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POSITION OF INDONESIA'S CRUDE PALM OIL EXPORT MARKET IN MAJOR IMPORTING COUNTRIES: AN ALMOST IDEAL DEMAND SYSTEM APPROACH

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Abstract

Background: Although Indonesia holds the largest share of global crude palm oil (CPO) exports, large market share does not necessarily imply market power. Competition with Malaysia remains intense in major importing countries, particularly India, Pakistan, and China, where differences in demand structure and price responsiveness may shape each supplier's export position.
Purpose: This study aims to (1) analyze Indonesia's CPO export market share in major importing countries and (2) evaluate Indonesia's export market position relative to Malaysia using a demand-system approach.
Design/methodology/approach: Monthly data for 1994–2023 were compiled from UN Comtrade, ITC, BPS, and FAOSTAT. The analysis applies the Almost Ideal Demand System (AIDS) estimated using the Seemingly Unrelated Regression (SUR) method to identify demand responses and substitution patterns between Indonesian and Malaysian CPO exports.
Findings/Result: The results show that Indonesia's CPO exports dominate the Pakistani market, maintain a strong position in India, and face balanced competition in China. Elasticity estimates indicate relatively stable demand in India and Pakistan, whereas stronger substitution patterns and higher price sensitivity characterize the Chinese market.
Conclusion: Indonesia's export position varies across markets: strongest in Pakistan, strong in India, and more competitive in China. These differences reflect heterogeneous demand structures and varying levels of substitution between Indonesian and Malaysian CPO.
Originality/Value (State of the Art): This study provides a long-term market-specific assessment of Indonesia's CPO export positioning using a theoretically consistent AIDS framework. The findings contribute new empirical evidence on substitution dynamics and competitive interactions between Indonesia and Malaysia in major global CPO markets.

Keywords: AIDS, CPO, demand-system approach, export market, market position

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INTRODUCTION

Crude palm oil (CPO) is one of Indonesia's most important non-oil and gas export commodities and plays a strategic role in supporting the national economic performance. As the largest producer and exporter of palm oil globally, Indonesia, together with Malaysia, dominates the international market, accounting for more than 80 percent of total world palm oil exports in recent years. This dominant position is supported by international trade statistics, which consistently show that Indonesia and Malaysia together account for the majority of the global palm oil supply, making them key suppliers and influential price setters in the international vegetable oil market (United Nations, 2024; FAOSTAT, 2024). The palm oil sector contributes not only to export earnings but also to rural employment, agro-industrial development, and food price stability, particularly in developing countries that rely heavily on imported edible oils. Several studies have highlighted that palm oil plays an important role in supporting economic development, employment generation, and food security in many developing economies (World Bank, 2024; Rifin, 2013; Ahmad et al., 2022).

The global CPO market has become increasingly competitive over time, alongside changes in trade structure and demand patterns. Based on international trade statistics over the last decade, Indonesia contributes approximately 53 percent of global CPO exports, while Malaysia accounts for approximately 28 percent of global exports (United Nations, 2024). Recent trends show that Indonesia's export share has tended to stabilize, while several emerging exporters, such as Thailand and Colombia, have gradually increased their participation in international markets. This situation reflects intensifying competition among major exporters and across destination markets, where importing countries respond more actively to price movements, trade policies, and supply reliability. These developments reflect structural changes in the global palm oil trade, in which price competitiveness, trade policies, and supply stability increasingly shape market dynamics (United Nations, 2024; Rifin, 2013; Ahmad et al., 2022).

Refined palm oil has become the dominant form of palm oil exports in Indonesia, yet CPO remains economically significant in international trade. CPO functions as the primary input for downstream palm oil products and fluctuations in CPO prices directly affect production costs and competitiveness along the value chain. Several major importing countries including India and Pakistan continue to import substantial volumes of CPO to meet their domestic refining demand. According to international trade statistics, India imported more than five million tons of CPO in 2023 while Pakistan imported over two million tons during the same period, reflecting strong demand from domestic refining industries (United Nations, 2024). CPO prices also function as a benchmark for palm oil derivatives, causing price movements in CPO to be transmitted to refined palm oil and other downstream products. Consequently, CPO prices often serve as reference prices in international vegetable oil markets because changes in CPO prices are quickly transmitted to refined palm oil and other palm-based products through integrated supply chains. Therefore, analyzing CPO trade flows provides an important representation of demand behavior and competitive dynamics in the global palm oil market (World Bank, 2024).

India, Pakistan, and China are the most important destination markets for Indonesian CPO exports and exhibit distinct market characteristics. India represents the largest importer driven by high consumption demand and a well-established domestic refining industry. Pakistan demonstrates a high level of dependence on Indonesian CPO supplies supported by price competitiveness and relatively stable bilateral trade relations (Chalil and Barus, 2018). China represents a more diversified and competitive market structure characterized by substitution among vegetable oils and stronger competition among exporting countries. These heterogeneous market conditions indicate that Indonesia's export position and demand responses vary substantially across importing countries.

Previous studies have analyzed the competitiveness and market position of Indonesian crude palm oil in international trade using various analytical approaches. Empirical evidence suggests that Indonesia generally holds a comparative advantage in major importing countries, although this advantage remains sensitive to relative price movements and trade policy interventions (Rifin, 2010; Utsaha and Anisa, 2022). Research focusing on the Indian market shows that Indonesia's competitive position is dynamic and influenced by pricing strategies and rivalry with Malaysia as the main competing exporter (Itamary et al., 2022). Comparative analyses further indicate that dominance in export

volume does not necessarily translate into stronger market power when demand elasticity and substitution effects are considered (Saban and Novianti, 2023).

Most existing studies rely on descriptive indicators such as export shares, revealed comparative advantage indices, or simple competitiveness measures, or employ partial equilibrium frameworks and therefore provide limited insight into market-specific demand behavior. While many studies apply regression-based inferential analysis, they often focus on single-equation models that do not simultaneously capture the substitution relationships among competing exporters. Long term analyses that explicitly model own price effects, cross price substitution, and expenditure responses across competing exporters remain scarce. This limitation is important because exporter competitiveness is not determined solely by export volume or market share but also by how importing countries adjust their demand in response to price changes and to income growth. A deeper understanding of these demand responses is required to accurately assess Indonesia's export position and competitive strength across heterogeneous importing markets (Suryana, 2016; Wibowo et al., 2021).

