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Impact of Production Capacity of Crude Palm Oil Downstream Industries on Competitiveness and Welfare of Oil Palm Farmers In Indonesia

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ABSTRACT

Indonesia is the largest country in exporting crude palm oil (CPO) to the world market. However, the production capacity of the CPO downstream industries in Indonesia must continue to be increased, bearing in mind that Indonesia also imports CPO derivative products. In addition, oil palm plantations in Indonesia still face environmental and social issues, such as: deforestation, damage to peatlands, destruction of wildlife habitat (such as orang-utans) and land tenure conflicts. In this connection, Indonesia needs to continue to develop the CPO downstream industries that can increase added value and foreign exchange, absorb employment, and address environmental and social issues. Therefore we need appropriate government policies to support the development of the CPO downstream industries. The purposes of writing this article were to analyze the factors that influence CPO demand by the CPO downstream industries (ie: palm cooking oil, margarine and soap industry) in Indonesia, and to evaluate the impact of facilitation policy that increasing production capacity of the CPO downstream industries on the CPO competitiveness of Indonesia-Malaysia and the palm cooking oil, margarine and soap competitiveness of Indonesia, as well as the welfare of oil palm farmers in the 2015-2017 period. This article was part of the research of the supply and demand for CPO and its derivative products. The research model specification is a dynamic simultaneous equation, while the model was estimated and simulated using the 2SLS and Newton methods. The results showed that the production capacity of the CPO downstream industries affected CPO demand by the CPO downstream industries. Furthermore, if the production capacity of CPO downstream industries (palm cooking oil, margarine, soap, biodiesel and others) increases, it will increase the Indonesian competitiveness in export CPO and its derivative and welfare of oil palm farmers in Indonesia.

Keywords: dynamic simultaneous equation, farmers, margarine, palm cooking oil, soap

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INTRODUCTION

Indonesia has been the world's largest producer of crude palm oil (CPO) since 2006 and has also become the world's first largest CPO exporter since 2008, previously led by Malaysia (FAOStat 2019; UN Comtrade 2019). From 2010 to 2018, Indonesia's CPO exports tends to decline. This happened because the demand for CPO by the CPO downstream industries in Indonesia increased with an average growth rate of 8.97% (Oil World 2018). In 2007, Indonesia's total CPO exports amounted to 5 701.29 thousand tons, then continued to increase to 9 566.75 thousand tons in 2009. Next, Indonesia's CPO exports decreased at a rate of 1.98% from 2010 to 2018 (except for 2015 and 2017), where Indonesia's CPO exports in 2010 were 9 444.17 thousand tons and 6 554.50 thousand tons in 2018 (UN Comtrade 2019).

Indonesia should not continue to depend on the acquisition of foreign exchange value from CPO exports, considering that Indonesia still imports CPO-derived products. Indonesia must continue to develop the CPO downstream industries rather than just exporting CPO, which has a very large added value in order to meet domestic needs and even be exported, so that it can save foreign exchange reserves (if it does not import CPO derivative products) and produce greater foreign exchange value (from exports of CPO derivative products) (Novindra *et al.* 2013).

The average CPO demands by the palm cooking oil industry, margarine, soap, etc. were 3 997.06 thousand tons, 306.91 thousand tons, 478.95 thousand tons and 2 507.00 thousand tons per year (2008-2018 period). While the average share of CPO demands by the palm cooking oil industry, margarine, soap and others to Indonesia's CPO production were 14.14%, 1.09%, 1.69% and 8.87% respectively (CIC 2018). Next, the average growth rate of exports of Indonesian palm cooking oil, margarine and soap to the world were 13.69%, 7.51% and 3.23% respectively, while the average growth rate of imports of Indonesian palm cooking oil, margarine and soap from the world respectively were 1 589.60%, 18.23% and 15.46% during the 2008-2018 period (UN Comtrade 2019). This shows that investment in the CPO downstream industries must continue to be increased (especially its production capacity) so that demand for CPO in the domestic market increases in order to increase production of CPO-derived products to reduce imports and increase exports of Indonesian CPO-derived products to the world (Novindra *et al.* 2019).

