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Analysing the determinants of Malaysian crude palm oil prices in short – run and long-run: An ARDL approach

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ABSTRACT

This research investigates the determinants of Crude Palm Oil (CPO) prices, focusing on the influence of selected independent variables using an advanced Autoregressive Distributed Lag (ARDL) method. CPO, known for its affordability and versatility compared to other vegetable oils, plays a pivotal role in the global economy. Despite its significance, the complexity of its pricing **dynamics**, which are influenced by multifaceted factors, has not been sufficiently addressed in the literature. This study aims to bridge the gap by examining both short-run and long-run relationships between selected independent variables and CPO prices, which include CPO exports, production levels, export tax, stock levels, weather conditions, population growth, economic growth, global consumption, and prices of other vegetable oils like soybean and sunflower, as well as the exchange rate and Consumer Price Index (CPI). Utilising monthly frequency data from January 2004 to December 2021, the research integrates these variables into an ARDL model to assess their impact on CPO prices in Malaysia. The analysis reveals that both immediate and lagged values of these variables significantly influence CPO prices in the short run. In the long run, key determinants such as CPO exports and production, economic indicators like the CPI, and the prices of competitive vegetable oils emerge as influential factors. The diagnostic tests confirm the model's stability through the robustness check. The research contributes valuable insights into the intricate dynamics governing CPO pricing, guiding informed decision-making for policy makers and CPO stakeholders.

1. Introduction

Crude palm oil (CPO) is affordable and adaptable that used in various culinary and non-food items (Corley, 2009). The remarkable quality of CPO makes it omnipresent in consumer goods and crucial to the

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global economy since it is a transformation, universal, and necessary to the globe as one of the fundamental components of various products. CPO is less costly than other vegetable oils since it needs ten times land to produce. CPO is a worldwide need while being inexpensive. Its adaptability, competitiveness, and health benefits impact the worldwide CPO industry (Khosla, 2011; May and Nesaretnam, 2014). Despite these advantages, the complexity of CPO pricing dynamics remains inadequately addressed in contemporary literature, particularly concerning the integration of diverse influencing factors into a coherent analytical model.

There is a growing understanding that more attention must be paid to the area of CPO price determinants in order to navigate the influence of external and internal variables on changes in CPO price. Where, changes in the CPO market, CPO price fluctuations provide a considerable risk to the government, plantation firms, investors, sector players, and small planters (Rianto at al., 2012). The commodity market of CPO is disposed to swings in its essential characteristics, especially price, where price variations impacted by stochastic external factors (Zaidi et al., 2021). The theoretical underpinning of this research is grounded in economic theory, specifically the Cobweb Theorem, which posits that supply and demand dynamics significantly influence CPO pricing mechanisms. Whereas, for the supply side, the factors are including exchange rate (Isa et al., 2021; Hadi et al., 2019; Rosa and Vasciaveo, 2008; Headey and Fan, 2008), trade restraints (Kadir et al., 2020), weather or climate change (Rosa and Vasciaveo, 2008; Headey and Fan, 2008). While the price of other vegetable oils (Kumar et al. 2023; Sehgal et al. 2013), economic growth (Rosa and Vasciaveo 2008; Nazlioglu and Soytas 2012), and population aren the factors for the demand side. However, existing models in previous research have not fully integrated the aforementioned criteria.

Addressing the gap, the current research further investigates the complex factors impacting the CPO prices using an advanced Autoregressive Distributed Lag (ARDL) method. The ARDL method stands out for its ability to model short-run adjustments and long-run relationships between variables. The flexibility is crucial when examining complex markets where the influences can have immediate impacts while also shaping trends over extended periods. The selection of the variables includes the current state of the economy, the prevalent weather patterns, and any other variables that may impact the price of CPO in Malaysia. Furthermore, ARDL provides a detailed breakdown of the short-run and long-run elasticities offering insights into how variables react in the immediate aftermath of a change and settle in the longer term to tackle the complex dynamics of CPO prices within the industry.

The paper expects to contribute to the literature in several ways, first, by enlightening the importance variables to estimate the CPO prices in Malaysia market. Second, the outcome of the paper may influence the stakeholders within the industry to get a crystal clear in making decision. The structure of the paper comprises of a review of pertinent literature which presented a foundation understanding of CPO price determinants. Subsequently, the methodology section elaborates on the data sources and the specific application of the ARDL model followed by the empirical findings. The final section of the paper concludes synthesizing the principal findings, offering recommendations for future research endeavors and policy development.

