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The Impact of CPO Downstream Policy in Cooking Oil Industry on Indonesian Export Foreign Change

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ABSTRACT

Cooking oil is one of the derivatives of Crude Palm Oil (CPO) food products, which plays an important role in life and the economy. Government policies downstream, such as changes in export taxes and increasing the production capacity of the downstream cooking oil industry, are designed to encourage the development of cooking oil production. This study employs an econometric equation model with simultaneous equations to: (1) analyze the factors affecting CPO demand by the cooking oil industry; demand and supply, as well as palm cooking oil exports (2) analyze the impact of changes in export taxes; increasing CPO production capacity and the combination of these policies on foreign exchange earnings from cooking oil exports. The findings indicated that changes in Indonesia's CPO export tax reduced the volume of CPO exports globally but increased domestic CPO supply. Consequently, CPO prices declined, leading to higher demand from the downstream industry. Increased demand for CPO and higher production capacity in the downstream industry were expected to boost cooking oil production further.

Keywords: *econometric models, government policy, growth economy, trade, and simultaneous equations*

BACKGROUND

Indonesia's position as the world's largest producer and consumer of CPO (Crude Palm Oil) is a challenge for comprehensive palm oil management in overcoming oversupply. It is because Indonesia's CPO production is much larger than the total domestic CPO consumption (Novindra *et al*. 2019a; Monitor 2023 & Siregar *et al*. 2023). The government responds to these challenges with palm oil management policies in both upstream and downstream systems by encouraging downstream products that have added value. This policy is aimed at supporting CPO price stability and encouraging an increase in CPO production (Bentivoglio 2018; PASPI 2021 & Purba *et al*. 2018a).

Indonesia's CPO Production and Exports have fluctuated and tend to increase in the last 10 years (2014-2023), with the largest exports in 2018 of 28,279.35 thousand tons. One of the factors

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that affects the fluctuation in CPO export volume is the high production of CPO and the low downstream ability, so the government encourages exports (Nurmalita & Wibowo, 2019; Silitonga et al., 2016). This is evidenced by the Indonesian government's policy of exempting export taxes for less than the last six years (2015-2020). However, this export tax exemption significantly increases the volume of Indonesia's CPO exports, threatening CPO supplies for domestic needs and depending on world CPO prices. Because of this, in 2021, the government began to re-implement the CPO export tax with a tax value of more than 20 percent (Immanuel et al. 2019; Monitor 2023; Novindra et al. 2019b; Sinaga et al. 2020).

The government needs to encourage downstream so that the value of CPO derivative products is still around 20 to 30 percent of total CPO production (Ali et al. 2020; Purba et al. 2018a; Tandra & Suroso 2023). In addition to export taxes, the government increases the production capacity of CPO derivatives by building Kawasan Ekonomi Khusus (KEK) as a center for developing large-scale and international quality downstream palm and rubber industries (GAPKI 2022). The importance of downstream CPO with the calculation of a reduction in CPO exports by five percent will increase the export of CPO derivative products by 15 percent, thus benefiting the Indonesian state by around USD 7 billion per year (Febrinda et al. 2022; PASPI 2021 & Tandra et al. 2023). This effort also encourages the government's goal of becoming an exporting country of CPO derivatives to increase the country's foreign exchange and expand marketing (Purba et al. 2018a; Sinuraya et al. 2017; Tandra & Suroso 2023; Widhosari 2013).

This research focuses on cooking oil products because it is one of the nine Indonesian food ingredients whose price stability and availability will affect the needs of the community (Azhar et al. 2017; Falgenti & Hambali 2021; Pacheco et al. 2017; Silitonga et al. 2016). The relatively large role of cooking oil as an export product indicates that this product is quite strategic and needs special attention in the CPO downstream policy set by the Indonesian government. This policy can strengthen the domestic industry, reduce economic risks and price fluctuations in the international market, and increase domestic CPO supply (Novindra et al., 2019a).

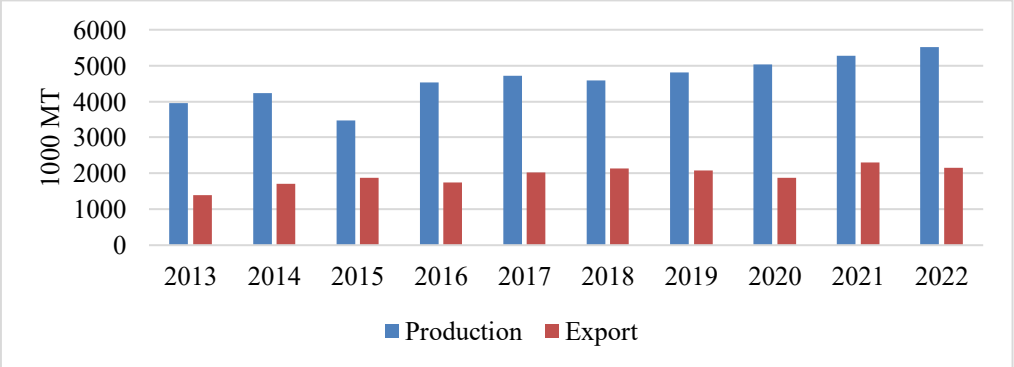

Figure 1. Indonesian Cooking Oil Production and Exports in 2013-2022
Source: Indexmundi, 2024

The average export of Indonesian palm cooking oil from 2013 to 2022 is 19,315.37 thousand tons. The export volume of this product fluctuates, with the largest decrease in export volume

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occurring in 2020 by 10.12 percent, while the largest increase in exports in 2019 was 107.98 percent (Figure 1). However, from 2013 to 2022, the average export of cooking oil products was almost half of its total production, so the CPO derivative products have export prospects in the future. Cooking oil exports are still fluctuating, tend to be unstable or declining, which can hinder economic growth, especially in countries with less developed economies (Prabowo et al. 2023 & Silitonga et al. 2016). Various factors influence fluctuations in the export of CPO derivative products of cooking oil, so it is necessary to research the factors that affect Indonesian cooking oil exports. Despite the government's policy of encouraging downstream, GAPKI (2022) recorded a cooking oil production capacity of 15.3 million tons. This production is still relatively low because Indonesia's CPO derivative production capacity is only about half of the CPO derivative production capacity of other CPO derivative-producing countries, so it has prospects for development (Abdul 2023; Malefane 2020; Riwaldi et al. 2023 & Purba et al. 2018b).