The Almost Ideal Demand System (AIDS) provides a theoretically consistent framework for analyzing import demand through the joint estimation of own price effects cross price substitution, and expenditure effects. Estimation using seemingly unrelated regression allows correlation across demand equations and improves efficiency in markets where suppliers compete closely (Deaton and Muellbauer, 1980; Chang and Chi, 2002; Green and Alston, 1990). This framework is well-suited for analyzing CPO trade, given the strong interdependence between Indonesia, Malaysia, and other suppliers in major importing markets and the high degree of substitutability among palm oil supplies from different origins. Recent studies indicate that global palm oil competitiveness is increasingly shaped by trade restrictiveness, policy interventions, and structural market conditions in the importing countries.

Hamidi et al. (2024) show that variations in trade restrictiveness significantly affect world palm oil exports, while Lugo-Arias et al. (2024) emphasize the role of price competitiveness and macroeconomic factors in determining export performance. In addition, empirical evidence suggests that competitiveness in the global palm oil market is dynamic and sensitive to structural changes and policy environments (Tandra et al., 2022; Pratama et al., 2024). Previous empirical studies have examined palm oil import demand and competitiveness using various approaches in different markets. Import demand analyses in Asian and non-traditional markets highlight the importance of price effects, substitution patterns, and income growth in shaping palm oil trade flows (Awad et al., 2016; Zakaria et al., 2018; Tandra, 2022).

Studies focusing on India and China emphasize heterogeneous demand responses and increasing competitive pressure among exporting countries (Kumar and Gulati, 2018; Yadav and Chattopadhyay, 2025; Abdullah, 2024). However, most of these studies rely on a single equation or partial equilibrium frameworks and provide limited market specific elasticity estimates. In contrast, demand system approaches allow a more comprehensive assessment of substitution and expenditure effects across competing suppliers (Aulia, 2019; Ximenes, 2022).

This study addresses the existing research gap by providing a long-term, market specific analysis of Indonesia's CPO export position in India, Pakistan, and China using the AIDS approach. The analysis focuses on Indonesia's CPO export market share and evaluates its market position relative to Malaysia and other suppliers based on own price, cross-price, and expenditure elasticities. By employing long-term monthly data and a theoretically consistent demand system framework, this study provides updated empirical evidence on the substitution dynamics and competitive interactions between Indonesia and Malaysia across heterogeneous importing markets.

METHODS

This study employs monthly secondary data from 1994 to 2023. The data consist of crude palm oil (CPO) import values, prices, and volumes classified under HS code 151110. Data were obtained from several authoritative sources, including the United Nations Comtrade Database, International Trade Centre Trade Map, Statistics Indonesia (BPS), and FAOSTAT. A long observation period was selected to capture structural changes in the global palm oil trade, including price fluctuations, policy interventions, and shifts in demand patterns across major importing countries. The analysis

focuses on Indonesia as the main exporting country, with Malaysia and other exporting countries grouped as the rest of the world (ROW) for comparison purposes. The selected importing countries are India, Pakistan, and China, which represent Indonesia's largest and most consistent CPO-export destinations during the observation period.

All data were collected through official international trade databases using harmonized commodity classifications to ensure consistency across countries and over time. Import values and quantities were compiled on a monthly basis and subsequently used to calculate unit import prices. Data verification was conducted by cross-checking information from multiple sources to minimize discrepancies and ensure data reliability. All variables were transformed into real values and standardized units prior to estimation.

This study uses an almost ideal demand system (AIDS) model based on the Deaton & Muellbauer (1980) a seemingly unrelated regression (SUR) estimate. This model, can be used because it is able to analyze the import demand for a commodity. The use of the AIDS model is further justified by its ability to produce theoretically consistent elasticity estimates, particularly when estimated using SUR and a properly defined Stone price index, as emphasized in the demand system literature (Alston et al., 1994; Moschini, 1995). The AIDS specifications used in the data analysis are as follows Chang & Chi (2002):

$$w_i = \alpha_i + \sum^{n}_{j=1} \gamma_{ij} \ln P_J + \beta_i \ln(x/p^*)$$

Description: w (CPO import share (%)); P (CPO import price (US$/ton)); αi, γ_{ij}, and βi(parameter); x (Total value of CPO imports (US$)); n (amount of CPO imports); p^* (stone price index). The Stone price index formula is:

$$\ln p^* = \sum^{n}_{i=1} w_i \ln p_i$$

In this study, for each market (India, Pakistan, and China), three CPO import share equations were compiled, each for Indonesia (ina), Malaysia (mly), and other suppliers (row), which aims to analyze the position of the Indonesian market compared to its competitors.

$$w_{ina} = \alpha_1 + \gamma_1 \ln P_{ina} + \gamma_2 \ln P_{mly} + \gamma_3 \ln P_{row} + \beta_1 \ln(x/p^*)$$

$$w_{mly} = \alpha_2 + \gamma_4 \ln P_{ina} + \gamma_5 \ln P_{mly} + \gamma_6 \ln P_{row} + \beta_2 \ln(x/p^*)$$

Description: (share of Indonesian CPO imports); (share of CPO imports from Malaysia); Pi (CPO import price from Indonesia (US$/ton); Pm (CPO import price from Malaysia (US$/ton); Pr (import price of CPO ROW(US$/ton); α1,α2 (intercept); γ_1, γ_2, ...γ_6 (coefficient); β_1, β_2 (coefficient); x/p^*(the total import value affected by the corrected Stone price index).