2. Literature review

The dynamics of CPO pricing are complex, influenced by various factors at both domestic and international levels. This review critically examines the dynamics factors which focusing on the interrelation between supply and demand within broader economic and environmental contexts. The Price Discovery Theory as explained by Tomek and Robinson (1981) became a central attention to the establishment of the understanding which emphasizes the pivotal role of supply and demand in financial markets. However, this theory's application to CPO markets, involving diverse platforms in derivatives market focus on spot, futures, and over-the-counter transactions, reveals a more intricate price discovery

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process. The pricing dynamics of CPO are shaped by a multitude of factors, each contributing uniquely to its market value. A study by Reynalto and Ernah (2020) underscores the direct impact of production levels on Indonesia's CPO exports, further influenced by global prices and exchange rates. In the realm of fiscal policy, Manurung, Bruemmer, and Kopp (2019) highlight the significant role of taxation policies, particularly in Indonesia, where export taxes are employed to stabilize the CPO market. The influence of environmental factors is evident in the work of Malesios, Jones, and Jones (2020), who demonstrate how extreme weather events, a byproduct of climate change, can disrupt agricultural output, thereby affecting commodities like CPO.

The market for CPO is also affected by the competitive pricing of alternative oils. Sofilda (2022) points out that Indonesia's edge in CPO exports is partly attributed to its higher pricing compared to oils like soybean and sunflower, illustrating the concept of substitution effects in commodity markets. However, the literature reveals gaps in understanding the direct impact of population and economic growth on CPO pricing, an area that warrants further exploration for a comprehensive understanding of market dynamics. The role of exchange rates in shaping CPO pricing, as discussed by Isa et al. (2020), and the indirect influence of the Consumer Price Index (CPI) on demand and pricing, remain areas ripe for detailed analysis. This complex interplay of factors culminates in a dynamic and multifaceted CPO market, where each element plays a critical role in determining its pricing and market stability. Hameed, Arshad, and Alias (2016) utilized the Autoregressive Distributed Lag (ARDL) approach to explore palm oil import demand in Asia, underscoring the model's suitability for small sample sizes and integrating variables of different integration orders. While their findings offer significant insights into Asian markets, the study's regional focus limits its applicability to global market trends, raising questions about its relevance to regions with different economic dynamics. Similarly, Awad et al. (2007) employed ARDL to examine palm oil demand, adeptly capturing the short and long-term dynamics. However, their study could have been enriched by considering additional variables specific to the MENA region, such as political instability or trade policies, to provide a more nuanced understanding of the market. Egwuma et al. (2016) also chose ARDL for analyzing Nigeria's palm oil market, effectively capturing short-term fluctuations and long-term trends. Nonetheless, their focus on a single national market restricts the study's generalizability. A comparative analysis with other major palm oil-producing countries would offer a more comprehensive view of the global palm oil market.

In conclusion, while the existing literature offers valuable insights into CPO pricing determinants, a comprehensive understanding requires a critical approach that challenges established paradigms, integrates diverse perspectives, and remains vigilant to emerging trends and policy implications. This is especially pertinent in understanding the unique challenges and opportunities within the Malaysian CPO market and beyond.

3. Methodology

The aim of the research was the use of monthly frequency data from January 2004 to December 2021. This time period was selected mostly owing to the availability of data, namely the MPOB tax rate (Malaysian Palm Oil Board). In this research, eleven variables are included in the ARDL model, with CPO price as the dependent variable. Export of CPO, CPO production, CPO Export Tax, Stock of CPO, weather (Rainfall), Population, Economic Growth, Global consumption, Price of Soybean, Price of Sunflower, Exchange rate, and Consumer Price Index are the independent factors. This study's data came from various sources, including the Malaysian CPO Board (MPOB), Refinitif, and Bloomberg. These sources were used to collect accurate and exhaustive data on the variables of interest, assuring the validity and precision of the study's conclusions.

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Table 1. Variables description

Notation	Variable	Description
Y	CPO Price	Influenced by supply, demand, production costs, and more.
X1	CPO Export	Influenced by international demand, trade agreements, etc.
X2	CPO Production	Affected by weather, land availability, and government policies.
X3	CPO Stock	The quantity available is influenced by production and demand.
X4	Tax Rate	Affects profitability and consumer costs.
X5	Weather	Impacts production, yield, and pest/disease incidence.
X6	Population	Influences demand due to population growth and dietary shifts.
X7	Soybean Price	Indirectly affects CPO pricing as both are used in products.
X71	Sunflower Price	Indirectly impacts CPO pricing as an alternative oilseed.
X8	Economic Growth	Affects pricing through income levels, spending, and trade.
X9	Exchange Rate	Influences competitiveness, production costs, and prices.
X10	Consumer Price Index	Measures inflation and impacts production costs and demand.

3.1 Unit root test

The first phase of the investigation consisted of establishing the stationarity of the variables in order to avoid false regression and assure the dependability of the results. The ARDL (Autoregressive Distributed Lag) method demanded that the dependent variable be rigorously I(1) stationary, although the other variables might display mutual cointegration. The Augmented Dickey-Fuller (ADF), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), and Zivot-Andrews (ZA) tests were used to evaluate the stationarity qualities of the parameters.