Although there is a CPO downstream policy, the policies carried out by the government are considered ineffective in maintaining the stability of domestic palm cooking oil production and prices. As is the case in 2022, there was an issue of cooking oil scarcity, so there was a restriction on the number of purchases of cooking oil, even though the volume of product exports was relatively large compared to imports. Based on previous research, there has been a study that examines the impact of internal and external policies of CPO on export foreign exchange receipts, but this study focuses on the CPO derivative industry, namely the cooking oil industry, with a policy of increasing export taxes and production capacity, so that this policy is considered important and different from previous research. This research is needed to (1) analyze the factors that affect the demand for palm oil by the cooking oil industry; supply and export of cooking oil, (2) evaluating the impact of the policy of increasing CPO export tax, cooking oil production capacity, and the combination of the two policies on Indonesia's export foreign exchange receipts.

RESEARCH METHODS

Data Types and Sources

The study used secondary time series data covering 1998-2022 (25 years). Data is sourced from BPS, Indexmundi, UN-Comtrade, PIHPS, the World Bank, and others. The research is focused on palm oil as a raw material for cooking oil (HS 151110) and palm cooking oil products (HS 151190), which are processed using SAS/ETS for Windows 9.4 software. This research is part of the research on the downstream of Indonesian CPO, which is divided into CPO blocks, cooking oil blocks, margarine blocks, and soap blocks. The research consists of 29 equations (16 structural equations and 13 identity equations), and the following eleven equations are used in the research:

Crude Palm Oil (CPO) Block

1. Demand for Palm Oil (CPO) by the Indonesian Cooking Oil Industry

$PdMSIMGt = a0 + a1(HRDMGSI_t) + a2(KPMGI_t) + a3(HRDMSIt\text{-}1) + a4(PdMSIMGt\text{-}1) + U1t$

The expected parameters are $a_1, a_2 > 0$; $a_3 < 0$ and $0 < a_4 < 1$

Information:

$PdMSIMG_t$ = Palm Oil Demand by the Cooking Oil Industry in the year t (000 tons)

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$HRDMGSI_t$ = Domestic Real Price of Indonesian Cooking Oil in year t (Rp/ton)
$KPMGI_t$ = Indonesia's Cooking Oil Production Capacity in t (tons)
$HRDMSI_{t-1}$ = Real Domestic Price of Indonesian Palm Oil in year t-1 (Rp/ton)
$PdMSIMG_{t-1}$ = Palm Oil Demand by the Cooking Oil Industry in the year t (000 tons)
U_{1t} = Disruptive variable

2. Total Palm Oil (CPO) Demand in Indonesia

$TPdMSIN_t = PdMSIMG_t + PdMSIM_t + PdMSIS_t + PdMSIL_t$

Information:
$TPdMSIN_t$ = Total Indonesian Palm Oil Demand in the year t (000 tons)
$PdMSIMG_t$ = Palm Oil Demand by the Cooking Oil Industry in the year t (000 tons)
$PdMSIM_t$ = Palm Oil Demand by Margarine Industry year t (000 tons)
$PdMSIS_t$ = Palm Oil Demand by Soap Industry year t (000 tons)
$PdMSIL_t$ = Demand for Palm Oil by Other Industries in year t (000 tons)

3. Indonesia's Palm Oil (CPO) Exports

$EMSI_t = b_0 + b_1(PIMSI_t) + b_2(HREMSI_t) + b_3(PEMSI_t) + U_{2t}$

The expected parameters are $b_1, b_2 > 0$ and $b_3 < 0$

Information:
$EMSI_t$ = Indonesia's Palm Oil Exports in the year t (000 tons)
$HREMSI_t$ = Real Price of Indonesian Palm Oil Exports year t (US$/ton)
$PIMSI_t$ = Indonesia's Palm Oil Production year t (000 tons)
$PEMSI_t$ = Indonesian Palm Oil Export Tax year t (000 tons)
U_{2t} = Disruptive variable

4. Domestic Real Price of Indonesian Palm Oil (CPO)

$HRDMSI_t = c_0 + c_1(TPdMSIN_{t-1}) + c_2(PsDMSI_t) + c_3(HREMSI_t) + c_4(HRDMSIt\text{-}1) + U_{3t}$

The expected parameters are $c_1, c_3 > 0$ and $c_2 < 0$ and $0 < c_4 < 1$

Information:
$HRDMSI_t$ = Domestic Real Price of Indonesian Palm Oil Year t (Rp/ton)
$TPdMSIN_{t-1}$ = Total Indonesian Palm Oil Demand in the year t-1 (000 tons)
$PsDMSI_t$ = Domestic Supply of Indonesian Palm Oil Year t (000 tons)
$HREMSI_t$ = Real Price of Indonesian Palm Oil Exports year t (US$/ton)
$HRDMSI_{t-1}$ = Domestic Real Price of Indonesian Palm Oil in the year t-1 (Rp/ton)
U_{3t} = Disruptive variable

