

IMPORT DEMAND OF PALM OIL FROM INDONESIA IN THE INDIAN MARKET

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Abstract: Palm oil has occupied an important position in the world trade of edible oils. India is still very dependent on palm oil imports, including other vegetable oils, to meet the needs of cooking oil and palm-based food industries. This study uses an ARDL approach to examine several factors that affect the demand for palm oil imports (CPO and RPO) from Indonesia in the Indian market. In the long run, CPO imports in the Indian market are significantly affected by CPO prices, sunflower oil prices, soybean oil prices, import tariffs, real exchange rates, real income per capita, soybean oil production in India, and India's population. Indonesian RPO imports in the Indian market are also significantly influenced by import price, soybean oil price, import tariff, and total vegetable oil production in India. Indonesia should be able to capitalize on the Indian market as its demand for vegetable oil is increasing. The increasing size of the Indian market (although more protective) is a challenge for Indonesia to meet the demand for vegetable oil in the Indian market. Indonesia's industrial and trade policy should shift the structure of India's import demand from CPO to palm oil-based downstream semi-finished and final products.

Keywords: import demand, crude palm oil, refined palm oil, Indonesia, Indian market

Abstrak: Minyak kelapa sawit telah menempati posisi penting dalam perdagangan minyak nabati dunia. India masih sangat tergantung kepada impor minyak kelapa sawit termasuk minyak nabati lainnya untuk memenuhi kebutuhan minyak goreng dan industri makanan berbasis kelapa sawit. Metode penelitian ini menggunakan suatu pendekatan ARDL untuk mengkaji sejumlah faktor yang mempengaruhi permintaan impor minyak kelapa sawit (CPO dan RPO) asal Indonesia di pasar India. Dalam jangka panjang, impor CPO di pasar India signifikan dipengaruhi harga CPO, harga minyak bunga matahari, harga minyak kedelai, tarif impor di India, nilai tukar riil Rupee terhadap USDollar, pendapatan riil per kapita, produksi minyak kedelai di India, dan populasi India. Impor RPO asal Indonesia di pasar India juga signifikan dipengaruhi harga impornya, harga minyak kedelai, tarif impor dan total produksi minyak nabati di India. Indonesia harus mampu memanfaatkan pasar India karena permintaannya terhadap minyak nabati semakin besar. Peningkatan ukuran pasar India (walaupun lebih protektif) menjadi tantangan Indonesia untuk memenuhi permintaan minyak nabati di pasar India. Kebijakan industri dan perdagangan yang seharusnya dilakukan Indonesia adalah menggeser struktur permintaan impor India dari CPO ke produk hilir setengah jadi dan produk akhir berbasis kelapa sawit.

Kata kunci: permintaan impor, minyak sawit kasar, minyak sawit rafinasi, Indonesia, pasar India

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INTRODUCTION

India is one of the major importers of palm oil from Indonesia. India has had a huge population and relatively high economic growth in the last decade; the distance is pretty close, and India's position is very important for Indonesia. India's vegetable oil production does not meet domestic demand. India is a group of net vegetable oil importing countries, so Indonesia has a great opportunity to fill India's vegetable oil needs.

India's dependence on imports of vegetable oil (including palm oil) is a serious concern for the Indian government. The large amount of foreign exchange needed to import vegetable oil encourages the development of import substitution through changes in the policy of supplying vegetable oil to increase domestic vegetable oil production. The policy on vegetable oils in India, issued in September 2015, is directly related to the Indonesian palm oil industry and other palm oil-producing countries. The policies in question are: (1) increasing palm oil import tariffs to India, which came into effect on 18 September 2015, and (2) Accelerating the development of oil palm plantations in India. These two policies will affect India's palm oil imports in the future, including Indonesia's palm oil exports to India. India's vegetable oil policy must be addressed, and the implications for the Indonesian palm oil industry must be studied.

Vegetable oil consumption in India comes from both domestic production and imports. More than half of the total vegetable oil consumption is met by imports. Vegetable oils consumed in India include palm, soybean, rapeseed, sunflower, and coconut oil. India's vegetable oil consumption is increasing yearly, which aligns with population and income growth. Fulfillment of domestic consumption of vegetable oils in India originating from production such as soybean oil, rape oil, sunflower oil, coconut oil, and other types in smaller quantities. The availability of vegetable oil originating from domestic production in 2005 was 8.32 million tons, increasing to 9.78 million tons in 2010, and in 2020, it was 10.46 million tons. The types of vegetable oils produced domestically in India in 2020 are soybean oil 2.09 million tons, rapeseed oil 2.43 million tons, peanut oil 2.77 million tons, coconut oil 0.60 million tons, sunflower oil 0.07 million tons, and several other vegetable oils (Indian Department of Agriculture, 2022). The demand for vegetable oil consumption in India is highly dependent on imports. In 2005, imports of vegetable oil in India amounted to 4.29 million tons, increasing to 7.24 million tons in 2010 and 14.52 million tons in 2020. India's vegetable oil production has stagnated in the last 15 years, resulting in a relatively high increase in vegetable oil imports. Production of various vegetable oils, domestic availability, and imports of edible oils in India in Figure 1.

