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Export stability of crude palm oil in Indonesia

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Abstract

This study aims to analyze the export stability of crude palm oil in Indonesia both on short and long-term basis during the time period of 2005: Q1 - 2017: Q4 by using the Autoregressive Distributed Lag (ARDL) model. The results showed that in long-term estimation only Indonesian crude palm oil production was giving a significant positive effect on Indonesia's crude palm oil export volume. In conclusion, the Indonesian government needs to diversify crude palm oil derivative products for additional value and addressing the crude palm oil dependency on foreign markets.

Keywords: Crude, Palm oil, Autoregressive, Term.

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Estabilidad de las exportaciones de aceite de palma crudo en Indonesia

Resumen

Este estudio tiene como objetivo analizar la estabilidad de las exportaciones de aceite de palma crudo en Indonesia tanto a corto como a largo plazo durante el período de 2005: Q1 - 2017: Q4 utilizando el modelo de Retraso distribuido autorregresivo (ARDL). Los resultados mostraron que en la estimación a largo plazo solo la producción de aceite de palma crudo de Indonesia estaba dando un efecto positivo significativo en el volumen de exportación de aceite de palma crudo de Indonesia. En conclusión, el gobierno indonesio necesita diversificar los productos derivados del aceite de palma crudo para obtener un valor adicional y abordar la dependencia del aceite de palma crudo en los mercados extranjeros.

Palabras clave: crudo, aceite de palma, autorregresivo, plazo.

1. INTRODUCTION

This research can provide benefits for the development of Crude Palm Oil (CPO) in Indonesia. Crude palm oil to be one contributor commodity of foreign exchange through exports. High productivity and followed by an increase in exports may result in a decrease in crude palm oil prices. The decline in palm oil prices negatively affect farmers and state income. This productivity is different from one region to another due to various factors. The same thing happened between Indonesia and Malaysia, in which both countries are the world's biggest crude palm oil producers and exporters. The total production of these two countries amounted to 85-95 percent of total

world production. Indonesian crude palm oil productivity grew at an average of 0.72 percent during the period 1995-2017. Throughout this period Indonesia has 12.31 million hectares of oil palm plantations, an increase of 10.21 percent per annum (HUCHET-BOURDON & KORINEK, 2012).

Productivity is related to the stability of export in addition to other factors. Some research suggests that there are several factors that cause instability of exports which is done by CHEN & ROGOFF (2003), BODART (2014) who found that the exchange rate has a significant influence on the development of a commodity export performance. Although several other studies such as FANG & MILLER (2004), FUGAZZA (2004), found the depreciation exchange rate did not significantly increase exports, the risk of the exchange rate has significantly fluctuated hinder exports.

Another factor that affects export is commodity production. HACKER & HATEMI (2003) found that exports are contributing to production growth, export expansion is an integral part of productivity growth. The increased exports mean market expansion and an incentive for producers to increase production. Some other studies also show that there is a relationship between the amount of exports commodity with its goods substitution such as research conducted by BUYUNG, MASBAR & NASIR (2017), HATEMI & IRANDOUST (2001) who found that the change in price of a substitute (soy oil) could affect the price of crude palm oil and export demand, other macroeconomic variables that have an influence on the development of export performance of goods or commodity is the price of goods or

commodities in international markets (HU, RODRIGUE, TANC & YU, 2017).

Although several studies on the performance of crude palm oil exports in Indonesia have been done, it did not include substitution goods variables prices, so the relationship between crude palm oil price with its substitution goods price was not found. With adding substitution goods price variables, this analysis becomes more comprehensive and able to meet the shortage of the existing analysis. With this consideration, then this study is very important and interesting to be conducted in terms of substitution goods price.

2. RESEARCH METHODS

The quarterly data used in this research over the period 2005 to 2017, a total of 52 samples. The variables used in this study are crude palm oil export volume (EXCPO), the world's crude palm oil price (PC), world soybean oil price (PSB), the exchange rate (ER), and the Indonesian crude palm oil production (PRD). All of this data is transformed in the form of the natural logarithm (ln) to provide reliable and consistent results.