5. Indonesia's Palm Oil (CPO) Export Foreign Exchange Receipts

$PDEMSI_t = EMSI_t * HREMSI_t * NTRTD_t$

Information:
$PDEMSI_t$ = Foreign Exchange Receipts for Indonesian Palm Oil Exports in the year t (Rp)
$EMSI_t$ = Indonesia's Palm Oil Exports in the year t (000 tons)
$HREMSI_t$ = Real Price of Indonesian Palm Oil Exports year t (US$/ton)
$NTRTD_t$ = Rupiah to Dollar Exchange Rate (Rp/US$)

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Cooking Oil Block

1. Indonesian Palm Cooking Oil Production

$PIMGI_t = PdMSIMG_t * FKMSMMG_t$

Information:

$PIMGI_t$ = Indonesian Cooking Oil Production year t (000 tons)
$PdMSIMG_t$ = Palm Oil Demand by the Cooking Oil Industry in the year t (000 tons)
$FKMSMMG_t$ = Factors of Conversion of Palm Oil to Cooking Oil

2. Indonesian Palm Oil Cooking Oil Demand

$PdMGSI_t = d_0 + d_1(HRDMGSI_t) + d_2(POPI_t) + d_3(PdMGSI_{t-1}) + U_{4t}$

The expected parameter is $d_1<0; d_2>0$ and $0<d_3<1$

Information:

$PdMGSI_t$ = Demand for Palm Cooking Oil in Indonesia in the year t (000 tons)
$HRDMGSI_t$ = Domestic Real Price of Indonesian Cooking Oil in year t (Rp/ton)
$POPI_t$ = Population of Indonesia in year t (million people)
$PdMGSI_{t-1}$ = Demand for Palm Cooking Oil in Indonesia in the year t (000 tons)
U_{4t} = Disruptive variable

3. Indonesian Palm Oil Cooking Oil Offers

$PsMGSI_t = PIMGI_t - EMGSID_t$

Information:

$PsMGSI_t$ = Palm Cooking Oil Supply in Indonesia year t (000 tons)
$PIMGI_t$ = Indonesian Cooking Oil Production year t (000 tons)
$EMGSID_t$ = Indonesia's Palm Oil Cooking Oil Exports to the World in the year t (000 tons)

4. Real Prices of Indonesian Palm Oil

$HRDMGSI_t = e_0 + e_1(PsMGSI_t - PsMGSI_{t-1}) + TREND + U_{5t}$

The expected parameter is $e_1<0$

Information:

$HRDMGSI_t$ = Domestic Real Price of Indonesian Cooking Oil Year t (Rp/kg)
$PsMGSI_t$ = Palm Cooking Oil Supply in Indonesia year t (000 tons)
$PsMGSI_{t-1}$ = Palm Cooking Oil Supply in Indonesia in the year t-1 (000 tons)
TREND = Time Trend
U_{5t} = Disruptive variable

5. Indonesian Palm Oil Cooking Oil Exports

$EMGSID_t = f_0 + f_1(HREMGSI_{t-1}) + f_2(PIMGI_t) + f_3(NTRTD_t) + f_4(EMGSID_{t-1}) + U_{6t}$

The expected parameters are $f_1, f_2, f_3>0$ and $0<f_4<1$

Information:

$EMGSID_t$ = Indonesia's Palm Oil Cooking Oil Exports to the World in the year t (000 tons)
$HREMGSI_{t-1}$ = Real Export Price of Indonesian Palm Cooking Oil in the year t-1 (US$/ton)
$PIMGI_t$ = Indonesian Cooking Oil Production year t (000 tons)
$NTRTD_t$ = Rupiah to Dollar Exchange Rate (Rp/US$)
$EMGSID_{t-1}$ = Indonesia's Palm Oil Cooking Oil Exports to the World in t year t (000 tons)
U_{6t} = Disruptive variable

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6. Foreign Exchange Receipts for Indonesian Palm Oil Exports

$PDEMGSI_t = EMGSID_t * HREMGSI_t * NTRTD_t$

Information:

$PDEMGSI_t$ = Foreign Exchange Receipts for Cooking Oil Exports in the year t (Rp)
$EMGSID_t$ = Indonesia's Palm Oil Cooking Oil Exports to the World in the year t (000 tons)
$HREMGSI_t$ = Real Export Price of Indonesian Palm Cooking Oil Year t (US$/ton)
$NTRTD_t$ = Rupiah to Dollar Exchange Rate (Rp/US$)

Data analysis techniques

This study uses a simultaneous equation model system. The simultaneous equation system model in this study is the CPO downstream model. The CPO downstream model in this equation consists of 29 equations covering four blocks, namely the palm oil block, consisting of five structural equations and six identity equations, as well as the cooking oil block, margarine block, and soap block, which each consists of three structural equations and three identity equations.

The analysis presented in this paper is part of the results of a study that only examines the impact of CPO downstream policy simulations on the CPO industry and the cooking oil industry (palm oil block and cooking oil block). The CPO downstream model used in this study has passed the stages of model specification, model identification, model estimation, model validation, and model evaluation. This is in line with the stages of data processing with the simultaneous method according to Koutsoyiannis (1997). After that, to analyze the policy, a simulation stage was carried out. The stages of the simulation scenario carried out are (1) an increase in CPO export tax by 43.95 percent, (2) an increase in the production capacity of the cooking oil industry by 61.25 percent, and (3) a combination of the two policies. The simulation of an increase in export tax of 43.95 percent is based on Mentri Keuangan Regulation (PMK) Number 1 in 2022 and PMK 76/2021 regarding the amount of specific tariffs on CPO and derivative products regarding Indonesia's CPO export tax in 2022 of 43.95 percent. The simulation of an increase in cooking oil production capacity by 61.52 percent is due to the upward trend of cooking oil industry production in 2018-2022 of 8,723,500 thousand tons and the combination of these two policies.