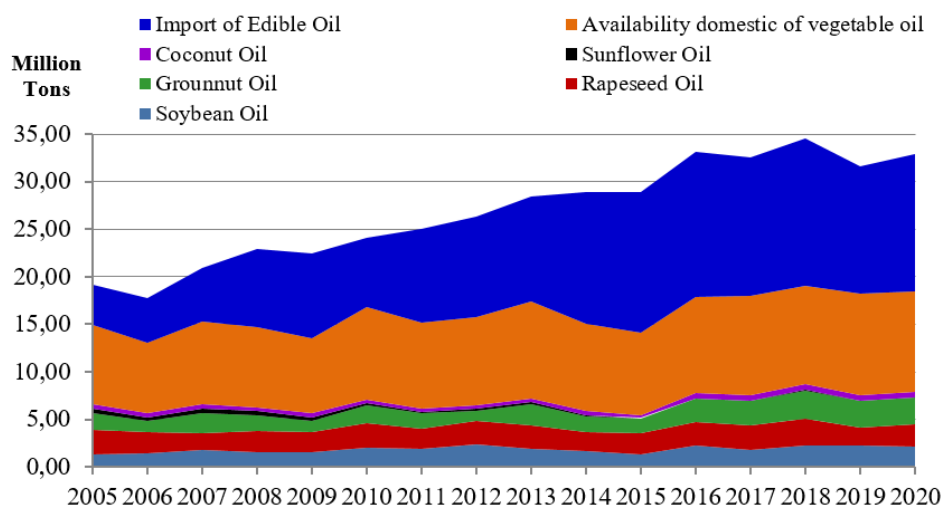


Figure 1. Production of various vegetable oils, domestic availability, and imports of edible oils in India (Indian Department of Agriculture, 2022)

The supply of vegetable oil for India's domestic consumption is met by imports and domestic production. Overall import content of Indian vegetable oil consumption increased from 34.02 percent in 2005 to 52.61 percent in 2011 and to 58.13 percent in 2020. Meanwhile, the local vegetable oil consumption content tends to decrease from 65.98 percent to 41.87 percent in the same period. This shows that India's vegetable oil consumption increasingly depends on imported vegetable oil. In the component of Indian vegetable oil imports, the share of palm oil dominated by 52 percent in 2005, increasing to 60 percent in 2020. The share of soybean oil decreased by 25 percent in 2005 to 21 percent in 2020. Contributions of sunflower oil, rape oil, coconut oil, olive oil, and others have a smaller share (UN Comtrade, 2022). India's total vegetable oil imports reached 4.29 million tons in 2005, increasing to 14.52 million tons in 2020 (Indian Department of Agriculture, 2022). India's dependence on imports of vegetable oil is so high that it is a market opportunity for Indonesia, especially vegetable oil from palm oil.

India imports palm oil in the form of crude palm oil (CPO), palm kernel oil (PKO), refined palm oil (RPO), refined palm kernel oil (RPKO), and palm oil derivatives in the form of oleochemicals. The share of CPO imports in India from Indonesia was 51 percent in 2001 (compared to Malaysia's 44 percent and another 4 percent), increasing to 63 percent in 2020 (compared to Malaysia's 30 percent and another 7 percent). However, in 2021, the share of Indonesian palm oil decreased to 39 percent, and Malaysia increased to 46 percent. This may be related to the increase in consumption of Indonesian palm oil, especially for the biodiesel industry, or the decline in the competitiveness of palm oil in the Indian market. Indonesia has a comparative

advantage in all palm oil products, as it controls world palm oil production (Sari, 2010). According to (Nova, 2010), currently, Indonesia needs to catch up with Malaysia in terms of developing CPO derivative products. Although Malaysia is only in the second position as the largest CPO producer in the world, the Malaysian palm oil industry currently produces and exports more downstream CPO products.

Several variables influence competitiveness, relating to the policies of the destination country (importing) and policies in the exporting country. Policies in importing countries include variable import duties and depreciation/appreciation of the importing country's currency. Likewise, in exporting countries, export policies include export taxes (export duty, export levy) and depreciation/appreciation of the exporting country's currency. Regarding taxes, the Indian government on September 18, 2016, also increased the import duty on CPO imports from 7.5 percent to 12.5 percent. Meanwhile, CPO derivative products (refined) increased from 15 percent to 20 percent. In 2021, there will be an increase in import duties on imports of CPO and its derivative products, 20 percent for trade agreements (preferential areas) and 30 percent for trade without trade agreements (standard duty rate). Import duties on CPO imports in India are experiencing a downward trend. However, in the last two years, import duties on several products, including palm oil and its derivatives, have been strengthening. This is an unfavorable situation for Indonesia, considering that the two mainstay Indonesian products will not have actual market access in the Indian market. Imports of palm oil and various other vegetable oils in India in Figure 2.

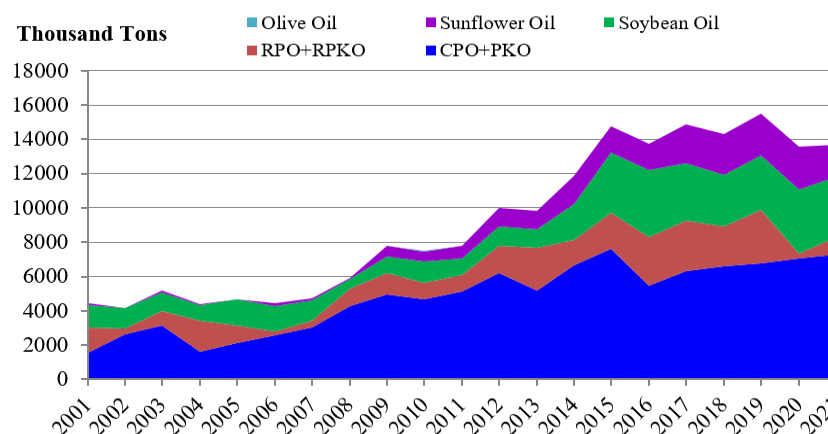


Figure 2. Imports of palm oil and various other vegetable oils in India (UN Comtrade, 2022)

The fulfillment of Indian vegetable oil consumption is highly dependent on imports because domestic vegetable oil production (soybean oil, rape oil, peanut oil) has not been able to meet demand. In India, the use of CPO for processed products includes the food industry (cooking oil, margarine, shortening, cocoa butter substitutes, vegetable ghee) and non-food industries such as oleochemicals (fatty acid, fatty alcohol, glycerin). India also imports various products of refined crude palm oil, refined palm kernel oil, and oleochemical products. The increase in palm oil imports by India is in line with demand and the factors driving demand for vegetable oil. For this reason, it is necessary to study what factors determine the demand for palm oil imports, especially crude palm oil (CPO) and refined palm oil (RPO) in the Indian market.

