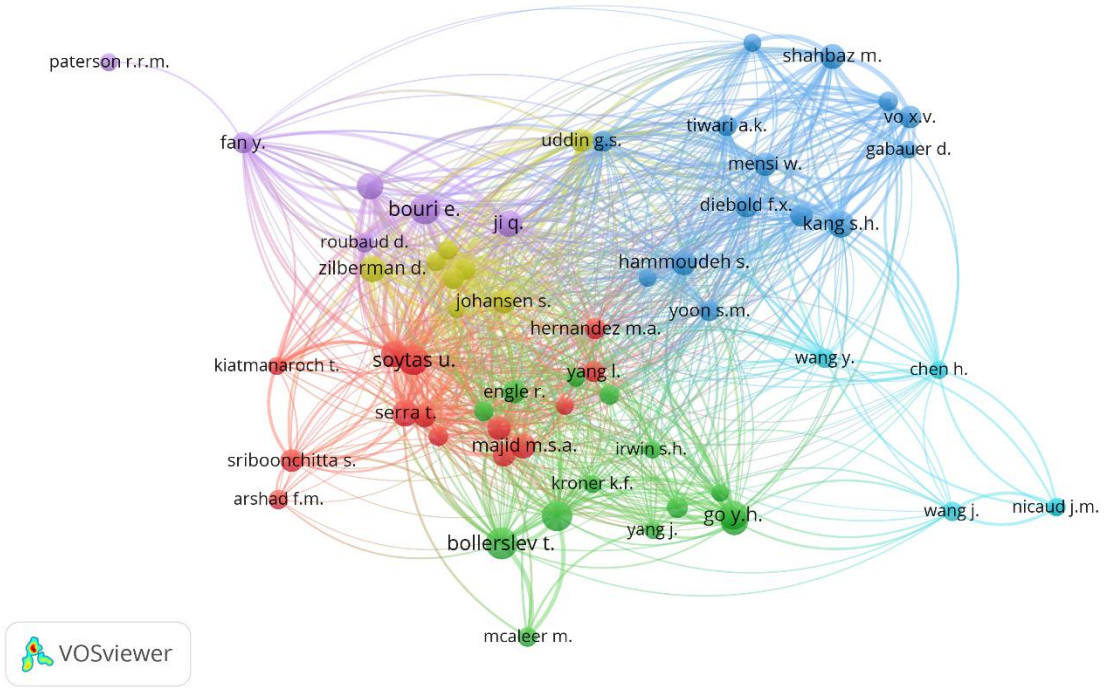

Figure 4. Author Visualization
Source: Data Analysis Result, 2025

Figure 4 reveals a dense and complex structure of scholarly influence within the field of palm oil price volatility and related macroeconomic topics. Prominent clusters, represented by different colors, highlight intellectual groupings of researchers who are frequently cited together, indicating shared thematic or methodological orientations. The green cluster, centered around influential figures like *Bollerslev T.* and *McAleer M.*, suggests a strong foundation in econometrics and volatility modeling. The blue cluster, led by authors such as *Shahbaz M.*, *Vo X.V.*, and *Mensi W.*, reflects contemporary empirical research focusing on energy markets and financial integration. Meanwhile, the red and yellow clusters (e.g., *Soytas U.*, *Ji Q.*, *Johansen S.*) represent scholars bridging environmental economics, policy analysis, and commodity market dynamics. The position of authors like *Zilberman D.*, *Fan Y.*, and *Roubaud D.* in peripheral yet well-connected positions indicates niche but influential contributions, possibly in sustainability, agricultural economics, or emerging risk assessment theme.

Discussion

The findings of this bibliometric study reveal an increasingly complex and interdisciplinary research landscape around palm oil price volatility and its macroeconomic effects in Southeast Asia. From the co-occurrence and density visualizations, it is evident that the term *"palm oil"* remains the epicenter of scholarly discourse, with dense interconnections to keywords such as *costs*, *crude palm oil*, *commerce*, *finance*, and *price volatility*. This concentration reflects a sustained interest in the economic and financial implications of palm oil as both a strategic export commodity and a macroeconomic variable affecting inflation, trade balances, and national fiscal performance.

One of the key observations from the keyword network map is the thematic clustering of research into three main domains. First, there is a strong emphasis on macroeconomic and financial dimensions, where keywords like *costs*, *international trade*, *finance*, and *economics* dominate the red cluster. This reflects the body of literature that assesses how fluctuations in palm oil prices affect economic indicators such as GDP contributions, government revenues from export levies, inflationary pressures, and monetary stability, especially in palm-oil-dependent countries such as

Indonesia and Malaysia. Studies in this cluster often employ quantitative econometric approaches, including vector autoregression (VAR), GARCH models, and cointegration analysis, to determine causality and volatility patterns across related commodities and macroeconomic variables [24], [25].