In answering the objectives of the study, the endogenous variables analyzed were the equation of palm oil demand (CPO) by the cooking oil industry, total palm oil demand, Indonesian palm oil (CPO) exports, domestic real prices of palm oil (CPO), foreign exchange receipts of Indonesian palm oil (CPO) exports, Indonesian palm oil production, Indonesian palm cooking oil demand, Indonesian palm cooking oil supply, real prices of Indonesian palm cooking oil, exports of Indonesian palm cooking oil, and foreign exchange receipts from Indonesian palm cooking oil exports.

RESULT AND DISCUSSION

Factors Affecting Demand, Exports, Prices, and Receipts of Indonesian Export Foreign Exchange from the CPO Industry and Cooking Oil Industry.

Crude Palm Oil (CPO) Block

1. Demand for Palm Oil by the Cooking Oil Industry

The factors affecting the cooking oil industry's demand for palm oil cooking oil production and demand for palm oil by the cooking oil industry in the year t-1 (Table 1).

Table 1. Results of the estimation of the palm oil demand equation by the cooking oil industry

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Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	BR		
PdMSIMG	Demand for Palm Oil by the Cooking Oil Industry (000 tons)				
Intercept	-62.0639			0.4336	Intercept
HRDMGSI	0.01494	0.0492	0.1701	0.3756	Domestic Real Price of Indonesian Cooking Oil (Rp/kg)
KPMGI	0.066305	0.3158	1.0906	0.0227***	Indonesian Cooking Oil Production Capacity (000 tons)
LHRDMSI	-0.00651	-0.0134	-0.0464	0.4320	Domestic Real Price of Indonesian Palm Oil in Year T-1 (Rp/kg)
LPdMSIMG	0.710437			<.0001****	Demand for Palm Oil by the Cooking Oil Industry in the year t-1 (000 tons)
R-Squared	0.95934	Prop>|F|	<.0001	Durbin-h stat	2.140131

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

The demand for palm oil by the cooking oil industry was positively influenced by the production capacity of the Indonesian cooking oil industry at the level of five percent and the demand for palm oil by the cooking oil industry in the previous year at a significant level of one percent. The parameter value of the production capacity of the cooking oil industry is 0.07, which means that if there is an increase in cooking oil production capacity by one thousand tons, it will increase the demand for palm oil by 0.07 thousand tons. The variables of Indonesia's palm cooking oil production capacity are inelastic in the short term (0.32) and elastic in the long term (1.09). The demand for palm oil by the cooking oil industry is elastic in the long term due to adaptation to technological developments, improving the efficiency of raw materials, providing government fiscal incentives, and other government policies that encourage an increase in cooking oil production. This can be supported by the government's policy to increase the production capacity of downstream industries by improving the quality and production of existing CPO derivative products, the inauguration of special economic zones such as the factory in Sei Mengkei to provide investment and facilitate the construction requirements for CPO derivative factories, and the encouragement of CPO derivative exports by providing export taxes that are much smaller than CPO export taxes. This research is supported by research by Novindra et al. (2019b) that says that the demand for palm oil by the domestic cooking oil industry is influenced by the industry's production capacity has a positive and significant effect at the level of 20 percent, but is not elastic in the short term (0.13) or long term (0.99) with a period of 1990 to 2017.

The demand for palm oil by the cooking oil industry in the previous year had a positive and significant influence at the level of one percent on the demand for palm oil by the cooking oil industry.

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This is due to the nature of cooking oil as a basic need whose demand and consumption are relatively stable and have become part of the consumption patterns of the Indonesian people. This research is supported by the fact that the demand for domestic palm oil (CPO) by the cooking oil industry was influenced by the demand for palm oil by the cooking oil industry in the previous year at the level of one percent (Novindra et al., 2019b).

2. Indonesia's Total Palm Oil Demand

The total demand for Indonesian palm oil is an identity equation calculated from the sum of palm oil demand by the cooking oil industry, palm oil demand by the margarine industry, palm oil demand by the soap industry, and palm oil demand by other industries.

3. Indonesia's Palm Oil (CPO) Exports

Variables affecting Indonesia's palm oil exports include by real price of palm oil and palm oil export tax (Table 2). The variable of the real price of palm oil exports has a significant positive effect at the level of five percent on Indonesia's palm oil exports. This is because, as the world's main palm oil producer, Indonesia's palm oil exports are still dependent on the world palm oil price. When the world price is higher than the domestic price, palm oil producers will tend to export palm oil because they will get higher profits. The parameter value of the real price of palm oil exports to Indonesian palm oil exports is 6.87, which means that when there is an increase in the real price of palm oil exports by one USD/ton, it will increase the export volume by 6.87 thousand tons. The results of this study are in line with Purba's (2019) research, which said that the price of Indonesian palm oil exports has a positive but insignificant effect at the level of 30 percent.