METHODS

This study focuses on the demand for palm oil imports and its derivative products from Indonesia. The product groups are crude palm oil (HS Code 151110) and Refined Palm Oil (HS Code 151190). The data used in this study is from 1995 to 2021, with the consideration that 1) India has been importing palm oil from Indonesia for an extended period; 2) there has been a significant increase in vegetable oil consumption in India over this period; and 3) palm oil consumption in India has grown at a higher rate of 9.6 times over this period, compared to 6.4 times for soybean oil, two times for rapeseed oil, and 4.2 times for sunflower seed oil (Indexmundi, 2024). The data used is the quantity and value of imports of crude palm oil (CPO) and refined palm oil (RPO) in the Indian market sourced from the United Nations Trade Commission, the number of and the value of imports of other vegetable oils in India comes from the United Nations Trade Commission, the amount of vegetable oil production in India comes from the Indian Ministry of Agriculture, the amount of availability and imports of vegetable oil in India comes from the Indian Ministry of Agriculture, the population in India is sourced from the World Bank, per capita gross domestic product in India is sourced from the World Bank, the exchange rate of the Rupee against the US Dollar is sourced from the World Bank, import tariffs for palm oil and its derivatives in India are sourced from the World Trade Organization.

The Specification of the Econometric Model

The relationship between economic variables, especially the dominant factors affecting the demand for Indonesian palm oil in the Indian market, can be studied using time series data. The demand model can be an EC (Error correction) model derived from the ARDL (Autoregressive Distributed Lag) model. The application of this model is more likely to study short-term and long-term responses (Verbeek, 2017). Stationary data behavior at the I (0) level is not always statistically appropriate, so it is necessary to test stationary at the I (1) or I (2) level. If stationary only at different levels, it is recommended to use the Error Correction Model (ECM). Furthermore, in long-run equilibrium, the relationship of economic variables can be written in the relationship as equation (1).

Suppose that in the long-run equilibrium, the relationship between economic variables as a model (1):

$$D_t = b_0 + b_1 S^t \quad (1)$$

This relationship can also be formed as a model that describes the dynamic behavior between S and D (2). The model is also in the form of an Autoregressive Distributed Lag (ARDL) model.

$$D_t = a_0 + a_1 D^{t-1} + c_0 S^t + c_1 S^{t-1} \quad (2)$$

Certain conditions will be determined under which model (2) is consistent with a model (1). The initial step ignores the dynamics and stochastic fluctuations in a model (2), so that.

$$D^t = D^{t-1} = D^* \quad \text{and} \quad S^t = S^{t-1} = S^*$$

which results in changes like the model (3).

$$D^* = a_0 + a_1 D^{t-1} + c_0 S^t + c_1 S^{t-1} = a_0 / (1 - a_1) + (c_0 + c_1) / (1 - a_1) S^* \quad (3)$$

Model (3) will be consistent with a model (1) if:

$$b_0 = a_0 / (1 - a_1) \quad \text{and} \quad b_1 = (c_0 + c_1) / (1 - a_1) \quad (4)$$

Furthermore, by substituting the relationship (4) in a model (2), by making the simplification, an Error Correction (EC) model is obtained as (5).

$$\Delta D_t = c_0 \Delta S_t + (1 - a_1)(b_0 + b_1 S^{t-1} - D^{t-1}) \quad (5)$$

Conducted a combination of cointegration and error correction models to form a trace error correction model. If there is a cointegration relationship between variables, the model is derived from ARDL (Engle and Granger, 1987). The error correction (EC) model requires a cointegration relationship to explain long-run relationships and short-run dynamic behavior. The short-run behavior will converge towards the long-run equilibrium over a period.

To explain several factors that affect the import of crude palm oil (CPO) and refined palm oil (RPO) from Indonesia in the Indian market using the following Error Correction (EC) model. The CPO import demand model:

$$\begin{aligned}
 D(\ln\text{IMCPOIND})_t = & \beta_0 + \sum^m \beta_1 m D(\ln\text{PRSCPOROT})_{t-m} \\
 & + \sum^n \beta_1 n D(\ln\text{PIMSPWIND})_{t-n} \\
 & + \sum^p \beta_1 p D(\ln\text{PIMSOYIND})_{t-p} \\
 & + \sum^q \beta_1 q D(\ln\text{TAXIM})_{t-q} \\
 & + \sum^r \beta_1 r D(\ln\text{EXCHRUEUS})_{t-r} \\
 & + \sum^s \beta_1 s D(\ln\text{RGNICAP})_{t-s} \\
 & + \sum^u \beta_1 u D(\ln\text{PRODLAI})_{t-u} \\
 & + \sum^v \beta_1 v D(\ln\text{POPIND})_{t-v} \\
 & + \gamma \{ \ln\text{IMCPOIND}_{t-1} - \alpha_1 (\ln\text{PRSCPOROT})_{t-1} \\
 & - \alpha_2 (\ln\text{PIMSPWIND})_{t-1} - \alpha_3 (\ln\text{PIMSOYIND})_{t-1} \\
 & - \alpha_4 (\ln\text{TAXIM})_{t-1} - \alpha_5 (\ln\text{EXCHRUEUS})_{t-1} \\
 & - \alpha_6 (\ln\text{RGNICAP})_{t-1} - \alpha_7 (\ln\text{PRODLAI})_{t-1} \\
 & - \alpha_8 (\ln\text{POPIND})_{t-1} \} + \varepsilon
 \end{aligned}$$