Rifai & Nila (2014), the development policy of palm oil derivative products industry will be able to increase exports of palm oil derivative products to the United States and will be able to reduce exports of crude palm oil that has low added value. Likewise Joni (2012), shows that the development of biodiesel from palm oil has a positive impact because it can create economic growth, reduce unemployment and poverty in Indonesia. Novindra (2011), an increase in domestic CPO supply has a negative impact on Indonesia's net welfare. This is because the increase in domestic CPO supply has not been supported by the development of CPO downstream industries other than the palm cooking oil industry, so increasing the domestic CPO supply will make domestic CPO prices and palm cooking oil prices decline. Zulkifli (2000), Indonesia's export of palm cooking oil is elastic to changes in domestic prices of palm cooking oil both in the short and long term. While domestic demand for palm cooking

oil is inelastic to changes in the price of palm cooking oil and the price of coconut cooking oil.

Trade of CPO and its derivatives have bright prospects, but palm oil plantations in Indonesia still face several environmental and social issues, including: deforestation, peatland destruction, destruction of wildlife habitat (such as: orangutans), burning of land plantation and land tenure conflicts (Erwidodo 2015). The development of the CPO downstream industries in Indonesia is also expected to be an alternative solution to the problem of the rapid expansion of palm oil plantation land for the benefit of meeting CPO production and export needs that have an impact on environmental and social problems. The increasing number and production capacity of the CPO downstream industries in Indonesia is expected to reduce the rate of increase in the opening of new palm oil plantation lands, because CPO is absorbed in the domestic market by the downstream CPO industry at a reasonable price as if CPO is exported, to meet the demand for CPO derivative products in the domestic and even exported, which results in a very large foreign exchange value.

The impact analysis of government facilitation policies in increasing the production capacity of CPO downstream industries on exports competitiveness increasement of CPO and its derivatives (ie: palm cooking oil industry, margarine and soap) and increase the welfare of oil palm farmers in Indonesia are things that need to be examined. Rifai & Nila (2014) only analyzed CPO derivative products in the aggregate and Joni (2012) analyzed derivative products in the form of stearin and olein. While Zulkifli (2000) and Novindra (2011) analyzed derivative products in the form of palm cooking oil.

Based on the description of these problems, an appropriate government policy analysis needs to be carried out to support the development of the CPO downstream industry. The purposes of writing this article are to analyze the factors affecting CPO demand by the CPO downstream industries in Indonesia (namely: the palm cooking oil, margarine and soap) and to evaluate the facilitation policy impact of the CPO downstream industry production capacity increasement on the CPO exports competitiveness of Indonesia-Malaysia and the Indonesian competitiveness in exports of palm cooking oil, margarine and soap, as well as the welfare of oil pa2lm farmers in the 2015-2017.

MATERIALS AND METHODS

This article was part of the research of the supply and demand for CPO and its derivative products. The research model specification was a dynamic simultaneous equation. The model specification that analyzed in the article was:

CPO Demand by the Palm Cooking Oil Industry

$$DPOIMG_t = a_0 + a_1 * PRPOD_t + a_2 * PRMGD_t + a_3 * (WRIN_t - WRIN_{t-1}) + a_4 * BIRR_t + a_5 * KAPQIMG_t + a_6 * DPOIMG_{t-1} \quad (1)$$

Hypothesis: $a_1, a_3, a_4<0$; $a_2, a_5>0$; $0<a_6<1$

CPO Demand by The Margarine Industry

$$DPOIMR_t = b_0 + b_1 * PRPOD_{t-1} + b_2 * PRMRD_t + b_3 * (WRIN_t - WRIN_{t-1}) + b_4 * BIRR_{t-1} + b_5 * KAPQIMR_t + b_6 * DPOIMR_{t-1} \quad (2)$$

Hypothesis: $b_1, b_3, b_4<0$; $b_2, b_5>0$; $0<b_6<1$

CPO Demand by The Soap Industry

$$DPOISB_t = c_0 + c_1 * PRPOD_{t-1} + c_2 * PRSBD_{t-1} + c_3 * BIRR_t + c_4 * KAPQISB_t + c_5 * DPOISB_{t-1} \quad (3)$$