The method used in this research is the Auto Regressive Distributed Lag Model (ARDL) analysis method. This model is used because it can distinguish the short-term response and long term of the dependent variable to a unit change in the explanatory variable values. In addition, the fluctuations in the exchange rate and crude palm oil

prices can be accommodated in this dynamic model. The model estimated in this study:

$$\Delta LNEXCPO_t = \beta_{01} + \sum_{i=1}^{k} \beta_{11}\, \Delta LNEXCPO_{t-i} + \sum_{i=0}^{k} \beta_{12}\, \Delta LNPRD_{t-i} + \sum_{i=0}^{k} \beta_{13} \Delta LNER_{t-i} + \sum_{i=0}^{k} \beta_{14}\, \Delta LNPC_{t-i} + \sum_{i=0}^{k} \beta_{15}\, \Delta LNPSB_{t-i} + \Theta_{11}\, LNEXCPO_{t-1} + \Theta_{12}\, LNPRD_{t-1} + \Theta_{13}\, LNER_{t-1} + \Theta_{14}\, LNPC_{t-1} \Theta_{15}\, LNPSB_{t-1} + \delta_1 ECT_{t-1} + e_{t1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In Auto Regressive Distributed Lag (ARDL) Model the conditions to be met for the cointegration test is δ Error Correction Term (ECT) Value should be negative (δ ECT <0) and significant. Further, model stability should be stable by CUSUM evidenced and significant CUSUMQ value. The short-term relationship Hypothesis between variables was tested with:

H_0: There is a short term relationship	H_1: There is a relationship
$\beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = \beta_{15} = 0$	$\beta_{11} \neq \beta_{12} \neq \beta_{13} \neq \beta_{14} \neq \beta_{15} \neq 0$
$\beta_{21} = \beta_{22} = \beta_{23} = \beta_{24} = \beta_{25} = 0$	$\beta_{21} \neq \beta_{22} \neq \beta_{23} \neq \beta_{24} \neq \beta_{25} \neq 0$
$\beta_{31} = \beta_{32} = \beta_{33} = \beta_{34} = \beta_{35} = 0$	$\beta_{31} \neq \beta_{32} \neq \beta_{33} \neq \beta_{34} \neq \beta_{35} \neq 0$
$\beta_{41} = \beta_{42} = \beta_{43} = \beta_{44} = \beta 4_5 = 0$	$\beta_{41v} \neq \beta_{42} \neq \beta_{43} \neq \beta_{44} \neq \beta_{45} \neq 0$
$\beta_{51} = \beta_{52} = \beta_{53} = \beta_{54} = \beta_{55} = 0$	$\beta_{51} \neq \beta_{52} \neq \beta_{53} \neq \beta_{54} \neq \beta_{55} \neq 0$

Meanwhile, to test a long-term relationship between hypothesis variables is formulated as follows (BAHMANI-OSKOOEE & NG, 2002):

H_0: There is a short term relationship	H_1: There is a relationship
$\Theta_{11} = \Theta_{12} = \Theta_{13} = \Theta_{14} = \Theta_{15} = 0$	$\Theta_{11} \neq \Theta_{12} \neq \Theta_{13} \neq \Theta_{14} \neq \Theta_{15} \neq 0$
$\Theta_{21} = \Theta_{22} = \Theta_{23} = \Theta_{44} = \Theta_{25} = 0$	$\Theta_{21} \neq \Theta_{22} \neq \Theta_{23} \neq \Theta_{44} \neq \Theta_{25} \neq 0$
$\Theta_{31} = \Theta_{32} = \Theta_{33} = \Theta_{34} = \Theta_{35} = 0$	$\Theta_{31} \neq \Theta_{32} \neq \Theta_{33} \neq \Theta_{34} \neq \Theta_{35} \neq 0$
$\Theta_{41} = \Theta_{42} = \Theta_{43} = \Theta_{44} = \Theta_{45} = 0$	$\Theta_{41} \neq \Theta_{42} \neq \Theta_{43} \neq \Theta_{44} \neq \Theta_{45} \neq 0$
$\Theta_{51} = \Theta_{52} = \Theta_{53} = \Theta_{54} = \Theta_{55} = 0$	$\Theta_{51} \neq \Theta_{52} \neq \Theta_{53} \neq \Theta_{54} \neq \Theta_{55} \neq 0$

3. RESULTS AND DISCUSSIONS

Augmented Dickey-Fuller (ADF) is used to test the unit root test. The calculations show all variables are at the same level that is stationary in the first difference (Table 1).

Table 1: Unit Root Test

Variable	ADF		Conclusion
	Level	1st Difference	
EXCPO	-3,574446	-3,574446	I(I)*
ER	-3,565430	-3,568308	I(I)*
PC	-3,568308	-3,571310	I(I)*
PRD	-3,581152	-3,581152	I(I)*
PSBO	-3,568308	-3,568308	I(I)*

Source: Estimated Results, 2019.