The RPO import demand model:

$$\begin{aligned}
 D(\ln\text{IMRPOIND})_t = & \beta_0 + \sum^m \beta_1 m D(\ln\text{PIMRPOIND})_{t-m} \\
 & + \sum^n \beta_1 n D(\ln\text{PIMSOYIND})_{t-n} \\
 & + \sum^p \beta_1 p D(\ln\text{PIMSPWIND})_{t-p} \\
 & + \sum^q \beta_1 q D(\ln\text{TAXIM})_{t-q} \\
 & + \sum^r \beta_1 r D(\ln\text{EXCHRUEUS})_{t-r} \\
 & + \sum^s \beta_1 s D(\ln\text{RGDPIND})_{t-s} \\
 & + \sum^u \beta_1 u D(\ln\text{BNIND})_{t-u} \\
 & + \sum^v \beta_1 v D(\text{AIFTA})_{t-v} \\
 & + \gamma \{ \ln\text{IMCPOIND}_{t-1} - \alpha_1 (\ln\text{PIMRPOIND})_{t-1} \\
 & - \alpha_2 (\ln\text{PIMSOYIND})_{t-1} - \alpha_3 (\ln\text{PIMSPWIND})_{t-1} \\
 & - \alpha_4 (\ln\text{TAXIM})_{t-1} - \alpha_5 (\ln\text{EXCHRUEUS})_{t-1} \\
 & - \alpha_6 (\ln\text{RGDPIND})_{t-1} - \alpha_7 (\ln\text{BNIND})_{t-1} \\
 & - \alpha_8 (\text{AIFTA})_{t-1} \} + \varepsilon
 \end{aligned}$$

Where is IMCPOIND, India's CPO imports from Indonesia (tons); IMRPOIND, India's RPO imports from Indonesia (tons); PRSCPOROT, the price of CPO on the world market (US\$/tons); PIMSOYIND, India

soybean oil import price (US\$/tons); PIMSPWIND, Indian sunflower oil import price (US\$/tons); TAXIM, palm oil import tax in India (%); EXCHRUEUS, the exchange rate of the Rupee against the US Dollar (Rupee/US\$); RGNICAP, Real gross national income per capita in India (US\$); RGDPIND, real gross domestic product per capita in India (US\$/cap); PRODLAI, Indian soybean oil production (tons); POPIND; Indian population (Million); NBIND, edible oil production in India (Million tons); D, sometimes one period; AIFTA, dummy for the period of free trade agreement between ASEAN - India; β , γ , coefficient; ε , error and t, year.

The price variable is included in the model by demand theory in the form of a negative relationship. An increase in price decreases the demand for imports in the Indian market. The effect of palm oil substitute goods used soybean oil and sunflower oil price variables. Increasing the price of substitute products increases the demand for palm oil imports. Economic size and purchasing power are proxied by real GDP and real GNP per capita. Larger market size and income increase the demand for palm oil imports in the Indian market. Also, market size proxied by population is included in the model. A larger population size leads to increased consumption of edible oils and related products and increased palm oil imports. India imposes tariff barriers on palm oil imports during the data period, so tariff variables are included in the model. High tariffs have a negative effect on import demand.

Furthermore, the value of the Rupee has decreased from 32.4 INR to 73.9 INR per USD from 1995 to 2021 (World Bank, 2024). The decline in the value of the Rupee has the effect of reducing the demand for palm oil imports in the Indian market. Therefore, the exchange rate in real terms is a variable that is included in the model. India, too, has developed a domestic vegetable oil industry, such as rapeseed oil, soybean oil, sunflower oil, and groundnut oil, and production has increased over the data period (Indian Department of Agriculture, 2022). The above endowment factors are considered for their influence in substituting imports. Therefore, the model for RPO and CPO import demand considers the use of endowment factors proxied by the variables of vegetable oil availability from domestic production and soybean oil production.

RESULTS

Descriptive Data

As in Table 1, descriptive statistics provide an overview of the data seen from the average value (mean), standard deviation, maximum, and minimum. N or the amount of data for each valid variable is 27. The mean value of each variable is greater than the standard deviation, or the deviation from the datum of the variable indicates good results for all variables.

Stationarity test

The commonly accepted ADF (Augmented Dickey-Fuller) and PP (Phillips Perron) unit root tests are adopted to the stationary test of IMCPOIND, IMRPOIIND, PRSCPOROT, POPIND, RGDPIND, TAXIM, EXCHRUEUS, NBLIM, TOTRPOIND, PIMRPOIND, and PIMSOYIND series. The test results in Table 2 show that the eleven sequences' level value is nonstationary. The further test indicates that IMCPOIND, IMRPOIIND, PRSCPOROT, POPIND, RGDPIND, TAXIM, EXCHRUEUS, NBLIM, TOTRPOIND, PIMRPOIND, and PIMSOYIND sequences are first-order difference stationary. The values in brackets in Table 2 are P values. ADF and PP values are less than the significant value of 5%, which indicates that the four sequences are stationary.

Table 1. Descriptive statistics

Variables	N	Mean	Std Dev	Min	Max
logIMCPOIND (tons)	27	13.894	1,974	9.466	15.329
logIMRPOIIND (tons)	27	13.274	0.901	11.356	14.706
logPRSCPOROT (US\$/tons)	27	6.467	0.369	5.659	7.084
logRGNICAP (US\$/Cap))	27	7.010	0.379	6.418	7.574
logRGDPIND (US\$/Cap)	27	7.018	0.379	6.427	7.587
logTAXIM (%)	27	3.496	0.179	3.401	3.951
logEXCHRUEUS (Rupe/US\$)	27	3.982	0.150	3.783	4.218
logBNIND (Million tons)	27	16.003	0.105	15.812	16.182
logPRODLAI (tons)	27	14.367	0.166	14.096	14.668
logPIMRPOIND (US\$/tons)	27	6.404	0.363	5.548	7.076
logPIMSPWIND (US\$/tons)	27	6.612	0.351	5.979	7.211
logPIMSOYIND (US\$/tons)	27	6.507	0.367	5.765	7.170

Table 2. Unit roots test

Variables	Level		First Difference	
	ADF Test	PP Test	ADF Test	PP Test
logIMCPOIND	-1.5391	-0.8789	-5.7627***	-5.9770***
logIMRPOIIND	-2.2215	-2.1744	-4.8576***	-4.9006***
logPRSCPOROT	-1.3595	-2.1992	-4.3424***	-3.6635**
logRGNICAP	-0.5839	-0.5876	-4.8782***	-4.8789***
logRGDPIND	0.4395	0.4395	-4.3795***	-4.3795***
logTAXIM	-3.4784**	-4.3506**	4.4477***	-5.8490***
logEXCHRUEUS	-0.5703	-0.5703	-4.6369***	-4.6315***
logBNIND	0.2554	-1.7883	-7.7392***	-11.5499***
logPRODLAI	-2.6704	-2.5438	-7.6459***	-11.3649***
logPIMRPOIND	-1.6072	-0.2813	-2.9105***	-2.9882***
logPIMSPWIND	-1.3268	-1.2006	-5.0309***	-5.0347***
logPIMSOYIND	0.5775	-0.4943	-2.2150**	-2.3297**

Notes: ***, ** and * indicate significant at the 1%, 5% and 10%, respectively.

