Demand Analysis of Indonesia's Coconut Crude Oil in Germany

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Abstract: Despite Indonesia being the world's largest coconut-producing country, the competitive position of coconut crude oil (CCO) is still weak in the international market. Indonesia should determine a potential market that plays a significant role in the coconut oil industry. The market share and elasticity of demand for Indonesian CCO in the primary market are controvertible in its policies. This study aimed to analyze the Indonesian competitive position in Germany - using the LA/AIDS model. Monthly time series data spanned values and quantities of CCO imported by Germany from 2004 to 2019. The main findings are that Indonesia had a strong market position. As a result of higher own-price elasticity, Indonesia is more sensitive to its price change. There is a weak competitive relationship between Indonesia and the Philippines since the cross-price elasticity is inelastic. Moreover, quantity demand for Indonesia will be higher due to the higher expenditure elasticity.

Keywords: Coconut Crude Oil, Demand Elasticities, LA/AIDS, Indonesia.

1. INTRODUCTION

Coconut is one of the essential commodities in most tropical countries (Li *et al.*, 2018). As a strategic commodity, this plant plays a critical role in Indonesia's economic, social, and culture (Alouw and Wulandari, 2020). Whole plant parts can utilize those roles in the flesh, leaves, trees, and roots. The fruit can produce after about 6 to 10 years (Pereira *et al.*, 2017; Kaur *et al.*, 2019; Nzekwe and Nzekwe, 2021). This commodity has contributed to Indonesian non-oil and gas exports.

The agricultural sector is a distinct factor in Indonesian development. This sector had contributed 2.45 percent to non-oil export from 2013 to 2020 (Statistics Indonesia, 2021). Overall, coconut oil's contribution is relatively lower than other products in the agricultural sector. It is suspected that the coconut commodity has not been developed optimally with various economic values. Coconut farmers sell the copra solely to sustain their daily income. A lack of diversfication of coconut commodities is supposed to be more attentive.

Indonesia was leading the world's coconut producing country in 2019, with a total production of 17.13 million tons, followed by the Philippines with 14.77 million tons, and India with 14.67 million tons (FAOSTAT, 2021). This should be Indonesia's primary key to pursuing non-oil and gas exports contribution to sustainable economic development. Unfortunately, this product only contributed 3.77 percent from 2013 to 2020 (Statistics Indonesia, 2021). Such exports earned a weak competition in the international market compared to the Philippines.

The world's price of CCO fluctuated from January 2004 to December 2019. The average price is US$ 1056.65 per month (Index Mundi, 2021). It was a sharp increase in February 2011 by US$2,256.00 per ton. It possibly affects the demand during the price volatility. The price of CCO is higher than other vegetable oil because of its derivative products. Typically, the coconut oil industry also relies on price to fulfill the supply in the market. The increase in CCO price is a market opportunity for supplying countries, but in reverse, it is a dilemma for importing countries. Germany produces local crops such as rapeseed, soybeans, and sunflowers as an alternative, mainly produced for the food industry. The price must remain stable at any level; otherwise, they prefer reasonable low-cost rapeseed.

The Philippines contributed to the world's CCO about 54.40 percent, while Indonesia contributed 33.60 percent over 16 years (ITC, Trade Map, 2021). The average exports of the Philippines and Indonesia are 0.67 million tons and 0.41 million tons, respectively. Indonesia's CCO export is still lower than the Philippines (Djoni *et al.*, 2013). An increase in domestic demand is one of the causes of this issue.

The world coconut oil demand is projected to reach 4.3 million tons in 2050 (Barthel *et al.,* 2018). There are several reasons the demand in Germany increased enormously, first of all, health and environmental issues. Then, the intervention and industrial opportunities can be utilized as raw materials. This product is produced for various industries such as food, biodiesel, cosmetics, oleochemicals, animal feed, and others. Consumers in Germany operate coconut oil for cooking, baking, or as a cosmetic product such as hair conditioner or body care (Grimhardt *et al.*, 2015).

The main essential issue is to see precisely the price factors, which often result in uncertainty implications from pricing strategies in the different specifications of models and data. An apparent orientation of price-sensitive policies may lead

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to negative implications. If the conditions were otherwise, there would be a principal discussion in the study. The differentiation and exclusive of products and services likely obtain a policy. Therefore, this study deals with the competitive position of Indonesian CCO in the German market.

2. LITERATURE REVIEW

A different approach produces a different policy in trade flow analysis. There are a plethora of studies in the literature discussing the trade flow analysis by several models, including multiple linear regression (e.g., Nguyen and Jolly, 2013; Tang, 2015), panel data regression (Bekele and Mersha, 2019; Nguyen, 2020), and the AIDS model (Sun and Niquidet, 2017, Heng and House, 2018; Mufeeth *et al.*, 2021). The AIDS model has been specified in several modifications, including Quadratic AIDS, Source-Differentiated AIDS, Linear Approximate AIDS, and others.