Hypothesis: c_1, c_3<0; c_2, c_4>0; 0<c_5<1

Total Demand for CPO in Indonesia

$$DPOD_t = DPOIMG_t + DPOIMR_t + DPOISB_t + DPOIL_t \quad (4)$$

CPO Competitiveness of Indonesia and Malaysia

The indicator of competitiveness used in this research is revealed comparative advantage (RCA). The RCA index value above one indicates the condition of comparative advantage in exporting CPO and if the value is below one, the index value indicates the condition of no comparative advantage in exporting CPO. Indonesian and Malaysian CPO competitiveness as an identity equation is formulated as such:

$$RCAPO^{ij}\,t = ((XPO^{ij}\,t) * (PRXPO^{ij}\,t))/(VTOTX^{ij}\,t) /(VXPOW^{j}\,t/VTOTXW^{j}\,t) \quad (5)$$

Palm Cooking Oil Competitiveness of Indonesia

$$RCAMGIW_t = ((XMGIW_t) * (PRMGW_t))/(VTOTXIW_t) /(VXMGW_t/VTOTXW_t) \quad (6)$$

Margarine Competitiveness of Indonesia

$$RCAMRIW_t = ((XMRIW_t) * (PRMRW_t))/(VTOTXIW_t) /(VXMRW_t/VTOTXW_t) \quad (7)$$

Soap Competitiveness of Indonesia

$$RCASBIW_t = ((XSBIW_t) * (PRSBW_t))/(VTOTXIW_t) /(VXSBW_t/VTOTXW_t) \quad (8)$$

explanation:

$DPOIMG_t$ = CPO demand by the palm cooking oil industry in year t (000 tons);

$PRPOD_t$ = Real price of CPO in domestic in year t (Rp/kg);

$PRMGD_t$ = Real price of palm cooking oil in domestic in year t (Rp/kg);

$WRIN_t$ = Real wages in the industrial sector in year t (Thousand Rp/year);

$WRIN_{t-1}$ = Real wages in the industrial sector in year t-1 (Thousand Rp/year);

$BIRR_t$ = Real interest rate of central bank (BI) in year t (%);

$KAPQIMG_t$ = Palm cooking oil industry production capacity in year t (000 tons);

$DPOIMG_{t-1}$ = CPO demand by the palm cooking oil industry in year t-1 (000 tons);

$DPOIMR_t$ = CPO demand by margarine industry in year t (000 tons);

$PRPOD_{t-1}$ = Real price of CPO in domestic in year t-1 (Rp/kg);

$PRMRD_t$ = Real price of margarine in domestic in year t (Rp/kg);

$BIRR_{t-1}$ = Real interest rate of central bank (BI) in year t-1 (%);

$KAPQIMR_t$ = Margarine industry production capacity in year t (000 tons);

$DPOIMR_{t-1}$ = CPO demand by margarine industry in year t-1 (000 tons);

$DPOISB_t$ = CPO demand by the soap industry in year t (000 tons);

$PRSBD_{t-1}$ = Real price of bar soap in domestic in year t-1 (Rp/unit);

$KAPQISB_t$ = Soap industry production capacity in year t (000 tons);