Table 3 shows two cointegration test results based on the ARDL bounds testing approach, each with the calculated F-statistics (12,9847) and F-statistics (4,2931) greater than the upper critical values at the significance levels of 1%. It also means that the null hypothesis of no cointegration is rejected. It confirms the long-run relationship among the variables.

When one cointegrating vector exists, Johansen and Juselius cointegration procedure cannot be applied (Nkoro and Uko, 2016). Hence, it becomes imperative to explore the proposed Autoregressive Distributed Lag (ARDL) approach to cointegration or bound procedure for a long-run relationship, irrespective of whether the underlying variables are I(0), I(1), or a combination of both (Shin, 1994) and (Pesaran, Shin, Smith, 1996). In such a situation, the application of the ARDL approach to cointegration will give realistic and efficient estimates. ARDL approach to cointegration helps identify the cointegrating vector(s). Each of the underlying variables stands as a single long-run relationship equation. If one cointegrating vector (i.e., the underlying equation) is identified, the ARDL model of the cointegrating vector is reparameterized into ECM. The reparameterized result gives short-run dynamics and long run relationship of the variables of a single model. Re-parameterization is possible because the ARDL is a dynamic single-model equation in the same form as the ECM. The distributed lag model includes the unrestricted lag of the regressors in a regression function.

To improve the reliability of interpretation, the ARDL (1,1,1,0,0,1,1,1,0) model for Indonesia's CPO import demand in the Indian market and the ARDL (1,1,1,0,0,1,0,0,0) model for Indonesia's RPO import demand in the Indian market, will be tested for misspecification, heteroscedasticity, and serial correlation before being used to estimate the long-run and short-run coefficients. As shown in Table 4, the misspecification, heteroskedasticity, and serial correlation test results for the Indonesian CPO import demand model in the Indian market show p-values greater than the F critical value of 0,05. Hence, it is concluded that the CPO model is statistically free from misspecification, heteroscedasticity, and serial correlation problems in the model estimation. Similarly, the test results for the Indonesian RPO import demand model in the Indian market also show a p-value greater than the F critical value of 0,05. In other words, the model estimation has no problem with misspecification, heteroscedasticity, or serial correlation. Since ARDL is lag sensitive, the ARDL specification (1,1,1,0,0,1,1,0) with long-run response for Indonesia's CPO import demand in the Indian market is chosen in this study. Similarly, since ARDL is lag sensitive, the ARDL model specification (1,1,1,1,0,0,1,1,0,0) with long-run response for Indonesia's RPO import demand in the Indian market is also selected in this study.

Table 3. Bounds test for cointegration

Crude Palm Oil (CPO):		
Dependent Variable (log IMCPOIND)		F-statistic (12,9847***)
Critical Value	Lower Bound	Upper Bound
1%	2.97	3.77
5%	2.79	3.15
10%	2.33	2.85
Refined Palm Oil (RPO):		
Dependent Variable (logIMRPOIIND)		F-statistic (4.2931***)
Critical Value	Lower Bound	Upper Bound
1%	2.62	3.68
5%	2.11	3.05
10%	1.85	2.75

Notes: ***, ** and * indicate significant at the 1%, 5% and 10%, respectively.

Table 4. Diagnostic tests results

Crude palm Oil (CPO):				
Test Statistics	LM Version	Test stat.	F Version	F-stat.
Misspecification	NA	NA	F (1,10)	1.907 (0.1972)
Serial Correlation	CHSQ (1)	3.4782 (0.0622)	F (1,10)	1.544 (0.2423)
Heteroskedasticity	CHSQ (14)	14.2506 (0.4312)	F (14,11)	0.952 (0.5422)
Refined palm Oil (RPO):				
Test Statistics	LM Version	Test stat.	F Version	F-stat.
Misspecification	NA	NA	F (1,11)	0.180 (0.6789)
Serial Correlation	CHSQ (1)	0.398 (0,5278)	F (1,11)	0.171 (0.6869)
	CHSQ (2)	4.435 (0,1089)	F (2,10)	1.028 (0.3925)
Heteroskedasticity	CHSQ (13)	5.612 (0,9591)	F (13,12)	0.254 (0.9897)

Import Demand of Crude Palm Oil and Refined Palm Oil in the Indian Market

The results of the ARDL estimation of import demand for crude palm oil (CPO) from Indonesia in the Indian market are presented in Table 5. It shows that in the long term, imports of crude palm oil (CPO) from Indonesia are significant with crude palm oil prices (logPRSCPOIND), sunflower oil prices (logPIMSPWIND), soybean oil prices (logPIMSOYIND), import tariffs for crude palm oil in India (logTAXIM), the real exchange rate of the Rupee to USDollar (logEXCHRUEUS), real income per capita (logRGNICAP), soybean oil production in India (logPRODLAI), and population India (logPOPIND).

The estimation results of the long-term relationship for palm oil (logPRSCPOROT) prices are not by economic theory but are significant at the 10% level. The possible cause of the positive price effect is a significant shift in the demand curve for palm oil in the Indian market due to the surge in population, increasing income, and limited substitute products so that palm oil import demand and prices move in parallel in the same direction in the Indian market. Other researchers found a negative relationship between price and palm oil import demand in the Netherlands and China (Hasan et al. 2018; Ahmad et al. 2022).