The hypotheses in this study are derived from economic demand theory and previous empirical studies on international commodity trade. These hypotheses were formulated to explain how price changes and import expenditure influence the demand for crude palm oil (CPO) from different exporting countries. In the context of the global palm oil trade, importing countries often adjust their sourcing decisions based on relative prices and overall import spending. Therefore, examining elasticity responses provides important insights into the competitive interactions between Indonesian and Malaysian CPO exports. Based on these theoretical considerations, the following hypotheses are proposed to analyze CPO competition in major importing markets. The provisional hypothesis for analyzing CPO competition in the major importer market is as follows:

1. Price elasticity itself is negative (-) across markets and suppliers, with varying amounts between countries: close to one in India, more than one in Pakistan, and below one in China.
2. The cross-price elasticity between suppliers is positive (+), reflecting substitution. Indonesian and Malaysian substitutions are estimated to be strongest in India, weaker in Pakistan, and weakest in China, while substitutions to ROW exist but tend to be smaller.
3. The elasticity of expenditure is estimated to differ across markets. In India and Pakistan, the value is more than one so that the increase in total import expenditure will increase the volume of CPO imports, while in China, the elasticity of Indonesia's expenditure does not exceed one, and the increase in total import spending is not proportional to the increase in Indonesia's share.

The following is a formal formula for the three main economic conditions in the AIDS model: adding-up, homogeneity, and symmetry are as follows:

1. Adding-up condition (Sum Coefficient = 0)

The purpose of this restriction is to ensure that the total allocation of expenditure is always added to 1 (or 100%), so that the model is consistent with economic theory, in order to meet the adding-up, the following conditions must be met:

$$\alpha_{ind} + \alpha_{mly} = 1, \gamma_{ind,ind} + \gamma_{mly,ind} = 0, \gamma_{ind,mly} + \gamma_{mly,mly} = 0,$$

$$\beta_{ind} + \beta_{mly} = 0$$

2. Homogeneity Condition (Zero Degree Homogeneity to Price)

The homogeneity restriction aims to ensure that, in each CPO demand equation, the sum of the entire price coefficient equals zero.

$$\text{Indonesia: } \gamma_{ind,ind} + \gamma_{ind,mly} = 0;$$

$$\text{Malaysia: } \gamma_{mly,ind} + \gamma_{mly,mly} = 0$$

3. Symmetry Condition

Symmetry ensures that the substitution relationship between commodities is reciprocal. Symmetry is fulfilled when:

$$\gamma_{ind,mly} = \gamma_{mly,ind}$$

Demand elasticity analysis is the main output of the AIDS model estimation and is important for assessing how sensitive demand is to changes in prices and expenditures. The estimation system was carried out by seemingly unrelated regression in Stata 17, because the equation of the share between suppliers is interrelated so that the efficiency of the estimation increases when the covariance error term is modeled together. (Juanda & Junaidi, 2012).

Figure 1 presents the conceptual framework used to analyze the market position of Indonesian CPO exports in major importing countries, India, Pakistan, and China. Relative import prices from Indonesia, Malaysia, and other suppliers are examined using the Almost Ideal Demand System (AIDS) estimated by SUR to obtain own-price, cross-price, and expenditure elasticities. These elasticity measures are then used to assess Indonesia's market position and derive conclusions and policy recommendations for the country.

This study estimates the uncompensated own-price elasticity, compensated cross-price elasticity, and expenditure elasticity. Uncompensated elasticity captures the combined effects of price changes and income adjustments, thereby reflecting the actual market response. In contrast, compensated elasticity isolates the pure substitution effect by holding the utility constant. The analysis is further complemented by expenditure elasticity to assess how changes in total import spending influence the CPO demand. The elasticity formulas employed in this study follow the established demand system literature (Forgenie et al., 2023; Nguyen & Jolly, 2013; Wan et al., 2010).

Expenditure elasticity

$$\eta_{ina/mly} = 1 + (\beta_{ina/mly}/w_{ina/mly})$$

Cross price elasticity (compensated)

$$E^*_{ina,mly} = -\delta_{ina,mly} + (\gamma_{ina,mly}/w_{ina}) + w_{mly}$$

Own price elasticity (uncompensated)

$$E^*_{ina,mly} = -\delta_{ina,mly} + (\gamma_{ina,mly}/w_{ina}) + \beta_{ind,pks,chn}(w_{mly}/w_{ina})$$

Where: $\delta_{ina,mly}$ denotes the Kronecker delta, which equals 1 when and 0 otherwise; w_{ina} and w_{mly} represent the import expenditure shares of Indonesian and Malaysian CPO in the importing country; $\beta_{ind,pks,chn}$ denotes the expenditure coefficient associated with the total CPO import expenditure of the importing country; $\gamma_{ina,mly}$ represents the price parameter capturing the substitution effect between Indonesian and Malaysian CPO.

RESULTS

Indonesia's CPO Export Market Share in Major Importing Countries

The global CPO market remains dominated by Indonesia and Malaysia, which together account for more than 80 percent of global palm oil production and exports. According to the World Bank (2024), Indonesia contributes around 53 percent of total global palm oil

production, while Malaysia accounts for approximately 28 percent. Based on international trade data from UN Comtrade (2024), Indonesia's CPO export value reached more than USD 24 billion in 2023, whereas Malaysia's exports were valued at approximately USD 14 billion. These figures confirm that both countries remain the primary exporters shaping the price and supply dynamics of CPO in the international market.

The structure of Indonesia's CPO export market in major importing countries shows variations in the dominance patterns. Table 1 shows that in India, Indonesia's market share reached 55.3 percent, much higher than Malaysia's 37.8 percent, while other countries (ROW) only contributed 6.9 percent. This condition confirms that India is the main importer of Indonesia, with a relatively strong level of dominance. In Pakistan, Indonesia's position is even more dominant, with a market share of 64.7 percent compared to Malaysia's 30.2 percent. Pakistan's high dependence on Indonesian CPO supply is not only influenced by price competitiveness and import volume, but also by long-standing bilateral trade relationships and stable supply arrangements between Indonesia and Pakistan (Chalil & Barus, 2018).