Table 2. Indonesia's palm oil exports

Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	LR		
EMSI	Indonesia's Palm Oil Exports				
Intercept	1724.758			0.1448	Intercept
PIMSI	0.017274	0.0786		0.3343	Indonesian Palm Oil Production (000 tons)
HREMSI	6.873881	-0.0789		0.00475****	Real Price of Indonesian Palm Oil Exports (US$/ton)
PEMSI	-142.199	-0.1527		0.00795***	Indonesian Palm Oil Export Tax (%)
R-Squared	0.70797	Prop>|F|	0.0002	Durbin-h stat	2.357831

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

Indonesia's palm oil export tax has a significant negative effect on Indonesia's palm oil exports at the level of five percent. This is because export tax is a government policy with a mechanism to increase export costs charged to exporters. The increase in export taxes has resulted in an increase in the price of exported products by the amount of taxes applied. The increase in export taxes results in

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higher CPO prices in the world market, thus reducing the competitiveness of Indonesian CPO and reducing exporters' profits, which leads to a decrease in CPO export volume. The parameter value of the export tax shows that if there is an increase in export tax by one percent, it will reduce the volume of Indonesia's CPO exports to the world by 142.20 thousand tons. The role of increasing palm oil export taxes in the increase in taxes by 37.05 percent from the previous year, which encouraged a decrease in the volume of Indonesian palm oil exports. The results of this study are in line with Purba's (2019) research, which said that export taxes have a significant effect on Indonesia's CPO export volume at the level of 15 percent. This research is supported by Siregar (2023) & Nawangsih *et al*. (2023), which states that palm oil exports are not affected by export taxes, but the interest rate and palm oil exports in the previous year significantly affect Indonesia's palm oil exports in the year at the level of 15 percent.

4. Domestic Real Price of Indonesian Palm Oil (CPO)

The equation of Indonesia's domestic palm oil (CPO) price is influenced by Indonesia's domestic palm oil supply and Indonesia's real palm oil (CPO) export price (Table 3). The variable of domestic palm oil supply has a negative and significant effect on the real domestic price of Indonesian palm oil at the level of five percent. The parameter value of this variable is -0.20, which means that when there is an increase in supply by one thousand tons, it will reduce the domestic price by Rp0.20/kg. When viewed from the elasticity value, the domestic cooking oil supply is inelastic both in the short term (0.56) and in the long term (0.56). This research is supported by Novindra *et al*. (2019a) concluded that the domestic palm oil supply affected the domestic real price of Indonesian palm oil negatively but not significantly at the level of 15 percent.

Table 3. Domestic real price of Indonesian palm oil

Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	LR		
HRDMSI	Domestic Real Price of Indonesian Palm Oil				
Intercept	4201.825			<.0001	Intercept
LTPdMSIN	0.264401	0.2631	0.2642	0.1524	Total Indonesian Palm Oil Demand for T-1 (000 tons)
PsDMSI	-0.19745	-0.5604	-0.5628	0.03025***	Domestic Supply of Indonesian Palm Oil (000 tons)
HREMSI	7.174009	0.6341	0.6368	<.0001****	Real Price of Indonesian Palm Oil Exports (US$/ton)
LHRDMSI	0.0042			0.48305	Domestic Real Price of Indonesian Palm Oil in T-1 (Rp/ton)
R-Squared	0.78642	Prop>|F|	0.1063	Durbin-h stat	2.349172

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

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The real price of palm oil exports has a positive and significant effect at the level of one percent on the domestic price of Indonesian palm oil. An increase in the domestic real price of USD 1/ton will increase the domestic real price of palm oil by Rp7.17/kg. This is because the higher the real price value of domestic exports, encourages Indonesia's palm oil exports to the world so that the supply of domestic palm oil and the real price of domestic palm oil increases. The results of this study are in line with Siregar's (2023) research, which said that the real price of Indonesian domestic palm oil is influenced by the real price of palm oil exports, which is positively related and has a real effect at the level of one percent.

5. Foreign Exchange Receipts for Indonesian Palm Oil Exports

This equation is an identity equation calculated from the volume of Indonesian palm oil exports to the world, multiplied by the real price of Indonesian palm oil exports, multiplied by the rupiah exchange rate against the dollar.

Cooking Oil Block

1. Indonesian Palm Cooking Oil Production

This equation results from multiplying the demand for palm oil by the Indonesian cooking oil industry and the conversion factor of palm oil to cooking oil in the same year.

2. Indonesian Palm Oil Cooking Oil Demand

The factors affecting the demand for Indonesian palm cooking oil can be seen in Table 4.

Table 4. Results of the estimation of the demand equation for Indonesian palm cooking oil

Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	LR		
PdMGSI	**Demand for Palm Cooking Oil in Indonesia (000 tons)**				
Intercept	-917.713			0.0207	Intercept
HRDMGSI	-0.00468	-0.0233	-0.0466	0.3403	Domestic Real Price of Indonesian Cooking Oil (Rp/kg)
POPI	8.601519	0.9592	1.9165	0.0065****	Population of Indonesia (million people)
LPdMGSI	0.499468			0.0059****	Indonesian Palm Oil Cooking Oil Demand in the year t-1 (000 tons)
R-Squared	**0.92254**	**Prop>|F|**	**<.0001**	**Durbin-h stat**	**1.985947**

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

The equation of Indonesia's palm cooking oil demand is positively and significantly influenced by the Indonesian population at the level of one percent, with a *unitary* elasticity value in the short

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term (0.96) and perfectly elastic in the long term (1.92). The increase in the population of the Indonesian people also increases the demand for Indonesian domestic palm oil due to the nature of cooking oil as a food need related to consumption and economic activities of the community, thereby increasing the demand for Indonesian domestic cooking oil.

The demand for palm cooking oil in the previous year had a positive and significant effect at the level of one percent. Rambe & Nunung (2018); Novindra *et al.* (2019b) said that the demand for cooking oil was not only influenced by the per capita income of the Indonesian people but also by the price of domestic and the demand for palm oil by the cooking oil industry in the previous year.