3.2 ARDL model

As mentioned by Pasaran, Shin, and Smith (2001), the advantage of ARLD is that the variables can be estimated with the combination of I(0) and I(1) series at the same time, with the single equations' setup, that makes it simple to implement and interpret. This paper stabilises the series variance all the variables were transformed into logarithmic form. Below is the ARDL model that used:

$$\Delta Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \lambda D + \sum(\delta_1 \Delta X_1 + \delta_2 \Delta X_2 + \ldots + \delta_n \Delta X_n) + \varepsilon \quad (1)$$

Where ΔY represents the differenced dependent variable (CPO price), X_1, X_2, ..., X_n denote the independent variables (Export of CPO, CPO production, CPO Export Tax, Stock of CPO, weather (Rainfall), Population, Economic Growth, World consumption, Price of Soybean, Price of Sunflower, Exchange rate, and Consumer Price Index), α_0 is the short-run intercept term, β_1, β_2, ..., β_n represent the coefficients corresponding to the long-run relationship between the independent variables, λ represents the coefficient of the lagged dependent variable (D), which captures the speed of adjustment towards the long-run equilibrium, δ_1, δ_2, ..., δ_n represent the coefficients corresponding to the short-run relationship between the differenced independent variables, D represents the lagged dependent variable, and ε is the error term.

3.3 Stability test

Diagnostic tests, including the Breusch-Godfrey LM test, the Breusch-Pagan-Godfrey test, and the Ramsey RESET test, confirm the model's stability and correctness of specification. Furthermore, the

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Cumulative Sum (CUSUM) and CUSUM of Square tests demonstrate the stability of coefficients in our error correction model.

4. Empirical result

4.1 Unit root test

The integration of the order between the dependent and independent variables is the first step to confirm the integration of the variables. ADF, KPSS, and ZA P-value are carried out to fulfil the requirements of the order of integration. The Unit Root Test for all the variables reveal that variables X1 (CPO Export), X3 (CPO Stock), X5 (Weather), X6 (Population), X7 (Soybean Price), X8 (Economic Growth), X9 (Exchange Rate), and X10 (Consumer Price Index) are stationary at the level (I (0)). Variables Y (CPO Prices), X2 (CPO Production), X4 (Tax Rate), and X71 (Sunflower Price) are stationary at the first order different (I (1)).

Table 2: Stationary test

Variables	ADF Test Statistic	ADF p-value	KPSS Test Statistic	KPSS p-value	ZA Test Statistic	ZA p-value
DY	-5.4887	0.0000	0.0772	0.1000	-5.9600	0.0009
X1	-8.0622	0.0000	0.3259	0.1000	-8.1092	0.0000
DX2	-6.5516	0.0000	0.0144	0.1000	-6.8664	0.0000
X3	-7.1533	0.0000	0.0589	0.1000	-7.4540	0.0000
DX4	-5.6946	0.0000	0.0385	0.1000	-6.0444	0.0008
X5	-6.7682	0.0000	0.3219	0.1000	-7.0710	0.0000
X6	-13.6762	0.0000	0.2092	0.0100	-15.0049	0.0000
X7	-5.5713	0.0000	0.0756	0.1000	-6.1406	0.0007
DX71	-9.8547	0.0000	0.0454	0.1000	-10.0723	0.0000
X8	-1.9044	0.0003	0.4575	0.0524	-4.8835	0.0418
X9	-4.0972	0.0010	0.2140	0.1000	-6.3934	0.0004
X10	-7.8708	0.0000	0.3669	0.0100	-7.1689	0.0000

4.2 ARDL analysis

This study employs an Autoregressive Distributed Lag (ARDL) approach within an Error Correction Model (ECM) framework to investigate the dynamic relationship between a set of explanatory variables and the dependent variable. The ARDL model, specified as ARDL (2, 3, 4, 0, 0, 0, 1, 0, 4, 0, 4, 4), effectively integrates both short-run dynamics and long-run equilibrium considerations.

The model's explanatory power is substantial, as evidenced by an R-squared value of 0.750635 and an Adjusted R-squared of 0.722928. These metrics indicate that the model accounts for approximately 75% of the variation in Y. The Durbin-Watson statistic of 2.005086 suggests no significant autocorrelation in the residuals, further validating the model's reliability.

The F-Bounds Test results provide compelling evidence against the null hypothesis of no levels relationship, with an F-statistic of 22.06781, significantly exceeding the critical values at all conventional

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significance levels. This finding corroborates the presence of a cointegrating relationship, affirming the validity of employing the ECM within the ARDL framework.