In contrast to India and Pakistan, the Chinese market exhibits a more balanced competitive structure. Indonesia accounts for approximately 48.5 percent of imports, Malaysia for around 40.6 percent and the rest of the world (ROW) represents about 10.9 percent. This distribution indicates stronger competition among suppliers, as market shares are more evenly distributed than in the other two markets. Because the analysis focuses on crude palm oil classified under the same HS code, these differences reflect variations in the import demand structure and supplier competition rather than consumer product preferences. Consequently, the Chinese market can be characterized as a more competitive environment where multiple exporters actively compete for market share.

The variation in market shares across importing countries reflects differences in industrial demand and the downstream utilization of palm oil. India imports large volumes of crude palm oil primarily to supply downstream industries that produce derivative products, such as ghee and other processed food products. China, by contrast, imports a more diversified mix of palm oil products, including refined palm oil (RPO) for household consumption and food processing industries, which contributes to a more balanced sourcing structure among exporters. Pakistan continues to rely heavily on crude palm oil as the primary input for its domestic cooking oil refining industry, which partly explains Indonesia's relatively larger market share in that market.

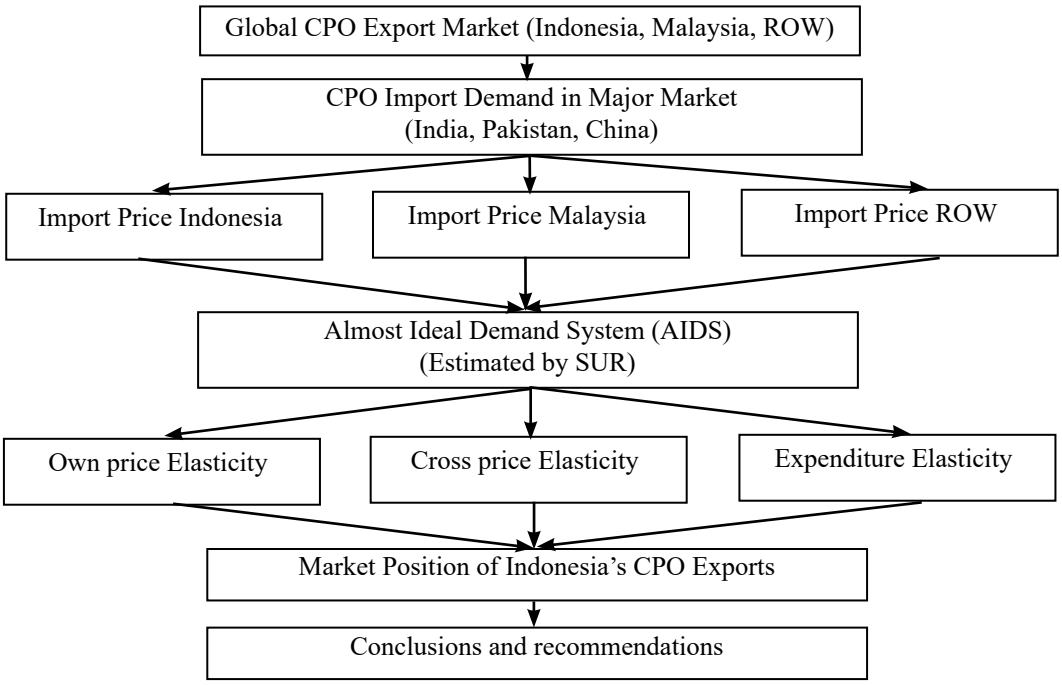

Figure 1. Conceptual framework of Indonesian CPO export market position analysis using the Almost Ideal Demand System (AIDS)

CPO Demand Structure in Indonesia's Main Export Market

The structure of CPO demand in Indonesia's main export market is illustrated by the results of the AIDS model estimation. In these estimates, the adding-up, homogeneity, and symmetry requirements were considered to maintain consistency with demand theory (Deaton & Muellbauer, 1980). The adding-up requirements are met automatically in the model specifications because the entire share of spending is added together. The homogeneity and symmetry restrictions were tested using the Likelihood Ratio Test, and the results showed that both restrictions were accepted at a significance level of 5%. Thus, the model used in this study is theoretically consistent and feasible to analyze price elasticity and expenditure in the CPO market.

Table 2 shows the AIDS Model estimates for CPO demand in India, Pakistan, and China. The result show that Indonesia has a higher share than Malaysia, especially in Pakistan, with a dominance of 0.647. In India, Indonesia's share is also larger (0.553 compared to 0.378), while in China, the difference is smaller (0.485 compared to 0.406), reflecting a more competitive market. The price coefficient (pi) is consistently negative and significant in almost all markets. This is in line with the law of demand, which states that an increase in prices will decrease demand. The relatively small coefficient value indicates that CPO demand is inelastic, meaning that price changes are not followed by comparable changes in demand.

The cross-price coefficient (p_m) is mostly positive, indicating a substitution relationship between Indonesian and Malaysian CPOs price. In India, a cross-price coefficient of 0.030 (p = 0.018) indicates that an increase in Malaysian CPO prices drive an increase in Indonesia's CPO demand. In China, the substitution pattern is relatively stronger, although the statistical significance only appears at the level of 10%. These findings support the research of Rifin (2013) and Ahmad et al. (2022), which show that consumers in the Asian market, particularly China, are very responsive to changes in price and product quality. Meanwhile, the expenditure coefficient (X/P*) is positive and significant in almost all equations, confirming that CPO is a normal good.

Table 1. Average Market Share of Indonesian and Malaysian CPO Exports in India, Pakistan, and China (1994–2023)

Importers	Indonesia	Malaysia	ROW (rest of world)
India	55.3	37.8	6.9
Pakistan	64.7	30.2	5.1
China	48.5	40.6	10.9

Source: United Nations Comtrade Database (2024).