Domestic soybean oil production (logPRODLAI) is also not based on economic theory but is significant at 10%. The vegetable oil industry in India may combine palm oil inputs with domestic soybean oil in certain portions to produce cooking oil for the domestic market, so to some extent it looks like complementary behavior. This is also consistent with the long-term relationship between imports of crude

palm oil (CPO) from Indonesia in the Indian market with soybean oil import prices (logIMSOYIND) and imported sunflower oil prices (logIMSPWIND), which are negative and significant at the 5% level. Other researchers have previously found a pure substitution (positive) relationship between soybean oil prices and palm oil export demand in the Chinese market (Ahmad et al. 2022).

What was found in this study is partly consistent with (Awad et al. 2007), which states that Imports of crude palm oil (CPO) in the Middle East and North African (MENA) countries are influenced by the price of crude palm oil (CPO), the price of substituted oil, and specific factors of each country. However, in contrast to (Ernawati et al. 2006) the short-term elasticity value of Indonesia's export demand to India to changes in the price ratio of soybean and palm oil is 2,74. This shows that soybean oil is a substitute for palm oil in India.

The results of this study show that the importing country's variable income (logRGNICAP) negatively affects India's imports of CPO from Indonesia. This is contrary to other researchers who show that income (GDP) in importing countries positively and significantly affects CPO imports (Zakaria et al. 2018; Hasan et al. 2018; Tandra et al, 2022; Ahmad et al. 2022). In addition, it was also found that GDP, population, and palm oil price significantly impact palm oil demand in Balkan countries (Zakaria et al. 2019). The negative effect shows that CPO commodities are inferior to other vegetable oils in the Indian market. An increase in the purchasing power of the Indian population (proxied by per capita Gross National Income) has the effect of reducing imports of CPO from Indonesia. In another study, it was found that in the long run, palm oil purchasing patterns in India are strongly influenced by

the size of the Indian economy (proxied by GDP) and palm oil's price discount to soybean oil (Zakaria et al. 2017). The study also found that the proportion of the Indian population aged between 15 and 64 years about the total population also shapes the country's importing pattern of palm oil. It was established that Indians generally perceive palm oil as being an inferior good. This is understandable because, in India, palm oil is sold in the retail market through the public distribution system. India's improved economic performance with a larger market size is driving an increase in demand for palm oil, especially refined palm oil and or in the form of cooking oil products, as well as other palm-based food products. Therefore, Indonesia must accelerate downstream to shift India's import structure to non-raw material palm oil products.

Import tariffs for crude palm oil (CPO) in the Indian market are very responsive to imports of these products. This finding is consistent with the economic theory that importing tariffs reduces trade. Although the opposite

finding was shown by (Annas et al. 2020), most previous studies are consistent with the results of this study. An increase in import tariffs reduces the amount of CPO imports in the Indian market. Import tariffs have become a trade barrier between Indonesia and India, especially for palm oil. The high import tariffs cause the potential of the palm oil market in the Indian market not to be matched by an increase in trade flows because tariffs are holding it back. The Indian government is still unwilling to open its market by reducing barriers because it wants to increase domestic vegetable oil production to reduce dependence on imports. The study found that India is the world's largest palm oil consumer and importer. Its demand for palm oil is expected to double by 2030. The Government of India's to expand oil palm cultivation in India. However, an aggressive push toward domestic oil palm cultivation at biodiversity's expense is underway. Unsustainable expansion of oil palm cultivation in India with short-term economic goals will lead to biodiversity and social issues (Sagar et al. 2019).

Table 5. ARDL's long-run estimate for palm oil imports from Indonesia in the Indian market

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Crude Palm Oil (CPO):				
Constant	-262.4643	102.1850	-2.5685	0.0261**
logPRSCPOROT	5.7218	2.9865	1.9159	0.0817*
logPIMSPWIND	-10.8169	4.5697	2.3670	0.0373**
logPIMSOYIND	-4.2711	1.4310	-2.9846	0.0124**
logTAXIM	-8.8365	2.4919	-3.5459	0.0046***
logEXCHRUPEUS	-23.0484	6.9677	-3.3078	0.0070***
logRGNICAP	-26.0678	6.7095	-3.8852	0.0025***
logPRODLAI	4.1868	1.9934	2.1002	0.0596*
logPOPIND	82.3935	21.2350	3.8800	0.0026***
Adjusted R squared	0.9068			
Refined Palm Oil (RPO):				
Constant	-124.2699	81.4597	-1.5255	0.1530
logPIMRPOIND	8.7244	4.1747	2.0898	0.0586*
logPIMSOYIND	-10.5665	4.5811	-2.3065	0.0397**
logPIMSPWIND	3.9536	2.4200	1.6337	0.1283
logTAXIM	-5.3392	2.6661	-2.0026	0.0683*
logEXCHRUPEUS	8.4081	6.2320	1.3491	0.2022
logRGDPIND	0.0300	2.5349	0.0118	0.9907
logBNIND	6.7648	3.5276	1.9177	0.0793*
AIFTA	1.0309	1.0469	0.9846	0.3442
Adjusted R squared	0.7898			

Notes: ***, ** and * indicate significant at the 1%, 5% and 10%, respectively.

From processed data, data sources are (UN Comtrade, 2023; Indian Department of Agriculture, 2022; World Bank, 2022; WTO, 2022).

India imposes a relatively high import tax on crude palm oil from Indonesia and others to protect the domestic soybean oil industry and its soybean farmers. With the imposition of a large import tax on crude palm oil, *ceteris paribus*, the price will be higher. In contrast, the price of other vegetable oils, including soybean oil, is certain (given) so that India's CPO imports from the world, including Indonesia, have decreased. India's tariff policy to protect the domestic vegetable oil industry, including encouraging an increase in palm oil cultivation, is considered acceptable in the short term but detrimental to the economy in the long term. Another study showed that the Indian government has intervened in the edible oil sector from time to time in the form of policies related to production, price, and trade to increase the availability of edible oil in India. A simultaneous equation simulation model was applied to determine the impact of the recent import duty hike on palm oil on the production and consumption of edible oils in India. The tariff hike will benefit the oilseed growers by increasing the price of edible oils. The net impact on the economy will be negative due to the higher reduction in consumer surplus that may outweigh the increase in producer surplus and government revenue. Increasing import duties can only provide short-term benefits (Renjini and Girish, 2019).