Description: * explain the significant level at 1 Percent

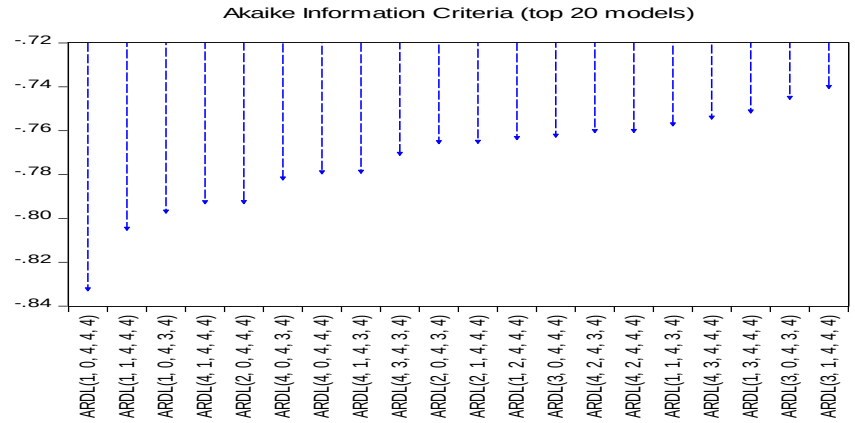
After the unit root tests carried out the determination model validity with the cointegration test as contained in Table 2. The table shows that there is a short-term equilibrium towards the long term so that these models are eligible to be used for analysis.

Table 2: Cointegration Test Results (Bound Test Cointegration)

F-statistics: 14.84277	**Critical Values**		**Conclusion**
	Lower Bound I(0)	**Upper Bound I(1)**	
1% significance level	3.29	4.37	Cointegrated
2,5% significance level	2.88	3.87	
5% significance level	2.56	3.49	
10% significance level	2.20	3.09	

Source: Estimated Results, 2019.

Akaike Information Criteria (AIC) is used to determine the optimal lag. Optimal lag results are presented in Picture 1, with the formation of (1,0,4,4,4). In accordance with this result, the estimation model used in this study is (1,0,4,4,4). Based on estimates it is obtained the error-correction term is negative and significant (level 1 percent), so the model is eligible to be used as an analysis model. Error-correction term Coefficient for -1331 shows that it can take as long as 3.99 months to reach a point of equilibrium before the shocks.



Picture 1: Optimal Lag Length Test Results (Lag Length Criteria)

The last condition that must be met for the estimation of ARDL models is to test the long-term stability along with short-term adjustment by using CUSUM and CUSUMQ stability tests are boundary line, in other words, is significant, and the model can be used as an analysis tool in this study.

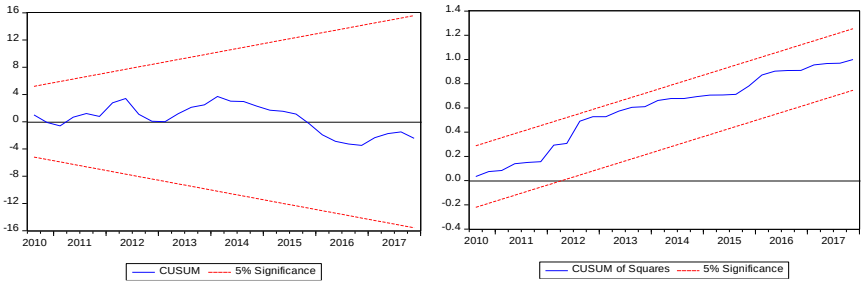


Figure. 2. Cumulative Sum (CUSUM) of Recursive Residuals and Cumulative Sum of Squares (CUSUMSQ) of Recursive Residuals Results

The estimation results indicate a long term basis only Indonesia's crude palm oil production variable is a significant positive effect on export volume crude palm oil export (1 percent level). The production marked a positive coefficient which indicates the sign test is in accordance with the hypotheses used in this study. The cause of this relationship is positive due to the increased export volumes resulted in an increase in crude palm oil variable supply in the world market, and ultimately affect the reduction in crude palm oil prices. The addition of oil palm acreage resulted in increased production so that the supply of crude palm oil for export is increase. Other variables did not affect the long term because it takes a long time to make a change so that in the short term is not possible.

Table 3: Long-Term (Long Run Model) Effect

Dependent Variable: DLOG(EXCPO)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOG(ER)	-0.041316	0.234572	-0.176134	0.8614
LOG(PC)	-0.296081	0.411842	-0.718920	0.4778
Dependent Variable: DLOG(EXCPO)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LOG(PRD)	1.074787	0.151564	7.091291	0.0000*
LOG(PSBO)	0.165378	0.425185	0.388955	0.7001
C	0.299913	1.849031	0.162200	0.8722

EC = LOG(EXCPO) - (-0.0413*LOG(ER) -0.2961*LOG(PC) + 1.0748*LOG(PRD) +

Source: Estimated Results, 2019.