Table 2. Estimation Results of the AIDS Model for CPO Import Demand in India, Pakistan, and China

Variable	India		Pakistan		China	
	Indonesia	Malaysia	Indonesia	Malaysia	Indonesia	Malaysia
α	0.553***	0.378***	0.647***	0.302***	0.485***	0.406***
	(0.002)	(0.004)	(0.001)	(0.012)	(0.007)	(0.003)
pi	-0.085***	0.030**	-0.090***	0.025	-0.100***	0.040
	(0.004)	(0.072)	(0.001)	(0.038)	(0.015)	(0.033)
Pm	0.030**	-0.075***	0.025**	-0.070***	0.040	-0.085***
	(0.018)	(0.002)	(0.021)	(0.003)	(0.067)	(0.001)
p_r	0.055***	0.045***	0.065***	0.045***	0.060***	0.045***
	(0.000)	(0.001)	(0.000)	(0.006)	(0.004)	(0.003)
X/P*	0.120***	0.030	0.100***	0.020	0.080***	0.060***
	(0.000)	(0.023)	(0.000)	(0.081)	(0.002)	(0.001)
R^2	0.613	0.578	0.685	0.535	0.527	0.643

Note: The equations were estimated using the Seemingly Unrelated Regression (SUR) method. The numbers in parentheses represent p-values. The parameters α, β, and γ correspond to the intercept, expenditure effect, and price interaction parameters in the AIDS demand system.

The R^2 values reported in Table 2 indicate the explanatory power of the AIDS demand equations in capturing the variation in the import expenditure shares of Indonesian and Malaysian CPO in the three markets. The values ranged from 0.527 to 0.685, suggesting that the model explains a substantial proportion of the variation in demand across importing countries. Higher R^2 values in the Pakistan and India equations indicate that price and expenditure variables play an important role in explaining the demand for CPO imports in these markets. This result is consistent with the expenditure elasticity estimates, where Indonesia's expenditure coefficients in India (0.120; p = 0.000) and Pakistan (0.100; p = 0.000) reflect the strong dependence of import demand on total import spending. In contrast, the relatively lower R^2 values in the China equations suggest a more diversified and competitive market structure, where substitution effects between Indonesian and Malaysian CPO are stronger. Overall, the results confirm that the AIDS model adequately captures the competitive interaction between Indonesian and Malaysian CPO exports across India, Pakistan, and China.

The Position of Indonesia's CPO Export Market in the Main Importer Market

The competition between Indonesia and Malaysia in India, Pakistan, and China is analyzed using three main indicators: uncompensated price elasticity, cross-price elasticity (compensated), and expenditure elasticity. Uncompensated price elasticity reflects the actual demand response because it incorporates both substitution and income effects. In contrast, cross-price elasticity focuses on the substitution effects between suppliers by controlling for purchasing power changes. Expenditure elasticity captures how import demand responds to changes in total import spending in each market.

These three indicators provide complementary information for assessing the export competition between Indonesian and Malaysian CPO. Higher cross-price elasticity indicates stronger substitution between suppliers and, therefore, more intense competition. Moderate elasticity values suggest a medium level of competition, where suppliers remain substitutable, but market shares are relatively stable. Low elasticity values indicate weaker substitution and, therefore, lower competitive pressure between exporters. Based on this framework, the elasticity estimates from the AIDS model are used to evaluate the relative competitiveness of Indonesian CPO exports in each importing market.

Price elasticity itself is analyzed using uncompensated elasticity because this indicator reflects real conditions in the market, where price changes not only trigger the substitution effect, but also affect purchasing power (income effect). In the context of international trade, importers not only consider the price differences between suppliers, but also adjust their import volumes to budget constraints. Therefore, the use of uncompensated elasticity is more relevant to analyze the competitiveness of Indonesia's CPO exports in the main importer market. In line with the literature that explains that (Green & Alston, 1990)uncompensated elasticity is used in agricultural commodity analysis because it is more applicable in policy formulation.

Own Price Elasticity (Uncompensated)

Table 3 shows the results of the estimated uncompensated price elasticity for Indonesian and Malaysian CPO demand in the three main importing countries: India, Pakistan, and China. The value of elasticity across the market is negative, according to the law of demand, which states that an increase in the price of an item will decrease the amount of demand. In addition, all elasticity values are in the inelastic category ($|E| < 1$), indicates that price changes do not cause a proportionate change in the amount of demand. This is because CPO is a staple commodity used as a raw material for food and industry, so its consumption is relatively stable despite price fluctuations.

This condition indicates a stronger reliance of Pakistani importers on Indonesian CPO, supported by relatively competitive prices and stable bilateral trade relations. This finding is consistent with studies that emphasize the role of structural trade relationships in shaping Indonesia's export competitiveness. In contrast, the price elasticity in the Chinese market is relatively larger in absolute value (Indonesia = −0.65; Malaysia = −0.72) compared with India and Pakistan, although it remains within the inelastic range. This suggests that while demand in China is still relatively inelastic, importers exhibit a higher responsiveness to price changes and greater substitution possibilities between suppliers than in other markets. Consequently, the Chinese market reflects a more competitive structure, where Indonesian and Malaysian CPO compete more closely in terms of price.

Cross-Price Elasticity (Compensated)

Cross-price elasticity (compensated) measures the percentage change in the quantity of goods consumed in response to price changes in related commodities. This elasticity provides insight into whether the export relationships between countries are characterized by substitution or complementarity. As illustrated in Table 4, the estimated cross-price elasticity between Indonesia's and Malaysia's CPO exports in major destination markets is positive, indicating that the two countries are perceived as substitute suppliers rather than complementary ones. A positive cross-price elasticity implies that an increase in the export price of one country leads to a shift in demand toward the other suppliers.

Cross-price elasticity measures the responsiveness of the demand for one product to changes in the price of another related product. In international trade analysis, this indicator is important for identifying whether goods from different suppliers act as substitutes or as complements. A positive cross-price elasticity indicates that an increase in the price of one exporter's product increases the demand for the competing supplier's product. In the context of the CPO market, this measure helps to explain the competitive interaction between Indonesian and Malaysian exports. Therefore, cross-price elasticity provides valuable information on the degree of substitution between suppliers in major importing markets.