Despite India's yellow revolution, edible oil production remains stagnant. The country still imports more than half of its domestic requirement, increasing with population and per capita income. The policy input in this regard is to carry out a solution policy by supporting oilseed farmers through research, long-term planning, and remunerative pricing (Thapa et al. 2019; Narayan, 2017). The Indian government's desire to reduce import dependency of oilseeds, especially palm oil from Southeast Asia, through domestic production support policies is considered high cost in the long run. The policy does not align with the principle of efficient exchange of products through trade. They forced themselves to produce domestic vegetable oil even though it was inefficient. People in India are faced with higher vegetable oil prices than international prices. India should have the opportunity to conduct fair and non-protective trade, especially with Indonesia, by exchanging (through trade) palm oil with rice and sugar to move towards specialization and achieve production and consumption efficiency for both countries.

The results showed that the real exchange rate ($\log EXCHRUPEUS$) is significant and has a negative

effect on CPO imports from Indonesia in the Indian market. The results of previous research on the effective real exchange rate have a negative effect on imports of the top 10 sectors in South Africa (Matlasedi, 2017). The results also show a negative relationship between exchange rate volatility and imports in 19 emerging market countries (Akçay and Akçay, 2023). However, other researchers have not found an effective real exchange rate effect on palm oil export demand in Malaysia (Ismail et al. 2022). Nevertheless, exchange rate volatility creates uncertainty when determining trade market value between countries. A more stable exchange rate policy is needed to maintain trade flows, including palm oil.

Imports of crude palm oil from Indonesia in the Indian market are very responsive to the Indian population ($\log POPIND$). The large population growth in India is an important driver in the demand for processed palm oil products such as cooking oil, fat, margarine, soap, washing products, and others, which are the final products. The domestic vegetable oil processing industry imports raw materials in the form of crude palm oil (CPO) in large quantities to be processed into various cooking oils, food products, and household products in India. (Sagar et al. 2019) reported that India is the world's largest consumer and importer of palm oil. Its demand for palm oil is expected to double by 2030.

The ARDL estimation results for imported refined palm oil (RPO) from Indonesia in the Indian market are shown in Table 5. It shows that in the long term, the import behavior of RPO from Indonesia is significant with the import price of refined palm oil ($\log PIMRPOIND$), soybean oil import prices ($\log PIMSOFIND$), import tariffs for RPO in India ($\log TAXIM$), and total vegetable oil production in India ($\log BNIND$). The long-term relationship with imported RPO prices is not in line with theoretical expectations because it is positive. The long-term relationship with import prices for soybean oil is negative, indicating a complementary relationship between RPO and soybean oil in the vegetable oil industry in India.

The results of the ARDL estimation of import demand for RPO in the Indian market show no long-term relationship with India's real GDP per capita ($\log RGDPIND$) and the real exchange rate of the Rupee to US Dollar ($\log EXCHRUPEUS$). This is different from Hassan et al. (2018), who found in their

study that there are long-run and short-run relationships in the demand for palm-based oleochemicals in the Netherlands. Based on the results, the most significant influence is GDP (positive relationship); as the GDP increases, the demand for palm-based oleochemicals from Malaysia also increases. The price of palm oil and total vegetable oils consumption are significant (negative relationship) with the demand for Malaysian palm-based oleochemicals.

In accordance with theoretical expectations, the result of the estimated import tariffs for RPO is negative for the demand for imports of these products from Indonesia. RPO import tariffs show that they are very responsive to imports of these products. Like CPO, the imposition of tariffs on imports of processed palm oil products such as RPO is also a trade problem. The high import tariffs cause the potential of the palm oil market in the Indian market not to be matched by an increase in trade flows because unfavorable tariffs limit it. Various bilateral and multilateral trade negotiations have yet to be able to pressure India to ease its tariffs.

Karim and Tiffani (2022) since January 2019, India has imposed higher import tariffs on Indonesian refined, bleached, and deodorized palm oil (RBDPO) than those imposed on Indonesia's main competitor, Malaysia. This tariff policy weakened Indonesia's exports, given that India is Indonesia's third-largest export destination for palm oil. To overcome these tariff disparities, the Indonesian government responded with a trade-off strategy, offering to lower its import tariffs on India's raw sugar in exchange for reducing India's import tariffs on Indonesia's RBDPO. However, this strategy has thus far failed to generate a satisfying outcome for Indonesia. India's hesitation and recalcitrance resulted in delays, policy reversal, and ignoring Indonesian requests regarding the trade-off strategy.

The ARDL model is transformed into a short-run error correction term (ECT) dynamic model to estimate the short-run coefficients. The results of the coefficients are shown in Table 6. The coefficient of the error-correction term, ECT (-1), is negative and very significant (see Table 6). The magnitude of this coefficient implies that about 45% of any disequilibrium between the dependent and independent variables is corrected within one year. Consistent with the long-run estimation, the difference in price import of crude palm oil (logPRSCPOROT), import price of sunflower oil (logPIMSPWIND), and real exchange rate Rupee

to USDollar (logEXCHRUEUS) in the Indian market is significant in the short run. This signifies the importance of the price import of crude palm oil in the import demand in the Indian market.

As for the import demand for refined palm oil in the short term in the Indian market, the coefficient of the error-correction term, ECT (-1), is negative and very significant (see Table 6). The magnitude of this coefficient implies that about 68% of any disequilibrium between the dependent and independent variables is corrected within one year. The estimation result shows that the difference in import price of refined palm oil (logPIMPOIND), import price of soybean oil (logPIMSOYIND), import price of sunflower oil (logPIMSPWIND), and real GDP per capita India (logRGDPIND) is significant in the short run. This signifies the importance of some variables that determine the import of RPO from Indonesia into the Indian market.