The second thematic area identified lies within energy economics and environmental policy, with keywords such as *biofuel*, *feedstocks*, *biodiesel*, and *commodity market* forming a distinct green cluster. This reflects growing scholarly interest in how palm oil is increasingly positioned as a renewable energy source, particularly in national biodiesel mandates. Research in this area often investigates how palm oil prices co-move with fossil fuel prices, and how energy policies, subsidies, and international sustainability regulations (such as the EU Renewable Energy Directive) impact price formation and export volumes. These studies also highlight the trade-off between food and fuel use of palm oil, a tension that has critical implications for food security and market stability in Southeast Asia [26].

A third domain, illustrated by the blue cluster, centers on price volatility and spillover effects, with terms like *crude palm oil*, *price volatility*, *volatility spillover*, and *vegetable oils*. This body of research is focused on understanding the mechanisms through which global shocks—such as oil price surges, geopolitical risks, or pandemics—transmit to the palm oil market. Studies in this stream often compare palm oil with substitute goods such as soybean oil or sunflower oil and analyze spillover channels using multivariate volatility models [27]. The emphasis on volatility underscores concerns about market predictability, the effectiveness of risk management strategies, and the vulnerability of smallholder producers to sudden income shocks.

From the overlay visualization, we can observe how the research focus has evolved over time. Early studies (circa 2016–2017), marked in darker shades of blue, concentrated heavily on *price volatility*, *volatility spillover*, and *crude palm oil*. This likely coincides with periods of heightened market instability, including the 2015–2016 El Niño event, crude oil crashes, and trade policy uncertainties. In more recent years (2018–2020), keywords such as *biofuel*, *commerce*, *costs*, and *vegetable oils* have gained prominence, as reflected by the shift toward green and yellow shades. This suggests a thematic expansion from narrow price-centric analysis to broader economic and environmental contexts—possibly driven by increasing global attention to sustainability, climate policies, and renewable energy transitions.

The density map further reinforces these insights by indicating the frequency and centrality of key topics. The highest density was recorded around the term *palm oil*, highlighting its dominant role in academic discourse. However, notable high-density regions also surround *crude palm oil*, *costs*, and *commerce*, pointing to their integral relevance within the macroeconomic narrative. Conversely, lower-density but still significant areas such as *feedstocks*, *biofuel*, and *volatility spillover* imply specialized research niches that have not yet reached saturation—suggesting opportunities for future inquiry. A particularly striking result emerged from the author co-citation analysis, which revealed a robust network of influential scholars working across different but overlapping areas. Notably, authors such as *Bollerslev T.*, *McAleer M.*, and *Soytas U.* have been foundational in developing econometric frameworks for volatility analysis, while *Zilberman D.* and *Roubaud D.* have contributed significantly to environmental economics and policy integration. The clustering of co-cited authors into thematic groups underscores the intellectual diversity of the field, ranging from applied economics to energy policy and international trade. It also reflects the interdisciplinary nature of the issue, where understanding palm oil volatility demands insights from finance, agriculture, environmental science, and international development.

Despite the overall growth and diversification of the literature, this study also reveals several research gaps. First, there is limited bibliometric evidence of studies explicitly linking palm oil volatility to poverty, inequality, or food insecurity, even though these are significant real-world consequences in palm oil-producing nations. Second, while *price volatility* is well explored in quantitative terms, there is a lack of qualitative or mixed-method research that examines how different stakeholders (smallholders, traders, policymakers) perceive and respond to price shocks.

Third, the role of climate change and extreme weather events in influencing production volumes and price fluctuations is underrepresented in the mapped literature, despite its growing importance. Moreover, as the palm oil industry becomes increasingly scrutinized under global sustainability frameworks, future research must pay greater attention to policy impact evaluations. For instance, how do EU deforestation regulations or trade bans affect the long-term volatility of palm oil prices? Are producer nations diversifying their export destinations or engaging in vertical integration to mitigate risk? These are pressing questions that can benefit from interdisciplinary and policy-oriented research supported by strong data and stakeholder engagement.

CONCLUSION

This bibliometric review has illuminated the evolving and multifaceted landscape of research on palm oil price volatility and its macroeconomic implications in Southeast Asia. The findings demonstrate that scholarly attention has gradually shifted from traditional econometric analyses of price dynamics and spillover effects toward broader themes involving trade, biofuel policy, and sustainability. The centrality of keywords such as *palm oil*, *costs*, and *commerce*, along with the emergence of interdisciplinary clusters, reflects a growing recognition of palm oil's strategic economic role and the complexity of managing its market fluctuations. Despite these advancements, the literature remains fragmented geographically and thematically, with limited collaboration across producing and consuming nations. Moreover, critical gaps persist in areas such as policy impact assessment, smallholder vulnerability, and climate-related risks. By mapping the intellectual structure and temporal trends in this domain, this study offers a valuable foundation for future research and policymaking aimed at fostering resilient, inclusive, and sustainable palm oil economies in the region.

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