Furthermore, the strong substitution relationship observed across markets suggests that non-price factors such as product quality, sustainability standards, and bilateral trade relations play an increasingly important role as strategic differentiation instruments. These results are consistent with previous studies indicating that India remains Indonesia's dominant CPO export market (Nurcahyani et al., 2018; Setyadewanta et al., 2016). This value shows that Chinese consumers are very responsive to price differences. These findings support studies that emphasize that the Chinese market is more competitive, price-sensitive, and influenced by sustainability issues (Ahmad et al., 2022). Thus, this result confirms that Indonesia cannot rely solely on production dominance but must strengthen its competitiveness through downstream innovation, quality control, and adaptive export policies. This strategy will ensure that Indonesia's position remains strong despite the competitive market structure.

Table 3. Own-Price Elasticity Estimates (Uncompensated) from the AIDS Model for Indonesian and Malaysian CPO Imports in India, Pakistan, and China

Importers	Indonesia	Malaysia
India	-0.42	-0.55
Pakistan	-0.38	-0.60
China	-0.65	-0.72

Source: Authors' estimation based on UN Comtrade data (1994–2023). Note: Uncompensated (Marshallian) elasticities measure the responsiveness of import demand to changes in the price of the same product while incorporating the income effects.

Table 4. Cross-Price Elasticity Estimates (Compensated) from the AIDS Model for Indonesian and Malaysian CPO in India, Pakistan, and China

Importers	Indonesia	Malaysia
India	0.22	0.20
Pakistan	0.18	0.15
China	0.35	0.32

Source: Authors' estimation based on UN Comtrade data (1994–2023). Note: Compensated (Hicksian) elasticities represent the substitution effects between Indonesian and Malaysian CPO imports while holding real expenditure constant.

The positive cross-price elasticity between Indonesian and Malaysian CPO indicates the presence of substitution between the two exporters, implying that an increase in the price of one supplier tends to increase the demand for the other. Although the magnitude of elasticity is less than one, the positive sign confirms that Indonesian and Malaysian CPO compete within the same import market and are partially substitutable in demand. This result is consistent with recent findings that document competitive interactions and substitution patterns among major palm oil exporters in the global market (Lugo-Arias et al., 2024). In addition, recent studies suggest that export competitiveness is increasingly shaped not only by price differences but also by broader structural factors, such as sustainability standards and supply chain integration (Dermoredjo et al., 2025).

Expenditure Elasticity

Expenditure elasticity is an important indicator for understanding how changes in income affect the level of demand for a commodity (Pindyck & Rubinfeld, 2018; Varian, 2010). Table 5 shows how changes in spending in major importing countries affect the demand for Crude Palm Oil (CPO) from Indonesia and Malaysia. Expenditure elasticity is an important indicator for determining whether CPO is categorized as a luxury or normal good. Luxury goods are indicated by an elasticity of more than one, which means that an increase in spending in the destination market is followed by a proportionately larger increase in demand. In contrast, normal goods are characterized by an elasticity of less than one, where an increase in spending is not entirely followed by an increase in demand (Pindyck & Rubinfeld, 2018).

The results of the estimation show that there are differences in demand characteristics in each country. In India and Pakistan, CPO from Indonesia and Malaysia tends to be in the luxury goods category. This indicates that income growth and increased purchasing power will drive a significant surge in CPO demand. These conditions reflect the large and prospective market potential, so export strategies need to be directed at increasing supply volumes, maintaining price stability, and strengthening long-term trade contracts. In China, CPO is more appropriately classified as a normal good. This shows that although import spending is increasing, the CPO demand is not increasing sharply. The main factors that explain this condition are the consumption pattern of palm oil in China, which is more oriented towards refined palm oil, the diversification in the use of other vegetable oils, and increasing attention to sustainability issues.

Thus, Indonesia's export strategy needs to be adjusted to the characteristics of each market segment. In India and Pakistan, the main focus is on maintaining competitive prices, expanding bilateral cooperation, and ensuring supply availability. In China, a more relevant approach is product differentiation through downstreaming, quality improvement, and compliance with sustainability standards to maintain competitiveness. The positive cross-price elasticity results are consistent with previous demand-system studies that identified substitution and competitive interactions among palm oil suppliers in international markets (Aulia, 2019; Ximenes, 2022). Similar evidence of heterogeneous expenditure responses across importing countries has been reported in recent palm oil import demand studies (Awad et al., 2016; Yadav, 2025).

Table 5. Expenditure Elasticity Estimates from the AIDS Model for Indonesian and Malaysian CPO Imports in India, Pakistan, and China

Importers	Indonesia	Malaysia
India	1.25	1.05
Pakistan	1.12	1.08
China	0.92	0.88

Source: Authors' estimation based on UN Comtrade data (1994–2023). Note: Expenditure elasticity measures the responsiveness of import demand to changes in total import expenditure of CPO in each destination market.

The results indicate that increases in total import spending in India and Pakistan tend to raise the demand for CPO proportionally more than the growth in expenditure, as reflected by expenditure elasticity values greater than one for both Indonesian and Malaysian CPO. This suggests that CPO behaves as an expenditure-responsive product in these markets, where expanding import demand is closely associated with the growth of edible oil consumption and downstream processing industry. In contrast, the estimated expenditure elasticities in China are below one for both Indonesia (0.92) and Malaysia (0.88), indicating that CPO behaves as a normal good with a relatively stable demand. This implies that an increase in total import expenditure does not lead to a proportionally larger increase in CPO demand in the Chinese market. The result reflect structural differences in market demand, where China's edible oil consumption is more diversified and substitution among vegetable oils is stronger, leading to a more moderate response of CPO demand to increases in import expenditure.

These findings differ from the results reported by Rifin (2013), who classified CPO in China as a luxury good, while Indonesian CPO in India was categorized as a normal good and Malaysian CPO as a luxury good. The differences between these findings suggest that market behavior and competitive dynamics among palm oil exporters may evolve over time due to changes in the demand structure, trade policies, and market conditions. Overall, these results highlight the need for Indonesia to strengthen its export strategy by improving price competitiveness, maintaining supply reliability, and adapting to evolving market conditions. Such strategies are consistent with recent evidence emphasizing the growing importance of competitiveness and structural adjustments in the global palm oil trade (Tandra et al., 2022; Dermoredjo et al., 2025).