A couple of studies use the AIDS model for analyzing the Indonesian coconut crude oil. Dewanti *et al.* (2020) calculated Indonesia's CCO's demand and competition in the international market. The results revealed that Indonesia is sensitive to its price changes in the German market. As the cross-price elasticity of Indonesia and the Philippines is a positive sign, they are competing with each other. Expenditure elasticity for Indonesia is higher but negative for the Philippines. In addition, Niemi (2004) investigated the demand or various agriculture exports from ASEAN countries, including coconut oil in the European market. The result showed that the short-run and long-run price elasticity of coconut oil in the European market is 0.27 and 077, respectively, implying that coconut oil from ASEAN countries is inelastic. Long-run income elasticity has a unitary in the European market.

On the other hand, Djoni *et al.* (2013) analyzed the determinant of Indonesia's CCO export demand by using panel data regressions. The market share of Indonesian export is 67 percent in Malaysia, 21 percent in Singapore, and 28 percent in the Netherlands, respectively. Significant factors to the Indonesia exports are the prices of Indonesia, price of the Philippines, exchange rate, GDP per capita of importing countries, and the population of the importing countries.

Furthermore, Dewi and Xia (2022) investigated Indonesian coconut oil's trade specialization and competitiveness in the international market. They used the Trade Specialization Index (TSI) and Revealed Comparative Advantage (RCA) for the analysis. The TSI value for Indonesian coconut oil is 0.94 or at the maturity stage, implying that Indonesia tends to be a coconut oil-exporting country. The RCA value carries a positive sign (30.67) for Indonesia. It means there is a comparative advantage and strong competitiveness. Aulia *et al.* (2020) analyzed the competitiveness and export similarity of Indonesian coconut oil by using RCA, Acceleration Ratio (AR), TSI, and Export Similarity Index (ESI). The results found that Indonesia and the Philippines have competitiveness with RCA values of 33.26 and 149.86, respectively. Since the TSI value is 0.99, the coconut oil supply is greater than the demand in both countries. Hence, the two countries tend to be exporting countries. Indonesia has a strong position in the competition with an AR value of 1.03. the market share and growth rates of Indonesia and the Philippines can-

not fully reflect the level of competition because the ESI value is under 50.

3. DATA AND METHODOLOGY

3.1. Data

Germany CCO import data was retrieved from International Trade Centre-Trade Map, using a six-digit HS code (151311). Major supply countries are the Philippines and Indonesia, and minor supply countries are aggregated into the rest of the world (ROW). We used monthly time series data from 2004 to 2019. The raw dataset covered the import value and quantity by country. The import market shares are calculated by the sum of value (Indonesia, Philippines, ROW) divided by the total value (World). Import market shares are presented in Fig. (**1**).
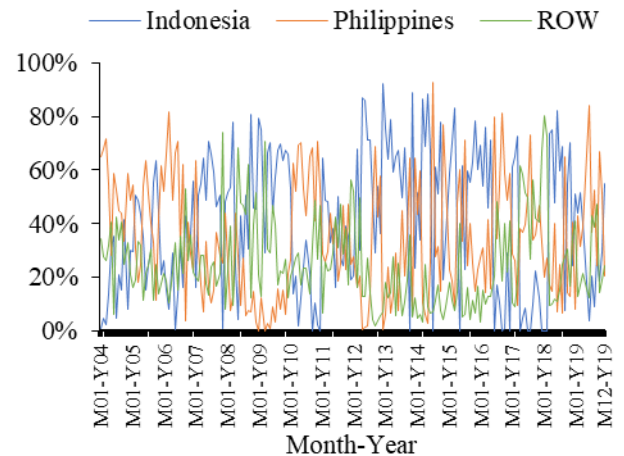

Fig. (1). Import shares of supply countries in Germany, Jan. 2004-Dec. 2019.

Source: ITC, Trade Map, (2021).

Table 1. Summary for the LA/AIDS variables in Germany

Variables	Mean	Std. Dev.	Min.	Max.
w_{Indo} (%)	40.20	25.72	0.00	92.40
w_{Phil} (%)	34.57	21.89	0.00	92.88
p_{Ind} ($/ton)	1042.56	372.22	496.02	2147.62
p_{Phil} ($/ton)	1426.06	974.22	512.84	4829.79
p_{Row} ($/ton)	1368.34	723.14	515.89	4288.85
Total Import ($)	17,544	11,058	2,559	99,243

Note: w_{Ind} is share Indonesia; w_{Phi} is share Philippines; p_{Ind} is price Indonesia; p_{Phil} is price Philippines; p_{Row} is price ROW.