3. Indonesian Palm Oil Cooking Oil Offers

The supply of palm cooking oil in Indonesia is a common identity obtained from Indonesian cooking oil production minus Indonesia's palm cooking oil exports to the world in the same year period.

4. Real Prices of Indonesian Palm Oil

The factors that affect the domestic price of Indonesian palm cooking oil are the difference between the supply of cooking oil in the year t and cooking oil in the previous year which has a negative but not significant effect at a certain level and the variable of the time trend (Table 5), that has a positive and significant effect at the level of one percent because over time, the price of cooking oil has increased due to several factors, such as inflation which causes the rupiah exchange rate to weaken, an increase in demand for cooking oil due to population growth which leads to an increase in domestic prices, limited raw materials, global price dynamics, and others (GAPKI 2022). The results of this study are by Novindra *et al*. (2019a); Rambe & Nunung (2018) conclude that the demand for cooking oil has a positive effect and the supply of cooking oil has a negative effect, but neither has a significant effect on the price of domestic cooking oil.

Table 5. Results of domestic real prices of Indonesian palm cooking oil

Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	LR		
HRDMGSI	**Domestic Real Price of Indonesian Palm Cooking Oil (Rp/ton)**				
Intercept	6174.879			<.0001	Intercept
DPsMGSI	-0.13408	-0.0005		0.4483	Difference in Cooking Oil Supply Year t and Year T-1 (000 tons)
TRAIN	354.244700	0.7875		<.0001****	Time Trend
R-Squared	0.65757	**Prop>|F|**	<.0001	**Durbin-h stat**	1.115597

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

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5. Indonesia's Palm Oil Cooking Oil Exports to the World

Factors affecting Indonesia's cooking oil export volume can be seen in Table 6.

Table 6. Indonesia's palm cooking oil exports to the world

Variable	Parameter Estimation	Elasticity		Prob > |T|	Variable Label
		SR	LR		
EMSI	Indonesian Palm Oil Exports (000 tons)				
Intercept	-743.241			0.0823	Intercept
LHREMGSI	0.015533	0.0904	0.1446	0.2037	Real Price of Indonesian Palm Cooking Oil Exports in T-1 (US$/ton)
PIMGI	0.19826	0.5907	0.9443	0.0166***	Indonesian Cooking Oil Production (000 tons)
NTRTD	0.070176	0.7357	1.1762	0.06975**	Rupiah to Dollar Exchange Rate (Rp/US$)
LEMGSID	0.374495			0.05605**	Indonesia's Palm Oil Cooking Oil Exports to the World in T-1 (000 tons)
R-Squared	0.97048	Prop>|F|	<.0001	Durbin-h stat	2.125271

Information:
****= significant α = 1%, ***= significant α = 5%; **= significant α = 10%; and *= significant α = 15%
SR = long-term, LR = short-term

The variable palm cooking oil production has a positive and significant effect on Indonesia's palm cooking oil exports to the world at the level of five percent. The higher domestic palm cooking oil production will increase domestic supply, thereby increasing Indonesia's palm cooking oil exports. Based on the parameter value, an increase in palm oil production by one thousand tons will increase Indonesia's palm oil exports by 0.19 thousand tons, which is elastic in the short term (0.59) and *unitary* elastic in the long term (0.94).

The variable exchange rate of the rupiah against the dollar has a positive effect at the level of ten percent on the volume of Indonesian cooking oil exports, where the larger the exchange rate of the rupiah against the dollar, the greater the increase in export volume. This is because the higher the price received by domestic cooking oil producers. The value of the elasticity of the rupiah exchange rate against the dollar is *unitary* elastic in the short term (0.74) and perfectly elastic in the long term (1.18). Meanwhile, palm cooking oil exports in the previous year had a positive and significant effect at the level of ten percent, while the real price of domestic cooking oil exports in the previous year had a positive but not significant effect at a certain level.

The existence of a regulation issued by the Minister of Trade in 2022 regarding restrictions on the export of CPO and its derivative products reduced the export volume of palm cooking oil by 148.78 thousand tons or by 6.46 percent. This regulation is supported by Novindra et al., (2019a) who

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conclude that cooking oil exports are influenced by cooking oil production and the rupiah exchange rate against the dollar is significantly positive at the level of ten percent, and cooking oil exports in the previous year are positively significant at the level of one percent.

6. Foreign Exchange Receipts for Indonesian Palm Oil Exports

The foreign exchange equation for palm cooking oil exports is an identity equation obtained from the multiplication of Indonesia's cooking oil export volume by the real price of cooking oil exports and the rupiah exchange rate against the dollar.

The Impact of the Increase in Export Tax, the Production Capacity of Indonesia's Downstream Cooking Oil Industry, and the Combination of Two Policies on the CPO Industry, the Cooking Oil Industry, and Indonesia's Export Foreign Exchange Receipts

The effect of increasing production capacity, downstream industrial production capacity, and the combination of policies can be seen in Table 7. The results of the validation of the model for the 2018-2022 time period show that the value of the endogenous variable U-Theil is 0.06 palm oil demand, palm oil demand by the cooking oil industry is 0.06; total domestic palm oil demand is 0.01; domestic real price of palm oil is 0.16; palm oil exports are 0.52; cooking oil production is 0.05; the average cooking oil demand is below 30 percent, which is 92.00 percent, so it can be continued to the simulation stage. These models can be used for alternative *simulation scenarios* on the impact of the downstream policy of CPO on Indonesian palm cooking oil and its impact on Indonesia's export foreign exchange earnings.