$DPOISB_{t-1}$ = CPO demand by the soap industry in year t-1 (000 tons);
$DPOD_t$ = Total CPO Demand in Indonesia in year t (000 tons);
$DPOIL_t$ = CPO demand by other CPO downstream industries in year t (000 tons);
$RCAPO^{ij}t$ = Revealed Comparative Advantage of CPO from origin i to the market j year t;
Origin i = I (Indonesia), M (Malaysia);
Market j = ID (India), NE (Netherlands), SI (Singapore), IT (Italy), SP (Spain), GE (Germany), TZ (Tanzania), UK (United Kingdom), KE (Kenya) and PK (Pakistan);
$XPO^{ij}t$ = CPO exports quantity from i to j market in year t (thousand tons);
$PRXPO^{ij}t$ = The real price of CPO exports from i to j market in year t (US.$/ton);
$VTOTX^{ij}t$ = The exports total value of all products origin i to j market in year t (million US.$);
$VXPOW^{j}t$ = The exports total value of CPO from the world to j market in year t (million US.$);
$VTOTXW^{j}t$ = The exports total value of all products from the world to j market in year t (million US.$);
$RCAMGIW_t$ = Revealed Comparative Advantage of palm cooking oil from Indonesia to the world market in year t;
$XMGIW_t$ = Palm cooking oil exports quantity from Indonesia to the world market in year t (thousand tons);
$PRXMGI_t$ = The export real price of Indonesian palm cooking oil in year t (US.$/ton);
$VTOTXIW_t$ = The exports total value of all products from Indonesia to the world market in year t (million US.$);
$VXMGW_t$ = The exports total value of palm cooking oil in world in year t (million US.$);
$VTOTXW_t$ = The exports total value of all products in world in year t (million US.$);
$RCAMRIW_t$ = Revealed Comparative Advantage of margarine from Indonesia to the world market in year t;
$XMRIW_t$ = Margarine exports quantity from Indonesia to the world market in year t (thousand tons);
$PRXMRI_t$ = The export real price of Indonesian margarine in year t (US.$/ton);
$VXMRW_t$ = The exports total value of margarine in world in year t (million US.$);
$RCASBIW_t$ = Revealed Comparative Advantage of soap from Indonesia to the world market in year t;
$XSBIW_t$ = Soap exports quantity from Indonesia to the world market in year t (thousand tons);
$PRXSBI_t$ = The export real price of Indonesian soap in year t (US.$/ton);
$VXSBW_t$ = The exports total value of soap in world in year t (million US.$).

The parameter of structural equation in the model was estimated by the 2SLS (two-stage least squares) method. Furthermore, the model was validated and simulated using newton's method to

analyze the impact of domestic policies on the CPO exports competitiveness of Indonesia-Malaysia and the Indonesian competitiveness in exports of palm cooking oil, margarine and soap and the welfare of oil palm farmers in the 2015-2017 period. The scenario of domestic policy simulations analyzed in this article were: (1) Indonesia's CPO export tax tariff is set at 6%; (2) Establishment of domestic market obligation (DMO) which is equivalent to the impact of setting Indonesia's CPO export tax tariff by 6% in increasing CPO supply in the domestic; (3) Increased production capacity of the palm cooking oil, margarine and soap industry by 5%, 10% and 40%, as well as an increase in CPO demand by other industries by 30%; (4) Combination of scenario 1 and scenario 3; (5) Combination of scenario 2 and scenario 3.

The indicator used as a change in the welfare of oil palm farmers was the change of oil palm producer surplus of smallholder estate. The analysis of changes in the welfare of oil palm farmers was formulated as follows (Sinaga 1989):

Change in Welfare (Surplus) of Oil Palm Farmers

$$QTBSR_B(PRTBS_S - PRTBS_B) + \tfrac{1}{2}(QTBSR_S - QTBSR_B)(PRTBS_S - PRTBS_B)$$

QTBSR = Production quantity of fresh fruit bunches in smallholder estate (thousand tons);
PRTBS = Real price of fresh fruit bunches (Rp/kg);
Subscript B= Base value;
Subscript S= Value after simulation.

The type of data used in this research is secondary data with the time series ranging from year 1990 to 2017. The data sources for this study were obtained from several agencies, namely: Central Bureau of Statistics (BPS), Directorate General of Estate Crops-Ministry of Agriculture, Ministry of Trade, UN Comtrade, Capricorn Indonesia Consult (CIC), FAO and other related agencies/publications. The data is processed by a computer program, namely: SAS/ETS for Windows 9.4.

RESULT AND DISCUSSIONS

Factors Affecting CPO Demand by CPO Downstream Industries in Indonesia

Based on Table 1, it is known that the CPO demand by the palm cooking oil industry in year t is significantly influenced by the production capacity of the palm cooking oil industry year t and the demand for CPO by palm oil cooking industry year t-1 ($DPOIMG_{t-1}$). The elasticity value of CPO demand by the palm cooking oil industry on change of the production capacity of the palm cooking oil industry is inelastic in the short run (0.13) and unitary elastic in the long run (0.99). This means that an increase in the production capacity of the palm cooking oil industry by 1% will increase the demand for CPO by the palm cooking oil industry by 0.13% in the short run and by 1% in the long run.