Table 3: ARDL error correction model results

Variable	Coefficient (P-value)	Std. Error	t-Statistic
D(Y(-1))	0.139801 ***	0.053664	2.605101
D(X1)	-0.062004	0.046912	-1.321715
D(X1(-1))	0.395240 ***	0.057605	6.861150
D(X1(-2))	0.252911 ***	0.044649	5.664436
D(X2)	-0.100538 **	0.046573	-2.158694
D(X2(-1))	-0.216145 ***	0.053243	-4.059579
D(X2(-2))	-0.229841 ***	0.053209	-4.319612
D(X2(-3))	-0.155467 ***	0.044970	-3.457139
D(X6)	0.050221	0.052645	0.953951
D(X71)	-0.094955 *	0.051167	-1.855791
D(X71(-1))	0.295842 ***	0.056042	5.278934
D(X71(-2))	0.099887 *	0.053220	1.876886
D(X71(-3))	0.170030 ***	0.051304	3.314174
D(X9)	-0.093038 *	0.047679	-1.951331
D(X9(-1))	0.139945 **	0.050442	2.774346
D(X9(-2))	0.093124 *	0.049550	1.879384
D(X9(-3))	0.152577 ***	0.046848	3.256817
D(X10)	0.037249	0.096871	0.384518
D(X10(-1))	0.331838 ***	0.098052	3.384301
D(X10(-2))	0.391213 ***	0.097883	3.996761
D(X10(-3))	0.246652 **	0.097279	2.535503
CointEq(-1)*	-1.380503 ***	0.078875	-17.50232

Note: (***, **, *) denote 1%, 5%, and 10%, respectively.

The model reveals significant short-run interactions between Y and the independent variables. Lagged values of several variables, including D(X1(-1)), D(X1(-2)), and D(X71(-1)), demonstrate positive coefficients, indicating a beneficial short-run influence on Y. Conversely, D(X2), D(X2(-1)), D(X2(-2)), and D(X2(-3)) exhibit negative coefficients, suggesting a detrimental short-run impact on Y. These findings align with the expectation that previous periods' values of certain predictors have immediate but transient effects on Y. In the ARDL Error Correction model analysis, the short-run dynamics of Crude Palm Oil (CPO) prices are influenced by a range of factors, each contributing uniquely to the price fluctuations. For example, the model's findings on CPO Production (X2) reveal a consistent negative impact on CPO prices across the current and lagged periods. This trend aligns with the fundamental principles of supply and demand, where an increase in production typically leads to a decrease in prices. The persistence of this effect across multiple lags underscores the ongoing influence of production levels on market prices. Similarly, the immediate impact of CPO Exports (X1) on prices appears slightly negative but not statistically significant. However, the lagged effects of exports, particularly in the first and second lags, are notably positive and significant. This delayed but substantial impact suggests that changes in export levels may take time to influence market prices, reflecting the market's adaptive response to export fluctuations.

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The relationship between Sunflower Price (X71) and CPO prices is complex, with both negative and positive impacts observed across different lags. This complexity could be indicative of the competitive and complementary dynamics between these commodities in the market.

Exchange Rate (X9) fluctuations also demonstrate a mixed impact on CPO prices, with varying effects across different lags. This indicates a nuanced relationship where exchange rate movements can have diverse implications for CPO prices, depending on the specific time frame considered. The Consumer Price Index (CPI, X10) and its lags mostly show a positive relationship with CPO prices. This suggests that broader economic conditions, as reflected in the CPI, significantly influence CPO prices over time. Population (X6), while showing a positive coefficient, does not emerge as a statistically significant determinant in the short run, indicating its marginal impact on CPO price fluctuations within the observed period. Lastly, the error correction term (CointEq(-1)) is highly significant and negative, highlighting a strong and rapid adjustment of CPO prices towards long-run equilibrium. This suggests that any short-run deviations from equilibrium are effectively corrected in subsequent periods, reflecting the market's efficiency in self-regulating.

Table 4: F-Bounds test

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	22.06781	10%	1.76	2.77
k	11	5%	1.98	3.04
		2.50%	2.18	3.28
		1%	2.41	3.61

Note: F-Bounds Test conducted with both asymptotic and finite sample adjustments.

The F-statistic (22.06781) is above the upper bound I(1) critical values at all significance levels, suggesting that the null hypothesis of no cointegration can be rejected. Moreover, the results are robust across both asymptotic and finite sample sizes, enhancing the credibility of the cointegration conclusion.

Table 5: ARDL long-run result

Variable	Coefficient (P-value)	Std. Error	t-Statistic
X1	-0.427436 ***	0.096941	-4.409253
X2	0.187011 *	0.095064	1.967206
X3	-0.210504 ***	0.065419	-3.217768
X4	0.032357	0.017742	1.823697
X5	-0.003107	0.043959	-0.070687
X6	0.113288	0.103574	1.093782
X7	0.425869 ***	0.058068	7.333946
X71	-0.210078 ***	0.058280	-3.604635
X8	-0.011721	0.031151	-0.376251
X9	-0.192609	0.104035	-1.851381

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X10	-0.163149	0.140219	-1.163529
C	0.006976	0.009324	0.748137

Note: (***, **, *) denote 1%, 5%, and 10%, respectively.

