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Determinants of Indonesian Palm Oil Export: Price and Income Elasticity Estimation

Ambiyah Abdullah

Department of International Development, Graduate School of International Development, Nagoya University 462-0810, Ozone Jyuutaku 2-5-4, Yamada2-11-62, Kita-ku, Nagoya, Japan

ABSTRACT

For Indonesian economy, palm oil is considered as one of important commodities. It provides a large amount of export revenue and job opportunities. From year 2000 to 2009, palm oil production in Indonesia has increased every year. In , 2008 about 70% of its production was exported. Recently, Indonesia has become the largest palm oil exporter and has 48% of the world's market share. The aim of present study was to estimate the determinants of both crude palm oil exports (HS = 151110) and refined palm oil exports (HS = 151190) from Indonesia to the world market. In this study the export demand approach is used as a methodology to estimate price and income elasticity for Indonesian palm oil exports since January 1996 to July 2010. The results found that Indonesian palm oil export is significantly determined by its own export price and foreign countries' income. The value of the elasticity of its own export price in the short-run is -0.54 which is larger than the value in the long-run is -0.41. It is similar to the estimated value of foreign countries' income elasticity. It has larger value in the short-run (0.61) than in the long-run (0.49). The inelastic income elasticity result indicated Indonesian palm oil export is normal good. The estimated results are supported by in-significant result of world price of soybean oil. In conclusion, Indonesian government should consider the improvement of marketing strategies, trade and domestic policies which support Indonesian palm oil export.

Key words: Indonesian palm oil, export demand, price and income elasticity, marketing strategy, domestic policies

INTRODUCTION

Palm Oil has become an important strategic commodity, both in the world market and domestic market. Basiron (2001) and PT Data Consult Indonesia (2009) found that the palm oil industry has the greatest potential out of development in future among other vegetable oils on the world market. The usage of palm oil for bio-fuel industry has strengthened demand for palm oil in the world market. Between 2005 to 2008, more palm oil was produced globally than any other vegetable oil. As of November 2010 the production was 47.91 million metric tons. It also has the biggest consumption level, which was 36.77 million metric tons (USDA, 2010). Many researchers believe that this industry will create more demand in the future.

As the largest exporter and producer of palm oil in the world, Indonesia has the potential to expand palm oil plantation due to its land availability. Palm oil has been considered as one of the most important sectors for the Indonesian economy. Indonesia production of palm oil has increased

significantly every year; as of November 2010 Indonesia produced 23,000 million metric tons, and ranks top among other major producer countries. And about 75% of palm oil production in Indonesia is exported to the world market (Rifin, 2010a). Palm oil exports have increased significantly during the period of 1980 to November 2010. Indonesia was able to catch up to Malaysian and become the largest palm oil exporter in the world market in 2008. Recently, Indonesia has about 46% of the share of the total world palm oil export market. With the assumption that Indonesia has the potential to expand its palm oil plantation due to its abundant land this study focuses mainly on factors that determine foreign consumer demand on palm oil from Indonesia.

In the case of palm oil production, a number of studies have been carried out using the export demand model to analyze the palm oil export from Indonesia, either at the level of an individual country or comparison in with Malaysia. Yulismi and Siregar (2007) and Rifin (2010a, b) have estimated elasticity for Indonesia and Malaysia's palm oil export. Yulismi and Siregar (2007) calculated the price elasticity and import response elasticity for palm oil export from Indonesia and Malaysia using annual data from year 1990-2004 through export demand model. The authors reported that in India and China, Indonesia's palm oil is price inelastic and income elastic. For the Malaysian palm oil exports, India and China have the price and income elastic while EU has price elastic but income inelastic. Furthermore, Rifin (2010a). examined the export competitiveness for Indonesia and Malaysia palm oil export using Constant Market Share Analysis (CMSA) for the cases of three regions Asia, Europe and Africa. The conclusion was Indonesia has gained an increasing market share or strong market competitiveness over Malaysia in Asia and Africa except in the EU market. In addition to this study, Rifin (2010b) analyzed the import demand model for Indonesia and Malaysia palm oil export using annual data from 1964 until 2006. In the conclusion, Indonesia benefited more than Malaysia from increasing of world income due to her higher income elasticity. In summary, three previous studies on comparing Indonesia and Malaysia palm oil exports suggested that Indonesia is more income sensitive while Malaysia is more prices sensitive.

Regarding case studies conducted with single countries, Shariff *et al.* (2006) estimated the price elasticity and income elasticity of Malaysian palm oil export for China, India, Pakistan, Egypt and South Korea using annual data from year 1980 until 2003. The result were Malaysian palm oil export price is elastic and palm oil and soybean oil is highly substituted. Furthermore, Ernawati *et al.* (2006) examined the impact of trade liberalization on the export demand of Indonesian palm oil export for India, China, EU and the rest of world. So, An export demand model for Indonesian palm oil which bases on monthly data for the period January 1996 to July 2010 is utilized as methodology to estimate the price and income elasticity for Indonesian palm oil export.