Note: *, **, *** significant at 1%, 5%, 10%.

The crude palm oil productions in three previous periods have a positive and significant influence. This happens because it needs a long time to reach the fruition period after planting, and the results of this study supported the research done by (GUILLAUME, CHRISTINE & SCHWEISGUTH, 2011). The influence is in a positive and significant correlation between increased productions towards export deals because when the production has increased the crude palm oil deals domestic and worldwide, causing exports will also increase.

For the current world's crude palm oil price variables and the current world crude palm oil price, one prior period had a significant negative relationship to the stability of Indonesia's crude palm oil exports. The decline in international prices can improve the competitiveness of exports. When international prices are higher than domestic prices, then a country tends to become exporters.

In addition, the world's crude palm oil prices during three periods were a positive and significant impact on Indonesian crude palm oil export volume stability. Study results confirmed research conducted by ISKANDAR (2005), which promoted that the shocking price world crude palm oil prices would be responded positively by commodity export volume of crude palm oil in Indonesia. These

responses can be understood that with rising world crude palm oil prices, the manufacturer will make the crude palm oil trade to the international market. In addition, because domestic goods are relatively cheaper than domestic residents, only going to buy some imported goods.

The short-term analysis also showed that the world soybean oil price variable in three previous periods is significantly at negative affect. These results are consistent with research conducted by (KALSOM, KAMALRUDIN, & BALU, 2017). Coefficients are negative, due in 2005 to 2017 the global competition is strictly between vegetable oil. When the soybean oil prices rose, the trend is crude palm oil prices will also be strengthened. This price increase resulted in the demand for vegetable oil is decreased, including demand for crude palm oil.

Table 4: Short-Term (Short Run Model) Effect

Dependent Variable: DLOG(EXCPO)				
Variable	**Coeficient**	**Std. Error**	**t-Statistic**	**Prob.**
DLOG(PC)	-0.630041	0.327588	-1.923272	0.0640***
DLOG(PC(-1))	-0.764505	0.353546	-2.162389	0.0387**
DLOG(PC(-2))	-0.209459	0.363846	-0.575679	0.5691
DLOG(PC(-3))	1.158063	0.348189	3.325964	0.0023*
DLOG(PRD)	0.528235	0.198016	2.667641	0.0122**
DLOG(PRD(-1))	-0.156963	0.228076	-0.688206	0.4966

DLOG(PRD(-2))	-0.048101	0.200335	-0.240103	0.8119
DLOG(PRD(-3))	0.408414	0.190694	2.141723	0.0405**
DLOG(PSBO)	0.692209	0.421148	1.643625	0.1107
DLOG(PSBO(-1))	0.405654	0.445601	0.910354	0.3699
DLOG(PSBO(-2))	-0.107035	0.409574	-0.261331	0.7956
DLOG(PSBO(-3))	-1.489465	0.390464	-3.814607	0.0006*
CointEq(-1)*	-1.331679	0.130645	-10.19311	0.0000

Source: Short Term Test Results processed by EViews 10, 2019

Description: ***, **, * significant at the 1%, 5%, 10%,

4. CONCLUSION

In general, the results showed that the estimate of long-term only Indonesia's crude palm oil production variables that giving a positive effect on the stability of Indonesia's crude palm oil export volume. Other variables, namely the exchange rate, the price of crude palm oil, world soybean oil prices did not significantly affect Indonesia's crude palm oil export volume.

The short-term estimation results indicate that the soybean oil and crude palm oil world price during three previous periods have a significant effect. World crude palm oil prices in three previous periods, the ongoing Indonesian crude palm oil production in the current period of global crude palm oil prices in the current year as well as the world's crude palm oil prices have a significant effect during three previous periods. Meanwhile, the ongoing world's crude

palm oil prices a significant effect on Indonesia's crude palm oil exports.

It is recommended that the governments should encourage diversification efforts on crude palm oil derivatives so that crude palm oil prices remain stable and the additional value is higher. This product diversification could be one of the new economic growth sources if it is supported by research and development in palm oil and its derivatives. The lack of the study is one of the local crude palm oil price variables was excluded which actually is the part of the internal factors of crude palm oil in Indonesia, so it is suggested for further research needs to be added such variable. Domestic Palm oil use also determines the availability of palm oil for export. This variable was also not included in this model so that the movement of domestic consumption is not included in the analysis model.

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