Table 2 shows the results of the estimated parameters in equation of the CPO demand by the margarine industry ($DPOIMR_t$). The demand for CPO by the margarine industry in year t is significantly

Table 1 Estimation results for equation of CPO demand by the palm cooking oil industry year t (000 tons)

Variable	Estimated parameter	Elasticity		Prob > |T|	Variable lable
		SR	LR		
Intercept	85.0451			0.4709	
PRPOD	-0.0082	-0.0231	-0.1721	0.4622	Real price of CPO in domestic year t (Rp/kg)
PRMGD	0.0102	0.0511	0.3802	0.4572	Real price of palm cooking oil in domestic year t (Rp/kg)
DWRIN	-0.0106	-0.0035	-0.0261	0.4543	Difference in real wages in the industrial sector on year t and t-1 (Rp thousand /year)
BIRR	-7.9303	-0.0098	-0.0729	0.3827	Real interest rate of Central bank (BI) year t (%)
KAPQIMG	0.0358	0.1331	0.9906	0.1662*	Palm cooking oil industry production capacity year t (000 tons)
LDPOIMG	0.8656	-	-	< 0.0001****	CPO demand by the palm cooking oil industry year t-1 (000 tons)
R-squared	0.9080	Prob>|F|	< 0.0001	Durbin-h stat	-1.2341

Note: SR = short run, LR = long run
* = significant at the α level = 20%, ** = significant at the α level = 15%
*** = significant at the α level = 10%, **** = significant at the α level = 5%

Table 2 Estimation results for equation of CPO demand by the margarine industry year t (000 tons)

Variable	Estimated parameter	Elasticity		Prob > |T|	Variable lable
		SR	LR		
Intercept	1.1051			0.4860	
LPRPOD	-0.0090	-0.3542	-0.8054	0.0083****	Real price of CPO in domestic year t-1 (Rp/kg)
PRMRD	0.0028	0.3830	0.8708	0.0060****	Real price of margarine in domestic year t (Rp/kg)
DWRIN	-0.0015	-0.0070	-0.0159	0.3320	Difference in real wages in the industrial sector on year t and t-1 (Rp thousand /year)
LBIRR	-0.1025	-0.0020	-0.0045	0.4642	Real interest rate of Central bank (BI) year t-1 (%)
KAPQIMR	0.1716	0.4482	1.0191	0.0060****	Margarine industry production capacity year t (000 tons)
LDPOIMR	0.5602	-	-	0.0006****	CPO demand by the margarine industry year t-1 (000 tons)
R-squared	0.9682	Prob>|F|	< 0.0001	Durbin-h stat	-2.0562

Note: SR = short run, LR = long run
* = significant at the α level = 20%, ** = significant at the α level = 15%
*** = significant at the α level = 10%, **** = significant at the α level = 5%

influenced by the real price of CPO in domestic in year t-1, the real price of margarine in domestic in year t, the production capacity of margarine industry in year t and the demand for CPO by the margarine industry in year t-1.

The elasticity value of CPO demand by the margarine industry against the change of production capacity of the margarine industry is inelastic in the short run (0.45) and elastic in the long run (1.02). This means an increase in the production capacity of the margarine industry by 1% will increase the demand for CPO by the margarine industry by 0.45% in the short run and by 1.02% in the long run.

The equation of demand for CPO by the soap industry ($DPOISB_t$) year t is significantly affected (level α = 5%) by soap industry production capacity year t and the demand for CPO by the soap industry year t-1 ($DPOISB_{t-1}$). The elasticity of CPO demand by the soap industry to the change of the soap industry production capacity is inelastic in the short run (0.11) and elastic in the long run (1.13) (Table 3).