Managerial Implications

The empirical findings of this study demonstrate that Indonesia's crude palm oil (CPO) export competitiveness varies markedly across major importing countries, reflecting heterogeneous demand structures and elasticity responses. These results indicate that a standardized export strategy is no longer appropriate, and that export and trade policies should be formulated based on market-specific demand characteristics to ensure sustained competitiveness. In the Indian market, CPO behaves as an expenditure-responsive product, as indicated by expenditure elasticity values that exceed unity. This result suggests that growth in import expenditure is likely to translate into a more than proportional increase in the demand for Indonesian CPO. At the same time, the presence of positive cross-price elasticity between Indonesian and Malaysian CPO indicates substitution between suppliers and highlights the importance of price competition in this market. Consequently, Indonesia's market position in India remains sensitive to the relative price movements.

Accordingly, export strategies should emphasize cost efficiency, logistics optimization, and pricing stability. The use of long-term supply contracts may help reduce demand volatility and safeguard market share under strong competitive pressure (Kumar & Gulati, 2018; Nurcahyani et al., 2018). In addition, deeper integration with India's refining industry through strategic partnerships or contractual cooperation may further strengthen Indonesia's long-term competitiveness by anchoring demand structurally, rather than relying solely on price mechanisms (Itamary & Hendrati, 2022). Pakistan has emerged as Indonesia's most stable export destination, characterized by the highest market share and relatively inelastic demand. This elasticity structure indicates a strong degree of importer dependence on Indonesian CPO and limited short-term substitution possibilities.

Under these conditions, managerial priorities should focus less on aggressive price competition and more on maintaining supply reliability and continuity. Therefore, stable supply chains, efficient distribution systems, and long-term trade agreements are critical instruments for preserving Indonesia's dominant position in this market. Given the high responsiveness of demand to import expenditure, ensuring uninterrupted access to the Pakistani market is likely to support sustained export growth as economic conditions improve (Chalil & Barus, 2018). In contrast, the Chinese market exhibits the most competitive structure among the three destinations analyzed. Higher own-price elasticity and stronger cross-price substitution indicate that Chinese importers are more responsive to price changes and tend to diversify their sources of supply. Furthermore, expenditure elasticity below one suggests that CPO behaves as a normal good in China, implying that demand expansion is relatively limited, even when total import expenditure increases. These characteristics reduce the effectiveness of volume-based export strategies.

Consequently, Indonesia's competitive advantage in China should be strengthened through non-price channels, particularly quality differentiation, sustainability compliance, and downstream product development. Enhancing certification standards, improving traceability, and expanding exports of refined and higher value-added palm oil products may help mitigate price competition and better align Indonesian exports with China's evolving consumption patterns and regulatory preferences (Ahmad et al., 2022; Dermoredjo et al., 2025). From a broader policy perspective, these findings underline the importance of differentiated export strategies consistent with market-specific elasticity structures. Export regulations and trade policy instruments should aim to maintain price competitiveness in markets with strong substitution dynamics, while simultaneously promoting value addition, supply chain efficiency, and sustainability upgrading in more competitive markets. Such a differentiated and evidence-based approach is essential for strengthening Indonesia's long-term resilience and strategic position in the global CPO trade.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Indonesia's share of CPO exports is dominant in Pakistan (64.7%), superior in India (55.3%), and competitive in China (48.5%), indicating variations in market structures that reflect different levels of dependence and competition intensity in each major importing country. Indonesia's CPO export position is very strong in Pakistan, strong in India, and weak in China. Pakistan shows high dependency, India is prospective with demand growth, and China is more competitive and price-sensitive.

Recommendations

For the Indian market, Indonesia must strengthen bilateral cooperation through tariff reductions, long-term contracts, and partnerships with the processing industry to maintain market access. This strategy is consistent with empirical findings showing that CPO demand in India is highly responsive to import expenditure and sensitive to price competition. In the Pakistani market, the main strategy is to ensure supply stability and price competitiveness through long-term contracts, logistics efficiency, and strengthened distribution. Given the relatively inelastic demand and strong dependence on Indonesian CPO in this market, maintaining reliable supply chains is crucial to preserve Indonesia's dominant position in the market. Meanwhile, in the Chinese market, policy efforts should focus on improving competitiveness beyond price factors. The results indicate stronger substitution between suppliers and more diversified demand structures in China, suggesting that Indonesian exporters should enhance their competitiveness through product differentiation, downstream development, and compliance with evolving market standards.

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REFERENCES

Abdullah, R. (2024). Indonesia's crude and refined palm oil exports to India: Demand and competitiveness analysis. Asian Journal of Agriculture and Development, 21(1), 77-94.

Ahmad, M. Y., Seng, K. W. K., & Kamarulzaman, N. H. (2022). Selected factors influencing China's palm oil imports from Malaysia. Agraris, 8(2), 261-274. https://doi.org/10.18196/agraris.v8i2.15511

Alston, J. M., Foster, K. A., & Green, R. (1994). Estimating elasticities with the linear approximate almost ideal demand system. Economics Letters, 45(2), 143-150.https://doi.org/10.2307/2109891

Aulia, R. (2019). Market position of Indonesian palm

oil derivatives in major importing countries: An AIDS approach. Jurnal Ekonomi Pembangunan, 20(1), 55-70.

Awad, A., Said, F., & Al-Sahli, A. (2016). Demand analysis of palm oil imports in selected Asian countries. International Journal of Economics and Financial Issues, 6(3), 1046-1053.

Chalil, D., & Barus, R. (2018). The sustainability of Indonesia-Pakistan palm oil supply chain. Jurnal Manajemen & Agribisnis, 15(2), 136-147. https://doi.org/10.17358/jma.15.2.136

Chang, H. S. C., & Chi, N. (2002). Elasticity of demand for Australian cotton in Japan. Australian Journal of Agricultural and Resource Economics, 46(1), 99-113. https://doi.org/10.1111/1467-8489.00169

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. American Economic Review, 70(3), 312-326.