3.2. Methodology

An Almost Ideal Demand System model (AIDS) was initially introduced by Deaton and Muellbauer (1980). Empirically, this model was selected to analyze the demand for CCO imported in Germany. According to Chang and Nguyen (2002), the AIDS model has been widely used because of its

theory consistency and flexible function. It is popular due to several advantages: able to offer an arbitrary first-order approximation to any demand system; satisfies the axioms of choice exactly; aggregates perfectly over consumers; simple to estimates; and can be used to examine the homogeneity and symmetry (Deaton and Muellbauer, 1980). The specification model of LA/AIDS is as follows:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln \left(\frac{x}{p^*} \right)$$

Where w_i is the import share of the supplying country; p is the price of coconut crude oil (US\$/ton); α_i, γ_{ij}, and β_i are parameters of share equations; x is the total expenditure (US\$); p^* is the Stone price index, specify as $\sum w_i \, lnp_i$.

The LA/AIDS model is applied as an empirical analysis for each supplying country into an importer country, where the stone price index is used. Selected supply countries are Indonesia and the Philippines, whereas Germany is an importer country in the model. There are three restrictions to be fulfilled in demand theory.

$$\text{Addin up:} \sum_{i=1}^{n} \alpha_1 = 1, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i=1}^{n} \beta_i = 0$$

$$\text{Homogeneity:} \sum_{i=1}^{n} \gamma_{ij} = 0$$

$$\text{Symmetry:} \gamma_{ij} = \gamma_{ji}$$

Both homogeneity and symmetry are obtained in the model, and adding-up is automatically satisfied as an advantage of the AIDS model since import shares add to one. Nevertheless, this study is restricted from empirically testing the homogeneity and symmetry conditions. The parameter estimates of LA/AIDS are used to compute the price and expenditure elasticities. This study applied price elasticity and expenditure elasticity (see Hayes et al., 1990; Jung and Koo, 2002; Rifin, 2013). Price elasticity is calculated by uncompensated which represents price and income effect, and compensated price elasticity represents only price effects. The estimation of the Marshallian (uncompensated) and Hicksian (compensated) price elasticity are in the following equations:

$$e_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \beta_i \left(\frac{w_j}{w_i} \right)$$

$$e_{ij}^* = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j$$

Where δ_{ij} is the Kronecker delta (1 for $i = j$ and 0 otherwise).

The expenditure elasticity is estimated as follows:

$$\eta_i = 1 + \frac{\beta_i}{w_i}$$

4. EMPIRICAL RESULTS

4.1. Coconut Crude Oil Market in Germany

It has been observed that European countries, including Germany, have tried to develop biodiesel as an attractive alternative energy source. Coconut oil produces biodiesel relatively higher than soybean and rapeseed (Hossain et al., 2012). From 2004 to 2019, Germany imported coconut crude oil, mainly from Indonesia, with an average total volume of 44.24 percent, then the Philippines with an average total of 34.87 percent (ITC, Trade Map, 2021). Moreover, the unit import value of the Indonesian CCO has fluctuated from January 2004 to December 2019. The average import value of Indonesia and the Philippines coconut oil were US\$ 7.76 million and US\$ 5.88 million, respectively. The highest total import value from Indonesia and the Philippines carried out by Germany occurred in May 2011 with a value of US\$ 38.01 million, and US\$ 32.43 million, respectively.
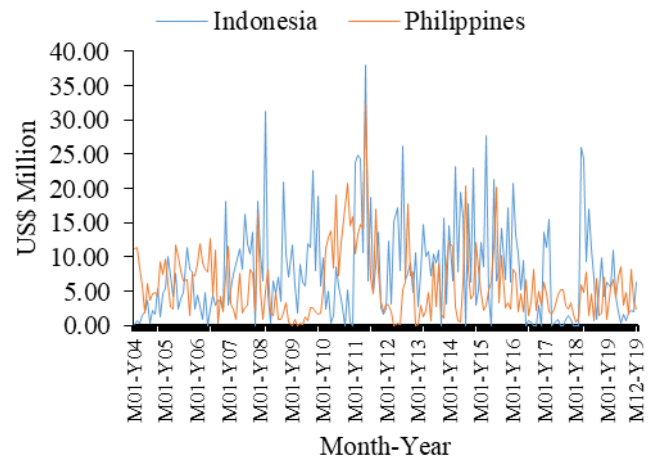

Fig. (2). Unit import value for Indonesia and the Philippines CCO in Germany, 2004-2019.
Source: ITC, Trade Map, (2021)

4.2. Elasticity Estimates

Estimation of the Marshallian, Hicksian, and expenditure elasticity utilize the parameters estimated in Table **2**. The price and expenditure elasticity are shown in Table **3**.

Table 2. Estimated Parameter of the LA/AIDS.