Based on the estimation results of the three equations, namely: CPO demand by the palm cooking oil industry, margarine and soap, it is known that CPO demand by the CPO downstream industries is significantly affected by the production capacity of the CPO downstream industry. Although the elasticity of CPO demand by the CPO downstream industry to the change of the CPO downstream industry production capacity is inelastic in the short run, these findings indicate that the production capacity of the CPO downstream industry is an important instrument to increase demand for CPO in the domestic market for increasing production of CPO-derivative products, especially palm cooking oil, margarine and soap. This is in line with Novindra (2011) that the development of the CPO downstream industry in domestic will increase domestic CPO demand, thereby increasing the CPO price that received by CPO producers.

In addition, the increase in world crude oil prices caused an increase in world

Table 3 Estimation results for equation of CPO demand by soap industry year t (000 tons)

Variable	Estimated parameter	Elasticity		Prob > |T|	Variable lable
		SR	LR		
Intercept	50.2515			0.1337	
LPRPOD	-0.0050	-0.1252	-1.2556	0.2159	Real price of CPO in domestic year t-1 (Rp/kg)
LPRSBD	0.0010	0.0100	0.1008	0.4714	Real price of bar soap in domestic year t-1 (Rp/unit)
BIRR	-0.9332	-0.0104	-0.1045	0.3158	Real interest rate of central bank (BI) year t (%)
KAPQISB	0.0355	0.1135	1.1380	0.0326****	Soap industry production capacity year t (000 tons)
LDPOISB	0.9003	-	-	< 0.0001****	CPO demand by the soap industry year t-1 (000 tons)
R-squared	0.9522	Prob>|F|	< 0.0001	Durbin-h stat	-1.3654

Note: SR = short run, LR = long run
* = significant at the α level = 20%, ** = significant at the α level = 15%
*** = significant at the α level = 10%, **** = significant at the α level = 5%

CPO imports and world CPO prices. Then Indonesia's CPO exports increased so that domestic CPO supply declined. The decline in domestic CPO supply causes domestic CPO prices to rise so this results causes the decrease of CPO demand by CPO downstream industry (Hartoyo *et al.* 2011). If the production capacity of the CPO downstream industry (such as palm cooking oil, margarine, soap and biodiesel) increases so that the demand for CPO by the CPO downstream industry increases and the price of CPO rises, this becomes a stimulus for CPO producers to sell their CPO in the domestic market with decent price. From 2008-2017, the average CPO demand by other CPO downstream industries were dominated by the biodiesel industry by 62.3%.

Impact of Domestic Policies on the Competitiveness of CPO and its Derivative and the Welfare of Oil Palm Farmers in the 2015-2017 Period

The model validation results for the 2015-2017 period show that the root mean square percent error (RMSPE) value of the CPO demand by the palm cooking oil, margarine and soap industry are respectively 14.64%, 13.55% and 13.08%. Furthermore, the U-Theil value of the CPO demand by the palm cooking oil, margarine and soap industry are respectively 0.06, 0.07 and 0.05. Thus in general, the developed model has a fairly valid and well predictive power that can be used to perform various alternative of simulation scenarios, including simulating the impact of domestic policies on the CPO export competitiveness of Indonesia-Malaysia and the Indonesian competitiveness in exports of palm cooking oil, margarine and soap, as well as the welfare of oil palm farmers in the 2015-2017 period.

According to the Table 4, the condition before simulation, Indonesia and Malaysia have a high rate of competitiveness or have a high comparative advantage in exporting CPO to the ten main importing countries that shown by the RCA index value of Indonesia and Malaysia greater than 1. Indonesia is superior to Malaysia in the CPO exports competitiveness to Singapore, Italy, Germany and Kenya, while Malaysia is superior to Indonesia in the CPO exports competitiveness to India and Pakistan (this is in line with Salleh *et al.* 2016), also to the Netherlands, Spain, Tanzania and the United Kingdom. It was also known that prior to the simulation, Indonesia had a high comparative advantage in exporting palm cooking oil, margarine and soap to the world market.