In the long-run analysis using the Autoregressive Distributed Lag (ARDL) model, several key determinants of Crude Palm Oil (CPO) prices have been identified, each revealing unique insights into the market dynamics. The model's estimation of a negative coefficient for CPO Export (X1) suggests a significant inverse relationship between CPO exports and their prices. Specifically, the coefficient of -0.427436, significant at the 1% level, indicates that increased exports are associated with decreased CPO prices, potentially due to market saturation or intensified competition in international markets.

Conversely, CPO Production (X2) shows a positive correlation with CPO prices, as evidenced by a coefficient of 0.187011, significant at the 10% level. This implies that higher production levels are likely to lead to increased prices, possibly reflecting the costs associated with scaling production or the market's positive response to increased supply. The stock of CPO (X3) is found to have a significant negative impact on its prices. The coefficient of -0.210504, significant at the 1% level, suggests that an accumulation of CPO stock tends to depress prices, likely due to an oversupply scenario. Regarding the Tax Rate (X4), the model estimates a positive but statistically insignificant coefficient of 0.032357. This indicates that within this study's scope, the impact of tax rates on CPO prices is marginal and uncertain. Weather conditions (X5), represented by a coefficient of -0.003107, show a negligible long-run impact on CPO prices, as the coefficient is statistically insignificant. This suggests that weather variations do not significantly influence CPO prices in the long run. Population growth (X6) is positively correlated with CPO prices, with a coefficient of 0.113288. This indicates that increasing population, as a proxy for rising demand, may exert upward pressure on CPO prices. The study also reveals a strong complementary relationship between Soybean Price (X7) and CPO prices. The significant positive coefficient of 0.425869 at the 1% level could be due to substitution effects in the global vegetable oil market.

In contrast, Sunflower Price (X71) shows a competitive relationship with CPO prices. The significant negative coefficient of -0.210078 at the 1% level suggests that rising sunflower prices are associated with falling CPO prices, indicating competition between these commodities. Economic Growth (X8) presents an inconclusive impact on CPO prices, as indicated by a statistically insignificant negative coefficient of -0.011721. This result suggests that the role of economic growth in determining CPO prices remains undetermined in this context. The Exchange Rate (X9) is found to negatively influence CPO prices, with a coefficient of -0.192609. This points to the impact of currency valuation, where a stronger domestic currency may lead to lower CPO prices. Lastly, the Consumer Price Index (X10) shows a negative relationship with CPO prices, as evidenced by a coefficient of -0.163149. This may reflect the broader economic conditions' influence on commodity pricing.

Overall, the ARDL model's long-run analysis provides a nuanced understanding of the factors influencing CPO prices, highlighting the complex interactions between market forces and economic indicators in shaping the global commodity market.

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5. Diagnostic test

Table 6: Diagnostic result

Diagnostic test	X2 (P-value)	Result
Breusch-Godfrey LM	0.95	No evidence of serial correlations.
Breusch-Pagan-Godfrey	0.44	No evidence of heteroscedasticity.
Ramsey RESET	0.33	Model specified correctly.
Durbin-Watson Statistic	2.01	No major autocorrelation issues.

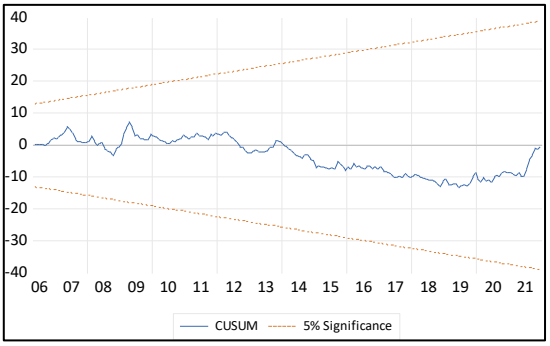

Figure 1. CUSUM

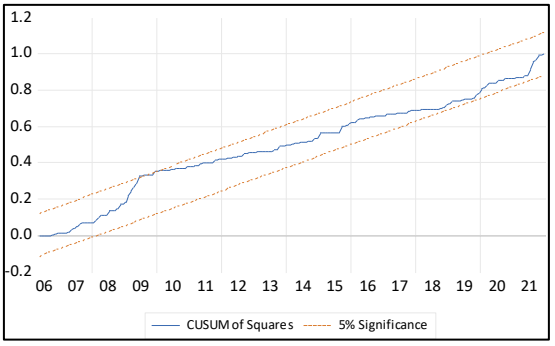

Figure 2. CUSUM

Figures 1 and 2 show the CUSUM and CUSUM of Square tests, confirming the stability of all coefficients in the error correction model.

6. Discussion

In the short run, our ARDL model findings reveal a significant influence of CPO exports (X1) and their lagged values on CPO Price, resonating with the observations of Sessa, Simonato, and Domingues (2017) on the Brazilian economy. This delayed yet substantial impact of export changes on commodity prices highlights the critical role of export dynamics in the CPO market. Additionally, our analysis indicates a negative relationship between CPO Production (X2) and its price, which aligns with the fundamental principles of supply and demand. This trend, also noted by Nikonenko et al. (2020), suggests that an increase in CPO production could lead to a decrease in market price, thereby affecting the economic landscape of exporting nations. Furthermore, the Consumer Price Index (X10) emerges as a significant predictor, underscoring the influence of broader economic conditions on CPO pricing. This is in line with Cavalcanti, Mohaddes, and Raissi (2012), who found that commodity terms of trade growth and volatility have substantial impacts on economic growth, emphasizing the importance of economic indicators in understanding commodity price dynamics.