The behavior of palm oil prices is inelastic in the short term but elastic in the long term, while income and exchange rates have an elastic impact in the long run (Dewanta, Arfani, Erfita, 2016). The analysis results indicated a decrease in palm oil's competitiveness in the Indian market. Palm oil is a normal product and can be easily replaced with palm oil from other countries or vegetable oils (Dewanta, Arfani, Erfita, 2016). All of these threaten the competitiveness of Indonesian palm oil in the Indian market. However, the demand for palm oil from Indonesia in the Indian market in the long term will continue to increase due to consideration of the increasing size of the market and income in the importing country of India. Imported palm oil in the market still has competitiveness against soybean and sunflower oils and vegetable oils produced by the domestic industry in India. India's vegetable oil processing industry produces relatively large volumes to meet domestic consumer demand. To produce vegetable oil at the best price for consumers in the domestic market, processors mix between types of vegetable oil. Import dependence on palm oil and its impact has resulted in higher substitution of low-priced palm oil by blending it with other vegetable oils of domestic origin in India (Indhushree and Shivakumar, 2020). There is a relationship between food demand and population. Besides, many factors influence the demand for vegetable oils in India, such as income growth and the growth of a large middle class (Patel, 2016).

Table 6. ARDL's short-run estimate for palm oil imports from Indonesia in the Indian market

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Crude Palm Oil (CPO):				
D(logPRSCPOROT)	0.7917	0.3089	2.5622	0.0264**
D(logPIMSPWIND)	-2.7739	0.3234	-8.5751	0.0000***
D(logEXCHRUEUS)	-2.8349	0.8602	-3.2952	0.0071***
D(logRGNICAP)	-0.4204	0.6804	0.6178	0.5492
D(logPRODLAI)	0.3788	0.2318	1.6336	0.1306
ECT (-1)	-0.4536	0.0295	15.3650	0.0000***
Refined Palm Oil (RPO):				
D(logPIMRPOIND)	1.7804	0.7004	2.5418	0.0259**
D(logPIMSOYIND)	-3.9152	0.9105	-4.3001	0.0010***
D(logPIMSPWIND)	1.8887	0.4001	4.7213	0.0005***
D(logRGDPIND)	10.9964	1.5980	6.8809	0.0000***
ECT (-1)	-0.6869	0.0792	-8.6677	0.0000***

Notes: ***, ** and * indicate significant at the 1%, 5% and 10%, respectively

Managerial Implication

India is the world's largest market for palm oil, with imports reaching 9 million tons by 2022. Palm oil from Indonesia meets about half of India's market demand of 4.6 million tons in 2022, with Malaysia 2.8 million tons, Thailand 0.8 million tons, and Papua New Guinea 0.3 million tons meeting the rest (UN Comtrade, 2023). The growing middle-class population in India is an important variable in vegetable oil demand. In the past decade, domestic vegetable oil production in India has been very limited compared to the market demand. The demand behavior of palm oil in India shows that the industry benefits from relatively lower raw material prices than other vegetable oils. Imports of crude palm oil (CPO) provide an opportunity to produce various derivative products from processing industry activities. Their market is protected with relatively high tariffs to protect domestic edible oil producers and government revenues. This finding is significant because the Indian market requires cooking oil at low prices. The Indian market also requires household products (soaps, cleansers, lotions) derived from palm oil, including industrial demand for oleochemical products such as fatty acids, fatty alcohols, and glycerin. As a producer that meets India's import demand, Indonesia must take steps to accelerate the increase in the level of palm oil products in the form of refined oil, oleochemical products, and final products for household needs. Accelerated industrialization to maximize added value can strengthen the palm oil trade through wider product diversification.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In summary, the empirical findings demonstrate that in the long term, imports of crude palm oil (CPO) from Indonesia in the India market are significant with crude palm oil prices, sunflower oil prices, soybean oil prices, import tariffs for crude palm oil in India, the real exchange rate of the Rupee to USDollar, real income per capita, soybean oil production in India, and population India. In contrast to the short term, the only price import of crude palm oil, the import price of sunflower oil, and the real exchange rate of Rupee to USDollar in the Indian market significantly affect the demand for crude palm oil imports.

The empirical findings demonstrate that in the long term, the import behavior of refined palm oil (RPO) from Indonesia in the Indian market is significant with the import price of refined palm oil, soybean oil import prices, import tariffs for refined palm oil in India, and total vegetable oil production in India. In the short term, the import price of refined palm oil, the import price of soybean oil, the import price of sunflower oil, and the real GDP per capita in the Indian market significantly affect the demand for refined palm oil imports.

Recommendations

A few policy recommendations can be drawn from these findings. First, Indonesia must take advantage of India's large market demand for vegetable oils,

especially crude palm oil and refined palm oil. In contrast, India's domestic capacity to produce vegetable oil still needs to grow. Secondly, palm oil is still price-competitive with other vegetable oils in the Indian market. Therefore, the Indonesian palm oil sector must be able to manage prices at a competitive level. Indonesian palm oil exporters must be able to meet the large demand in the Indian market. In the short term, a pricing strategy might be to not exceed the price of vegetable oils in the Indian domestic market (CPO price versus the price of vegetable oil materials at the industrial level and RPO price versus the price of cooking oil at the processor level), after considering import duties and shipping costs. In this case, increasing the share of higher quality products (e.g., RPO) or other processed products is more appropriate than CPO. Thirdly, the policy of downstream the palm oil industry in Indonesia to process crude palm oil into refined palm oil and other derivative products has responded to the growing demand in the Indian market. Lastly, Indonesia should never give up on renegotiating import duties on palm oil products with the Indian government because we know that its policies have caused relatively large distortions for their economy. India is a big exporter of sugar and rice, while Indonesia is a big exporter of palm oil. Both countries do not need to force themselves to increase production of all these products domestically, which tends to be inefficient. Renegotiation is needed to open their respective markets through progressive tariff harmonization agreements for palm oil and import targets for sugar and rice. Indonesia should also try again to use its negotiating weapon by providing fair tariffs for Indian rice and sugar and fair tariff harmonization for palm oil. More open and fair trade between palm oil, sugar, and rice will increase consumer surplus for both countries.

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