Dermoredjo, S. K., Darmawan, D. H. A., Sumedi, Mutaqin, Yusuf, E. S., Pasaribu, S. M., Sayaka, B., Wardana, I. P., Adnyana, I. M. O., Estiningtyas, W., & Antriyandarti, E. (2025). The global sway of Indonesian palm oil: An export analysis. Journal of Agriculture and Food Research, 22, 102064. https://doi.org/10.1016/j.jafr.2025.102064

FAOSTAT. (2024). FAO statistical database. Food and Agriculture Organization of the United Nations.

Forgenie, D., Khoiriyah, N., Mahase-Forgenie, M., & Adeleye, B. N. (2023). An error-corrected linear approximate almost ideal demand system model for imported meats and seafood in Indonesia. Heliyon, 9(11), e20531. https://doi.org/10.1016/j.heliyon.2023.e21390

Green, R., & Alston, J. M. (1990). Elasticities in AIDS models. American Journal of Agricultural Economics, 72(2), 442-445. https://doi.org/10.2307/1242346

Hamidi, H. N. A., Khalid, N., & Karim, Z. A. (2024). Palm oil trade restrictiveness index and its impact on world palm oil exports. Agricultural Economics - Czech, 70, 101-111. https://doi.org/10.17221/332/2023-AGRICECON

International Trade Centre. (2024). Trade Map database. ITC.

Itamary, A. I., & Hendrati, I. M. (2022). Analysis of the competitiveness of Indonesia's crude palm oil exports in the Indian market. Journal of Development Economics, 8(2), 208-217. https://doi.org/10.35906/jep.v8i2.1184

Juanda, B., & Junaidi. (2012). Ekonometrika deret waktu: Teori dan aplikasi. IPB Press.

Kumar, R., & Gulati, A. (2018). Edible oil demand and import dependence in India. Food Policy, 78, 61-72.

Lugo-Arias, E., Lugo-Arias, J., Vargas, S. B., de la Puente Pacheco, M. A., Borre Granados, I., Barraza Heras, C., & Triana Hernández, D. (2024). Determinants of the competitiveness of world palm oil exports: A cointegration analysis. Transnational Corporations Review, 16(3), 200063. https://doi.org/10.1016/j.tncr.2024.200063

Moschini, G. (1995). Units of measurement and the Stone index in demand system estimation. American Journal of Agricultural Economics, 77(1), 63-68. https://doi.org/10.2307/1243889

Nguyen, G. V., & Jolly, C. M. (2013). A cointegration analysis of seafood import demand in Caribbean countries. Applied Economics, 45(6), 803-815. https://doi.org/10.1080/00036846.2011.613771

Nurcahyani, M., Masyhuri, & Hartono, S. (2018). The export supply of Indonesian crude palm oil to India. Agro Ekonomi, 29(1), 18-34. https://doi.org/10.22146/ae.29931

Pindyck, R. S., & Rubinfeld, D. L. (2018). Microeconomics (9th ed.). Pearson Education Limited.

Pratama, K. P. M. P., Sukmawati, C. P., & Abidin, A. Z. (2024). Global dominance in crude palm oil: Strategic factors shaping Indonesia's competitive edge. Buletin Ilmiah Litbang Perdagangan. https://doi.org/10.55981/bilp.2024.7205

Rifin, A. (2010). An analysis of Indonesia's palm oil position in the world market: A two-stage demand approach. ASEAN Journal of Economics, Management and Accounting, 10(1), 35-41.

Rifin, A. (2013). Analysis of Indonesia's market position in palm oil market in China and India. Journal of Food Products Marketing, 19(4), 299-310. https://doi.org/10.1080/10454446.2013.726950

Saban, A., & Novianti, T. (2023). Comparison of the competitiveness of Indonesian crude palm oil with Malaysia in the main export destination countries. Scientific Bulletin of Trade Research and Development, 17(2), 225-246. https://doi.org/10.55981/bilp.2023.89

Setyadewanta, A., Arfani, R. N., & Erfita, E. (2016). Elasticity and competitiveness of Indonesia's palm oil exports in the Indian market. Economic

Journal of Emerging Markets, 8(2), 91-104. https://doi.org/10.20885/ejem.vol8.iss2.art7

Suryana, A. (2016). International demand for palm oil estimated within a fats and oils demand system. Jurnal Agro Ekonomi, 6(1-2), 67-82. https://doi.org/10.21082/jae.v6n1-2.1987.67-82

Tandra, H., Suroso, A. I., Syaukat, Y., & Najib, M. (2022). The determinants of competitiveness in global palm oil trade. Economies, 10(6), 132. https://doi.org/10.3390/economies10060132

United Nations. (2024). Commodity trade statistics database (Comtrade).

Utsaha, A., & Anisa, U. (2022). Comparison of the competitiveness of crude palm oil between Indonesia and Malaysia in the international market. Palm Oil, 30(2), 95-108. https://doi.org/10.22302/iopri.jur.jpks.v30i2.177

Varian, H. R. (2010). Intermediate microeconomics (8th ed.). W. W. Norton & Company.

Wan, Y., Sun, C., & Grebner, D. L. (2010). Analysis of import demand for wooden beds in the United States. Journal of Agricultural and Applied Economics, 42(4), 643-658. https://doi.org/10.1017/S1074070800003862

Wibowo, R. P., Khaliqi, M., & Maryunianta, Y. (2021). Analyzing global competitiveness of Indonesian palm oil. IOP Conference Series: Earth and Environmental Science, 892(1), 012094. https://doi.org/10.1088/1755-1315/892/1/012094

World Bank. (2024). Commodity markets: Price data and analysis. The World Bank.

Ximenes, J. P. (2022). Export competitiveness of Indonesian palm oil derivatives using an almost ideal demand system. International Journal of Economics and Management, 16(2), 245-260.

Yadav, A. K., & Chattopadhyay, U. (2025). Determinants of the crude palm oil import demand in India: An empirical analysis. Journal of Agribusiness in Developing and Emerging Economies. Advance online publication. https://doi.org/10.1108/JADEE-09-2024-0305

Zakaria, K., Balu, N., Baharim, N. M., & Rapiee, N. M. (2018). Demand for palm oil in Turkey. Oil Palm Industry Economic Journal, 18(1), 9-15.