Table 7. The Impact of Increasing Production Capacity in Indonesia's Downstream Cooking Oil Industry and Export Foreign Exchange Receipts for the 2018-2022 Period

Variable	Basic Values	Percentage Change		
		S1	S2	S3
PdMSIMG (Palm Oil Demand by the Cooking Oil Industry 000 tons)	5902.348296	0.001809	38.695223	38.697033
TPdMSIN (Total Indonesian Palm Oil Demand 000 tons)	16471.094693	0.001983	15.038431	15.040414
HRDMSI (Indonesian Domestic Real Price Rp/kg)	6218.943345	-1.951816	7.254251	5.302556
EMSI (Indonesian Palm Oil Exports 000 tons)	6203.251303	-10.252056	0.017930	-10.234137
PIMGI (Indonesian Palm Oil Production 000 tons)	5312.113466	0.001809	38.695223	38.697033
PsMGSI (Indonesian Palm Oil Cooking Oil Offer 000 tons)	3084.819987	0.002498	48.915897	48.918395
PdMGSI (Indonesian Palm Oil Cooking Oil Demand 000 tons)	2689.533839	0.000002	0.017231	0.017233
HRDMGSI (Domestic Real Price of Indonesian Palm Oil 000 tons)	14302.453973	-0.000072	-0.405201	-0.405273

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Variable	Basic Values	Percentage Change		
		S1	S2	S3
EMGSID (Indonesian Palm Oil Export to the World 000 tons)	2227.293479	0.000856	24.539505	24.540360
PDEMSI (Foreign Exchange Receipts for Indonesian Palm Oil Exports)	67558.029889	-13.350763	0.020635	-13.330142
PDEMGSI (Foreign Exchange Receipts for Indonesian Cooking Oil Exports)	257975.65313	0.001185	27.102198	27.103384

Information:
S1: Increase in CPO export tax by 43.95 percent; S2: Increase in palm cooking oil production capacity by 61.26 percent, and S3: Combination of scenario 1 (S1) and scenario 2 (S2)

S1: The Impact of the Increase in CPO Export Tax

The government's policy in increasing the export tax on CPO in 2022 to 43.95 percent has caused a decrease in the price of Indonesia's CPO exports to the world market. The decline in CPO export prices had an impact on the decrease in Indonesia's CPO export volume by 10.25 percent. On the other hand, the increase in Indonesia's CPO export tax to the world has caused government revenue from CPO export taxes to increase. The decrease in CPO export volume due to the increase in taxes caused an increase in domestic CPO supply, so that the demand for CPO by the cooking oil industry increased by 0.002 percent, and increased the total demand for Indonesian CPO. As for the simulation period, the increase in domestic CPO supply was greater than the increase in domestic CPO demand, so that domestic CPO prices decreased by 1.95 percent. The decline in domestic CPO prices has an impact on the decline in the area of plantations and the productivity and production of Indonesian palm oil. This condition resulted in a decrease in the surplus of oil palm farmers due to the decline and production of Indonesian palm oil. In addition, the decline in palm oil production has led to a decrease in CPO production and productivity, resulting in a decrease in the surplus of Indonesian CPO producers.

The decline in domestic CPO caused an increase in CPO demand by the cooking oil industry by 0.002 percent. This condition has led to an increase in CPO consumer surplus by the cooking oil industry. The increase in CPO demand by the downstream industry also encouraged an increase in cooking oil production by 0.002 percent. The increase in cooking oil production increased Indonesia's cooking oil exports to the world by 0.0009 percent. At the same time, the percentage increase in cooking oil production was greater than the increase in exports, resulting in an increase in palm cooking oil supply by 0.002 percent. The increase in the supply of cooking oil resulted in a decrease in the price of cooking oil by 0.00007 percent. In this condition, there is an increase in the surplus of cooking oil producers due to an increase in cooking oil production, even though the price has decreased. The decline in palm cooking oil caused the demand for cooking oil to increase by 0.000002 percent. This is in line with the opinion of PASPI (2021), which says that the CPO export tax policy encourages an increase in the supply of CPO raw materials and an increase in CPO demand by the

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CPO downstream industry. The increase in demand for cooking oil is smaller than the increase in supply, so that the price of palm cooking oil decreases and there is an increase in consumer surplus.

S2: The Impact of Increasing Production Capacity in the Cooking Oil Industry

The simulation of increasing the production capacity of the cooking oil industry by 61.25 percent increased the demand for CPO by the cooking oil industry by 38.70 percent, so that the total domestic CPO demand and domestic CPO prices increased. The increase in CPO prices is due to the increase in demand for CPO on the upstream side, causing an increase in the area of oil palm and an increase in the price of palm oil, which also has an impact on increasing palm oil productivity. Increasing productivity and oil palm land area will increase oil palm production. In this condition, there is an increase in the surplus of oil palm farmers due to an increase in oil palm prices and production. Increased palm oil production and prices will increase Indonesia's CPO production, increasing CPO producer surplus. The increase in domestic CPO production had an impact on increasing Indonesia's CPO exports to the world by 0.02 percent. The increase in CPO production was greater than the increase in Indonesia's CPO exports (0.02 percent) to the world, increasing domestic CPO supply. The increase in Indonesia's domestic CPO supply was lower than the increase in Indonesia's CPO demand, so that Indonesia's CPO prices increased by 7.25 percent.