In the long run, findings parallel those of Makin (2013), who observed that export commodity price fluctuations significantly impact macroeconomies, particularly in resource-exporting countries. This is consistent with our results, where increased CPO exports correlate with lower prices, likely due to market dynamics and competition. The positive relationship between CPO production and its price over the long term aligns with Tokgoz et al. (2007), who noted that expanded production of certain commodities leads to price increases. The influence of economic indicators like the CPI on CPO prices is further corroborated by Wang and McPhail (2014), who highlighted the significant contribution of energy price shocks to commodity price variation. Additionally, the complex interplay between different commodities, such as

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soybean, sunflower, and CPO prices, reflects the findings of Bodart, Candelon, and Carpantier (2012), emphasizing the long-run impact of dominant commodities on real exchange rates. These insights are crucial for policymakers in the CPO market, aiding in the formulation of strategies to stabilize and predict market movements amidst global inflationary processes and supply chain disruptions.

7. Conclusion

Our study reveals key insights into the dynamics of Crude Palm Oil (CPO) prices. In the short run, CPO exports significantly influence prices, highlighting the importance of export dynamics in market trends. A negative relationship between CPO production and its price reflects the classic supply-demand principle, suggesting that increased production can lower prices. Additionally, the Consumer Price Index (CPI) emerges as a significant factor, indicating the impact of broader economic conditions on CPO prices. In the long run, similar trends are observed, with exports and production continuing to play a crucial role in price determination. The findings stress the importance of long-run planning, considering future market trends and global demand-supply changes. This knowledge enables stakeholders to develop more effective strategies, such as adjusting production levels, exploring new export markets, or enhancing marketing efforts. For policymakers, these insights are vital for crafting policies that support a sustainable and profitable CPO industry, focusing on production optimisation, export enhancement, and resilience during economic fluctuations.

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Conflict of interest statement

The authors hereby affirm that the conduct of this study has been executed without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Amin, F. A., Sukeri, N. A. S., Hasbullah, N., and Jamaludin, N. (2019). Forecasting Value at Risk for Malaysian Palm Oil using Monte Carlo Simulation. International Journal of Academic Research in Business and Social Sciences.

Ahmad Hamidi, H. N., Khalid, N., Karim, Z. A., and Zainuddin, M. R. K. (2022). Technical Efficiency and Export Potential of the World Palm Oil Market. Agriculture, 12(11), 1918. https://doi.org/10.3390/agriculture12111918

Ahmad, T., Ahmad, F., Siswantara, I., Auzani, A., Susanto, I. (2021). External and internal shocks and the movement of CPO price: SVAR approach. Economies, 10(1), 7. https://doi.org/10.3390/economies10010007

Alatas, A. (2015). "Trend Produksi dan Ekspor Minyak Sawit (CPO) Indonesia." Agrarista, 19(2), 1-10. DOI: 10.18196/AGR.1215.

Amiruddin, A., Syamsul, H. M., and Siregar, H. (2021). "Factors affecting the volume of Indonesian CPO exports in international trade." IOP Conference Series: Earth and Environmental Science, 681(1), 012105. DOI: 10.1088/1755-1315/681/1/012105.

Ayudya, Resi, Suwandari, Anik, and Hartadi, Rudi. (2017). "The Impacts of Fundamental and Macroeconomic Factors on the Stock Price of Oil Palm Plantation Companies in Indonesia Stock Exchange (IDX)." Jurnal Ekonomi dan Bisnis Airlangga, 20(2), 1-10. DOI: 10.14414/JEBAV.V20I2.847.

Azhimah, F., and Saragih, C. (2019). FAKTOR – FAKTOR YANG TERKAIT DENGAN EKSPOR CRUDE PALM OIL (CPO). JURNAL AGROTEKNOSAINS. https://doi.org/10.36764/ja.v3i1.183.

Bodart, V., Candelon, B., and Carpantier, J. (2012). Real exchanges rates in commodity producing countries: A reappraisal.

Cavalcanti, T., Mohaddes, K., and Raissi, M. (2012). Commodity Price Volatility and the Sources of Growth.

Hassan, A., and Balu, N. (2016). Examining the long-term relationships between the prices of CPO and soyabean oil, CPO production and export: cointegration and causality. Oil Palm Industry Economic Journal, 16(1), 31-37.

Hadi, A., Hussain, H. I., Zainudin, Z., and Rehan, R. (2019). Crude Oil Price and Exchange Rates - The Case of Malaysia and Brunei. International Journal of Financial Research. DOI: 10.5430/IJFR.V10N5P1.