W	Variable			
	p_{Ind}	p_{Phil}	p_{Row}	x
w_{Ind}	-0.5436***	0.2445***	0.2991***	0.2228***
	(0.000)	(0.000)	(0.000)	(0.000)
w_{Phil}	0.2445***	-0.2650***	0.0205	-0.0653***
	(0.0000)	(0.000)	(0.503)	(0.003)

Note: ***, **, * significance at 1%, 5% and 10%, respectively.

Table 3. Estimated Elasticity of Coconut Crude Oil.

Elasticity	p_{Ind}	p_{Phil}	p_{Row}
Price			
Compensated (Hicksian)			
p_{Indo}	-1.9501	0.9538	0.9963
p_{Phil}	1.1093	-1.4209	0.3117
Uncompensated (Marshallian)			
p_{Ind}	-2.5749	0.4166	0.6042
p_{Phil}	0.7832	-1.7013	0.1071
Expenditure			
Indonesia	1.5541		
Philippines	0.8110		

The Marshallian own-price elasticities of Indonesia and the Philippines coconut crude oil carry a negative sign. This result has fulfilled the law of demand that changes in price and quantity are inversely (negative) all the time. The Marshallian own-price elasticities for Indonesia and the Philippines are -2.5749 and -1.7013, respectively. This means that when the coconut crude oil price of Indonesia and the Philippines increase by 1 percent, *ceteris paribus*, the quantity demand of both countries will decrease by 2.57 percent and 1.70 percent in Germany.

As the own-price elasticity is greater than 1, Indonesia and the Philippines coconut crude oil are sensitive to price changes. In this case, Indonesia is the most price elastic, implying that Indonesia's coconut crude oil is more sensitive to its price change compared to the Philippines. In demand theory, consumers' purchasing behaviors towards price sensitivity affect quantity demand. There is a level of consumers' importance in the market: some consumers value quality over price, and some are willing to sacrifice quality. Marketing, advertising, and promotion are the strategy to shift consumers' focus from price to other factors, such as product offerings, benefits, and other values.

The Hicksian price elasticities are identical to the Marshallian price elasticities in magnitude. Own-price elasticity for Indonesia and the Philippines CCO carries a negative sign, implying that when the CCO price of two countries increases by 1 percent, *ceteris paribus*, the quantity demand will decrease based on each value. To better understand the competitive relationship among supplier countries, the Hicksian cross-price elasticities are interpreted as follows. The cross-price elasticity of Indonesia and the Philippines carries a positive sign. The competitive relationship between both countries is relatively weak since the cross-price elasticity is inelastic. The cross-price elasticity of Indonesia with the Philippines is 0.9538, which means that a 1 percent increase in the price of the Philippines coconut crude oil import, *ceteris paribus*, will result in a 0.95 percent increase in quantity demand for Indonesia. An increase in the price levels of the Philippines' CCO causes Germany to purchase substitutes goods or Indonesian coconut crude oil.

Furthermore, coconut crude oil of Indonesia and the Philippines are normal goods. The values of expenditure elasticity for Indonesia and the Philippines are 1.5541 and 0.8110, respectively. When total expenditure on coconut crude oil imports in Germany increases by 1 percent, *ceteris paribus*, the quantity demanded will increase by 1.55 percent for Indonesia and 0.81 percent for the Philippines. Both values indicate that Indonesia is higher than the Philippines. As Germany is still expanding its market in the European region, Indonesia will earn more benefits when Germany increases its expenditure. In essence, a fall in Indonesian CCO prices increased Germany's expenditure.

5. CONCLUSION

Although demand in Germany tends to increase based on health and environmental issues, the price factors sometimes discourage supplying countries, especially the coconut oil industry. Aside from that, unit import volume for the supplying country determines the market position. Differences estimated results among the countries affect each other, either in the price or expenditure elasticity. The analysis discovers a few differences that might have otherwise gone unnoticed compared to the previous study. To estimate the purpose of the study, we employ 192 observations of monthly time series data from 2004 to 2019. Besides the market share, there are two main points in the findings that conclude in the study. The market share of Indonesia holds the first position instead of the Philippines. Higher elastic own-price elasticity of Indonesian CCO cause the price is more sensitive to its price change. As the cross-price elasticity is inelastic, the relationship between Indonesia and the Philippines tends to be a weak substitute. Indonesia will be more profitable due to the higher expenditure elasticity. It is worthy of note that the increased imports of CCO may have far-reaching implications on quantity demand. Applying a dynamic pricing strategy based on current market demands during the competition is necessary. In addition, enlarging the market size into the new consumers, promotions, and upgrading CCO quality are immediate steps in the competition. For further research, Indonesian CCO can be tested separately for short-rung and long-rung elasticity.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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