After the policy simulation, it is known that if there is a single simulation, namely: an increase in the production capacity of the palm cooking oil, margarine and soap industry by 5%, 10% and 40% and an increase in CPO demand by other CPO downstream industries by 30% (it is dominated by the biodiesel industry), the Indonesian CPO exports competitiveness to the world's major importing countries (except Germany) will be increased. The simulation also increased the Indonesian competitiveness in exports of palm cooking oil, margarine and soap to the world market.

Meanwhile, a combined simulation namely: Indonesia's CPO export tax tariff set at 6% and an increase in the production capacity of the palm cooking oil, margarine and soap industry respectively by 5%, 10% and 40% and an increase in CPO demand by other CPO downstream

Table 4 Impact of domestic policies on the CPO export competitiveness of Indonesia-Malaysia and the Indonesian competitiveness in exports of palm cooking oil, margarine and soap in 2015-2017

Description	Basic value (before simulation)	Changes after simulation (Δ)				
		S1	S2	S3	S4	S5
RCA- Indonesian CPO export to India	16.50	-0.06	-0.01	0.01	-0.05	-0.006
RCA- Malaysian CPO export to India	16.79	0.09	0.02	-0.01	0.08	0.01
RCA- Indonesian CPO export to Netherlands	35.81	-0.61	-0.74	0.03	-0.58	-0.71
RCA- Malaysian CPO export to Netherlands	38.05	0.23	0.28	-0.03	0.20	0.24
RCA- Indonesian CPO export to Singapore	35.61	1.07	0.07	0.03	1.10	0.09
RCA- Malaysian CPO export to Singapore	1.08	0.08	0.01	0.001	0.08	0.008
RCA- Indonesian CPO export to Italy	136.06	-0.64	-0.40	0.11	-0.52	-0.29
RCA- Malaysian CPO export to Italy	129.87	1.25	0.73	-0.23	1.02	0.49
RCA- Indonesian CPO export to Spain	79.85	-0.52	-0.12	0.10	-0.42	-0.02
RCA- Malaysian CPO export to Spain	112.36	0.81	0.30	-0.19	0.63	0.10
RCA- Indonesian CPO export to Germany	81.51	-0.25	-0.40	-0.02	-0.27	-0.42
RCA- Malaysian CPO export to Germany	5.14	0.01	0.02	-0.01	0.0002	0.01
RCA- Indonesian CPO export to Tanzania	23.65	-0.12	-0.01	0.01	-0.11	-0.006
RCA- Malaysian CPO export to Tanzania	30.77	0.21	-0.01	0.01	0.22	-0.01
RCA- Indonesian CPO export to England	21.80	-3.98	-0.16	0.05	-3.93	-0.11
RCA- Malaysian CPO export to England	22.11	0.26	0.06	-0.02	0.24	0.03
RCA- Indonesian CPO export to Kenya	6.72	-0.06	-0.01	0.003	-0.06	-0.01
RCA- Malaysian CPO export to Kenya	3.60	0.01	0.01	-0.002	0.01	0.00
RCA- Indonesian CPO export to Pakistan	3.33	-0.17	-0.07	0.02	-0.15	-0.06
RCA- Malaysian CPO export to Pakistan	31.95	0.25	0.07	-0.02	0.23	0.05
RCA-Indonesian palm cooking oil	54.42	0.00056	0.0125	0.122	0.123	0.13
RCA-Indonesian margarine	4.87	0.00014	0.0016	0.054	0.055	0.06
RCA-Indonesian soap	9.88	0.00001	0.0002	0.00980	0.00981	0.01

S1: Indonesia's CPO export tax tariff is set at 6%.
S2: Establishment of domestic market obligation (DMO) which is equivalent to the impact of setting Indonesia's CPO export tax tariff by 6% in increasing CPO supply in the domestic.
S3: Increased production capacity of the palm cooking oil, margarine and soap industry by 5%, 10%, and 40%, as well as an increase in CPO demand by other industries by 30%.
S4: Combination of S1 and S3.
S5: Combination of S2 and S3.

industries by 30% (it is dominated by the biodiesel industry), it can increases the Indonesian competitiveness in exports of palm cooking oil, margarine and soap to the world market. However, this combined simulation caused a decrease in the Indonesian CPO exports competitiveness to the world's major importing countries (except Singapore).