Headey, D., and Fan, S. (2008). Anatomy of a crisis: The causes and consequences of surging food prices. Agricultural Economics, 39(1), 375-391.

Hrabynska, I., and Kosarchyn, M. (2022). Factors in the Formation of Super-Cycles in World Commodity Markets.

Iskandar, A. (2015). Dampak Perubahan Harga Crude Palm Oil (CPO) Dunia Terhadap Value Ekspor Komoditas Kelapa Sawit Dan Perekonom1an Indonesia (Pendekatan Vector Autoregression Analysis).

Isa, M., Baharim, A., Mohamed, S., Noh, M., Nasrul, F., Ibrahim, W., and Hassan, S. (2021). A Study on Malaysian Crude Palm Oil Price Volatility. Modern Perspectives in Economics, Business and Management Vol. 6. https://doi.org/10.9734/bpi/mpebm/v6/12161d.

Isa, M., Baharim, A. T., Mohamed, S., Noh, M., Nasrul, F., Ibrahim, W. M. F. W., and Hassan, S. S. (2020). Crude Palm Oil Price Fluctuation in Malaysia. International Journal of Academic Research in Business and Social Sciences.

Ismail, M. A. (2022). Impak Harga Minyak Sawit terhadap Pertumbuhan Sektor Pertanian. Jurnal Ekonomi Malaysia.

Jamil, I., Kogid, M., Lim, T., and Lily, J. (2022). The Impact of Soybean Futures and Crude Oil Futures on Palm Oil Indexes: Evidence from Bounds Test of Level Relationship and Causality Analysis. Economies, 10(10), 237. https://doi.org/10.3390/economies10100237

Kadir, A. (2020). Oil Palm Economic Performance in Malaysia and RandD Progress in 2019. Journal of Oil Palm Research. https://doi.org/10.21894/jopr.2020.0032.

Kadir, A. P. G. (2020). Oil palm economic performance in Malaysia and RandD progress in 2019. Journal of Oil Palm Research

Kanchymalay, K., Salim, N., Sukprasert, A., Krishnan, R., and Hashim, U. (2017). Multivariate Time Series Forecasting of Crude Palm Oil Price Using Machine Learning Techniques. IOP Conference Series: Materials Science and Engineering, 226. https://doi.org/10.1088/1757-899X/226/1/012117.

Khalid, A., Daud, S. N. M., Arsad, Z., and Mobin, M. A. Energy Futures Price Bubbles and Asset Co-movements with Crude Palm Oil Futures: Through the Lenses of Geopolitical Events and Speculation.

Khosla, P. (2011). Nutritional characteristics of CPO. In Reducing Saturated Fats in Foods (pp. 112-127). Woodhead Publishing.

May, C. Y., and Nesaretnam, K. (2014). Research advancements in CPO nutrition. European Journal of Lipid Science and Technology, 116(10), 1301-1315.

Makin, A. (2013). Commodity prices and the macroeconomy: An extended dependent economy approach.

Malesios, C., Jones, N., and Jones, A. (2020). A change-point analysis of food price shocks. Climate Risk Management. DOI: 10.1016/j.crm.2019.100208.

Manurung, I., Bruemmer, B., and Kopp, T. (2019). Price Transmission in International Crude Palm Oil Markets: The Effects of Export Tax of Indonesia. Proceedings of the International Conference on Trade 2019 (ICOT 2019).

Muslih, A. M., Zakaria, W., and Kasymir, E. (2013). Faktor-Faktor Yang Mempengaruhi Ekspor CPO Provinsi Lampung

Mohammadi, F., Bilash, A., Abdulla, A. (2020). System dynamics analysis of the determinants of the Malaysian CPO price. Journal of Oil Palm Research, 32(4), 589-601.

Nazlioglu, S., and Soytas, U. (2012). Oil price, agricultural commodity prices, and the dollar: A panel cointegration and causality analysis. Energy Economics, 34(4), 1098-1104.

Neethling, J., and Stiglingh-Van Wyk, A. (2022). Analyzing the rising oil price shock driven by Russia-Ukrainian tensions - effect on inflationary pressure in South Africa. 14th GCBSS Proceeding 2022. DOI: 10.35609/gcbssproceeding.2022.2(63).

Nurcahyani, Marizha, Masyhuri, M., and Hartono, S. (2018). "The Export Supply Of Indonesian Crude Palm Oil (CPO) To India." Agro Ekonomi, 29(1), 1-14. DOI: 10.22146/AE.29931.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326.

Reynalto, A. (2019). Factors affecting the export of crude palm oil Indonesia. Agroland The Agricultural Sciences Journal (e-Journal), 6(2), 89-99.

Reynalto, A., and Ernah, E. (2020). Factors Affecting The Export of Crude Palm Oil Indonesia.