The increase in demand for CPO by the cooking oil industry has increased CPO consumer surplus, even though CPO prices have increased. Because of this, the increase in demand for CPO by the cooking oil industry increased cooking oil production by 38.70 percent. The increase in cooking oil production prompted an increase in cooking oil exports by 24.53 percent. The increase in cooking oil production in this period was higher than the increase in cooking oil exports, resulting in an increase in cooking oil supply by 48.92 percent. The increase in cooking oil supply resulted in a decrease in domestic cooking oil prices by 0.41 percent. In this condition, there is an increase in the surplus of cooking oil producers even though there is a decrease in domestic cooking oil prices. The decline in domestic cooking oil prices caused an increase in cooking oil demand by 0.02 percent. The increase in demand for cooking oil products is smaller than the increase in supply, resulting in a decrease in cooking oil prices. This condition created an increase in the consumer surplus of cooking oil due to the decline in domestic prices of cooking oil as well as an increase in demand for cooking oil.

S3: The Impact of the Combination of CPO Export Tax Increase and Cooking Oil Production Capacity Increase

An increase in export taxes of 43.95 percent will cause an increase in government revenue from export taxes and the price of Indonesia's CPO exports to the world to decrease, so that Indonesia's CPO exports to the world will also decrease. Then, the policy simulation of increasing the production capacity of cooking oil by 61.25 percent increased the demand for Indonesian CPO by the domestic downstream industry, increasing the demand for Indonesian CPO in the domestic market as a whole. This increase in CPO demand will increase domestic CPO prices, thus encouraging an increase in the area of oil palm production. The increase in Indonesian CPO prices also encourages an increase in

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palm oil prices and productivity. The increase in palm oil productivity will encourage an increase in palm oil production to an increase in CPO production. In the simulation period from 2018 to 2022, Indonesia's CPO production increased, but CPO exports decreased. The change in the value of CPO production was not as large as the change in CPO supply, so that domestic CPO prices increased by 5.30 percent.

The combination of these two policies increased domestic CPO production and prices due to the increase in the production capacity of the downstream cooking oil industry, as well as a decrease in Indonesia's CPO exports, resulting in an increase in domestic CPO supply by 1.81 percent. Based on these conditions, it is known that the increase in domestic CPO supply has a lower value than the increase in domestic CPO demand by the cooking oil industry, so that domestic CPO prices increased by 5.30 percent. The increase in Indonesian CPO prices has led to an increase in the area of oil palm production by 0.08 percent. The increase in domestic CPO prices also encourages an increase in palm oil prices, so that palm oil productivity and production increase. In this condition, there is a surplus of farmers due to the increase in prices and the increase in oil palm production. The increase in palm oil production prompted an increase in CPO production by 0.10 percent. This condition resulted in a surplus of CPO producers due to the increase in Indonesian CPO prices and production.

The condition of cooking oil has increased, causing a surplus of consumers in the cooking oil industry, even though domestic CPO prices have increased. The increase in demand for CPO by the cooking oil industry has led to an increase in cooking oil production by 38.70 percent. This increase in production has led to an increase in the volume of cooking oil exports by 24.54 percent. The production of cooking oil has increased more than the increase in exports, so that the supply of cooking oil has also increased by 48.92 percent. The increased supply of cooking oil reduced the domestic price of cooking oil by 0.41 percent. This condition shows that there is a surplus of cooking oil producers because cooking oil production has increased, even though the domestic price of each product has decreased. Declining domestic prices of cooking oil drove an increase in cooking oil demand by 0.02 percent. The increasing demand for cooking oil has a lower value than the increase in the supply of cooking oil, so that the domestic price of cooking oil decreases. This condition creates an increased consumer surplus because domestic cooking oil prices have decreased, and the demand for cooking oil has increased.

The simulation of an increase in Indonesia's palm oil export tax caused a decrease in state foreign exchange revenue from Indonesia's CPO exports by 13.35 percent (Rp9,019.51 billion) and increased palm cooking oil export foreign exchange by 0.002 percent (Rp3.06 billion), with a decrease in total export foreign exchange by 9,016.45 billion. The simulation of the implementation of the production capacity increase policy increases the country's foreign exchange revenue from CPO by 0.02 percent (Rp13.94 billion) and increases the foreign exchange of cooking oil exports by 27.10 percent (Rp69,917.07 billion), with an increase in total export foreign exchange of 69,913.01 billion. The combination of the two policies will reduce the foreign exchange of CPO exports by 13.33 percent (Rp9,005.58 billion) and increase export foreign exchange receipts from palm cooking

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oil by 27.10 percent (Rp69,920.13 billion). The combination of these two policies indicates that Indonesia's total export foreign exchange receipts are still increasing by 60,914.55 billion.

CONCLUSION AND SUGGESTION

The study concludes that (1) the demand for palm oil by the cooking oil industry is influenced by the cooking oil production capacity and the demand for palm oil by the cooking oil industry in the previous year; the supply of cooking oil is influenced by the production and export of cooking oil; and cooking oil exports are influenced by cooking oil production, the exchange rate of the rupiah against the dollar, and palm cooking oil exports the previous year. (2) The increase in export taxes CPO decreases the total export foreign exchange receipts because the decrease in palm oil export foreign exchange is greater than the increase in cooking oil export foreign exchange, the increase in cooking oil production capacity increases the total export foreign exchange receipts due to the increase in palm oil and cooking oil export foreign exchange receipts. The combination of policies increased total foreign exchange exports because the decrease in palm oil export foreign exchange was smaller than the increase in cooking oil export foreign exchange.

The government's efforts to encourage the downstream are by providing incentives to the cooking oil industry through policies such as providing exemption from production input export duties, such as tax exemption for the purchase of machine inputs for cooking oil production. Then, the government continues to increase the downstream of cooking oil, which is to increase the production capacity of cooking oil. In the next study, it is expected to combine various downstream policies and compare them with the government's flagship programs, such as the Mandatory B40 biodiesel, and examine the impact of these policies on the availability of Indonesian palm oil raw materials.

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