This result shows that if the government wishes to increase the income from export taxes and also to increase the competitiveness of CPO-derivative products, which in turn increases the exports of CPO-derivative products, then the combination policies simulation namely: increasing the CPO export tax tariff and facilitating to increase the production capacity of CPO downstream industries, is a good alternative. On the contrary, if the government wishes to increase the exports of CPO-derived products and keep

to continue CPO exports, a single policy simulation namely facilitating to increase the production capacity of CPO downstream industries is a good alternative.

Based on Table 5, the simulation that causes the largest increase in the oil palm farmers surplus (Rp 16.11 billion) is if there is an increase in the production capacity of the palm cooking oil, margarine and soap industries by 5%, 10% and 40%, as well as an increase in CPO demand by other CPO downstream industries by 30%, because the price of fresh fruit bunches has experienced a large increase. On the other hand, the establishment of the domestic market obligation (DMO), which is equal to the impact of the 6% Indonesia CPO export tax tariff in increasing domestic CPO supply, causes the largest decrease in oil palm farmers surplus (Rp 203.96 billion) because the price of fresh fruit bunches has experienced a large decline.

While the simulation of Indonesian CPO export tax tariff set at 6% also caused a decrease in oil palm farmers surplus by Rp 3.91 billion. This shows that if the government wants to increase government revenue from CPO export taxes and also wants to improve the welfare of oil palm farmers, the combination policies simulation is needed. The combined policy mentioned is: an increase in CPO export taxes tariff by 6% and facilitating that can increase the production capacity of the palm cooking oil, margarine and soap industries by 5%, 10% and 40% and an increase in CPO demand by other CPO downstream industries by 30%. This combination policy caused an increase in the oil palm farmers surplus by Rp 12.19 billion.

CONCLUSIONS

Conclusions

Based on the results and discussions, several things can be concluded as follows: CPO demand by the palm cooking oil, margarine and soap industries is significantly influenced by the production capacity of the palm cooking oil, margarine and soap industries; A single simulation by increasing the production capacity of the palm cooking oil, margarine and soap industries as well as increasing demand for CPO by other CPO downstream industries (it is dominated by the biodiesel industry), can improve the competitiveness of Indonesian CPO and the Indonesian competitiveness in export palm cooking oil, margarine and soap and also improve the welfare of oil palm farmers Indonesia; The Combination simulation through increasing CPO export taxes tariff and facilitating that can increase the production capacity of the palm cooking oil, margarine and soap industries as well as increasing demand for CPO by other CPO downstream industries, can improve the Indonesian competitiveness in export palm cooking oil, margarine and soap and

Table 5 Impact of domestic policies on changes in welfare of Indonesian oil palm producers in 2015-2017

Description	Changes after simulation (million Rp)				
	S1	S2	S3	S4	S5
Oil palm producer surplus of smallholder estate	-3,911.76	-203,956.39	16,108.77	12,192.67	-187,055.74
Oil palm producer surplus of government estate	-825.77	-43,136.46	3,399.61	2,573.27	-39,552.21
Oil palm producer surplus of private estate	-6,482.10	-337,388.50	26,712.22	20,217.14	-309,637.50
Indonesian oil palm producer surplus	-11,219.62	-584,481.36	46,220.61	34,983.08	-536,245.45

also improve the welfare of Indonesian oil palm farmers.

Recommendations

Some things that can be suggested from this article are as follows: In order to increase the demand for CPO in the domestic market by the Indonesian CPO downstream industries, the government should continue to increase facilitation for businessmen to increase the production capacity of the CPO downstream industries, namely: the palm cooking oil, margarine, soap and biodiesel industries. The government can provide investment incentives to the CPO downstream industries through instruments such as: tax allowance, tax holidays and exemption from import duties on the import of machinery and goods and materials for the development of the CPO downstream industries; In order to increase state revenues from the CPO export tax and also increase the competitiveness of CPO-derived products and the welfare of oil palm farmers in Indonesia, the government needs to increase the CPO export tax tariff and increase the facilitation so that the production capacity of the palm cooking oil, margarine, soap and others CPO downstream industries in Indonesia increase.

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