Rianto, B., Mochtar, H., and Sasmito, A. (2012). Palm Oil Plantation. Industry landscape, regulatory and financial overview. Jakarta.

Rosa, F. S., and Vasciaveo, M. (2008). Climate change and price transmission in Italian wheat markets. Agricultural Economics, 39(2), 219-229.

Sari, R., Suryani, A., and Wibowo, S. S. (2018). The effect of weather factors on crude CPO price: A case study of Indonesia. International Journal of Energy Economics and Policy, 8(6), 275-281.

Santeramo, F., Gioia, L., and Lamonaca, E. (2020). Price responsiveness of supply and acreage in the EU vegetable oil markets: Policy implications. Land Use Policy, 105102. DOI: 10.1016/j.landusepol.2020.105102.

Sehgal, S., et al. (2013). Relationship between crude CPO, crude oil, and vegetable oil: A wavelet-based analysis. Energy Sources, Part B: Economics, Planning, and Policy, 8(4), 400-408.

Sessa, C., Simonato, T. C., and Domingues, E. (2017). O ciclo das commodities e crescimento regional desigual no Brasil.

Siregar, K., and Syafarudin, A. (2020). Analysis of crude palm oil (CPO) production volume and price on profitability and its impact on stock returns. International Journal of Engineering Technologies and Management Research, 6(7). https://doi.org/10.29121/ijetmr.v6.i7.2019.419

Sivapragasam, A. (2008). The determinants of crude CPO prices: An empirical investigation. Journal of Agricultural Economics, 59(2), 171-184.

Siami-Namini, S., and Hudson, D. (2017). Volatility Spillover Between Oil Prices, US Dollar Exchange Rates and International Agricultural Commodities Prices. DOI: 10.22004/AG.ECON.252845.

Songsiengchai, Patchaya, Sidique, S. F., Djama, M., and Azman-Saini, W. (2018). "A cointegration analysis of crude palm oil price in Thailand." E3S Web of Conferences, 52, 00035. DOI: 10.1051/E3SCONF/20185200035.

Sofilda, E. (2022). Determinasi Permintaan CPO Pada 5 Negara Tujuan Ekspor Indonesia. Media Ekonomi.

Suarez, M., and Fernández, P. (2009). Commodities Prices Modeling Using Gaussian Poisson-Exponential Stochastic Processes, A Practical Implementation In The Case of Copper, 433-438. https://doi.org/10.7148/2009-0433-0438.

Susila, W. (2004). Impacts of CPO-export tax on several aspects of Indonesian CPO industry.

Syahril, Masbar, R., Majid, M., and Syahnur, S. (2019). Does Indonesia As The World Largest Palm Oil Producing Country Determine The World Crude Palm Oil Price Volatility. Regional Science Inquiry, 93-104.

Tomek, W. G., and Robinson, K. L. (1981). Agricultural product prices [USA]. Cornell University Press.

Tokgoz, S., Elobeid, A., Fabiosa, J. F., Hayes, D., Babcock, B., Yu, T.-H., Dong, F., Hart, C., and Beghin, J. (2007). Emerging Biofuels: Outlook of Effects on U.S. Grain, Oilseed, and Livestock Markets.

Wang, S. L., and McPhail, L. (2014). Impacts of energy shocks on US agricultural productivity growth and commodity prices.

Wong, K., Shamsudin, M., Mohamed, Z., and Sharifuddin, J. (2014). Effects of export duty structure on the performance of the Malaysian palm oil industry. Journal of Food Products Marketing, 20, 193-221. https://doi.org/10.1080/10454446.2014.946194

Yanita, M., Napitupulu, D., and Rahmah, K. (2020). Analysis of Factors Affecting the Competitiveness of Indonesian Crude Palm Oil (CPO) Export in the Global Market. , 2, 156-169. https://doi.org/10.32734/INJAR.V2I3.2857.

Zaidi, M., Abdul Karim, Z., and Zaidon, N. A. (2021). External and Internal Shocks and the Movement of Palm Oil Price: SVAR Evidence from Malaysia. Economies, 10(1), 7. MDPI. https://doi.org/10.3390/economies10010007

Zaidon, N. A., and Karim, A. (2019, September). Z. The Effects of External and Internal Shocks on the Movement of CPO Price: A SVAR Analysis of Malaysia. In Proceedings of the International Conference on Economics, Kota Kinabalu, Sabah, Malaysia (pp. 18-19).

Zulham, T., Hasan, I., Saputra, J., Noviar, H., and Risma, O. R. (2020). Does the World Price of Crude CPO and Total of Production Determine CPO Marketing Margins in Indonesia? Industrial Engineering and Management Systems, 19(3), 520-526.

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Authors' contributions

Mohd Shahrin Bahar carried out the research works with Prof. Dr Bujang and Dr Aziz Karia's assistance in conceptualising the central research idea and providing the theoretical framework. Prof. Dr Imbarine Bujang and Dr Nur Zahidah Baharudin carried out the reviews and revisions process and approved the article submission.