MATERIAL AND METHODS

This study started from December 2009 to November 2010 and used monthly data, were from January 1996 to July 2010. The data sources were taken from World Trade Atlas database, IDE Library (2010) Office and International Financial Statistic and IMF. Starting period in 1996 because year 1996 was before Asian economic crisis and still included on the second expansion period of palm oil in Indonesia. Five key importer countries of Indonesian palm oil were taken as representative of income variable indicator. In this equation, Q_d is the volume of Indonesia palm oil export (CPO and other palm oil); EPPO is the real value of Indonesian palm oil exports in US Dollars; WPSOt is the real price of soybean oil at Dutch ports in US dollars per tons; and I_t is the

Table 1: Variable measurement and data source for econometrics analysis of determinant of Indonesian CPO export

Variable	Variable measurement	Data source
Q_t^d	Export demand quantity of Indonesian palm oil (tons)	World Trade Atlas Database, IDE JETRO, Nagoya (IDE Library, 2010)
EPPO _t	Unit value of Indonesian palm oil (US\$/ton) deflated by world consumer price index	a. World Trade Atlas Database, IDE JETRO, Nagoya (IDE Library, 2010) b.IFS (IMF, 2010)
WPSO	World price of soybean oil at Dutch port (US\$/ton) deflated by world consumer price index	IFS (IMF, 2010)
I_t	Total value import of five key importer countries deflated by world import price index and multiplies by weight (calculated from average monthly share of palm oil import of five key importer countries)	a.IFS (IMF, 2010) b.World Trade Atlas Database, IDE JETRO Nagoya (IDE Library, 2010)

Table 2: Augmented Dickey- Fuller (ADF) test

Variable	ADF test none	ADF test constant included	ADF test constant and trend included
Level			
Export quantity	0.86	-1.40	-4.79***
Export price	-0.34-1.76	-1.73	
Soybean oil price	-0.32	-1.95	-2.13
Income	1.74	-0.47	-3.93**
First difference			
Export quantity	-10.23***	-10.27***	-10.24***
Export price	-10.86***	-10.83***	-10.89***
Soybean oil price	-5.07***	-5.06***	-5.09***
Income	-9.48***	-6.65***	-6.64***

***, **Significant at 1 and 5% probability levels, respectively

Table 3: Co-integration test using ADF test on residual

Variable	ADF test none	ADF test constant and trend included	ADF test constant included
Level			
Residual (u)	-10.35***	-10.32***	-10.34***

Note: ***Significant at 1% probability levels

total value of imports of five key importer countries (India, China, Pakistan, Singapore, Malaysia) and deflated by a world import price index. The result is multiplied by weight. Weights used are average monthly share of Indonesia Palm oil exports to five key importer countries. All of data, sources and measurement are presented in Table 1.

Since data comes from monthly data, first, a unit root test to test the stationary of the variables was conducted. One of the methods in testing unit root is the ADF test. Three different ADF equations were calculated to test the presence of a unit root; the first equation did not include either constant or trend (none) the second equation included constant variable while the last equation included constant and trend. The results showed that all the variables were stationary at the 1% significance level at the first difference (Table 2). Then the co-integration test was appropriate to be conducted on all variables.

Since all variables were stationary on the first difference; thus the next step was to test co-integration between the three variables utilizing Engle-granger method by testing stationary on residual. The co-integration test is reported in Table 3. The result revealed that residual was stationary so there was co-integration among three variables (EPPO, WPSO and I).

As mentioned previously this study examined the determinants of Indonesian palm oil export using export demand model and relied on imperfect substitute assumption. The export demand model is utilized with the assumption that export supply is infinitely elastic. In this study the dependent variable is the quantity of palm oil export from Indonesia to the world market and our independent variables are Indonesian palm oil export price world soybean oil price as one of substitute prices for palm oil. Soybean oil price is chosen because soybean is ranked second after palm oil as a large amount of it is imported by world market.

Since the data were taken from a series, a seasonal adjustment form, stationary, co-integration and lastly an error correction model are conducted. The export demand model for Indonesian palm oil export is calculated as follows:

$$\Delta Q_t^d = e_0 - e_1 \Delta EPPO_t - e_2 \Delta WPSO_t + e_3 \Delta I_t + e_4 ECM_{t-1} + \varepsilon_t$$

Where:

- Q = Quantity of Indonesian CPO Export to the world market (tons)
- EPPO = Real export price of Indonesian palm oil (USD/t)
- WPSO = Real world price of soybean oil as one of substitute goods (USD/t)
- e₁ = Own-price elasticity for Indonesian palm oil
- e₂ = Substitute price elasticity
- e₃ = Income elasticity
- Δ = Difference form and all data are in the log, real values and seasonal adjusted form (normalized version)

RESULT AND DISCUSSION

The next step was to calculate the export demand function using ECM after considering the results of stationary test and co-integration test. The results of export demand model of Indonesian palm oil export both for short-run and long-run are presented in Table 4.

Table 4 shows the estimated export demand for Indonesian palm oil export in the short-run and long-run. Both in the short-run and in the long-run the sign of export price are negative as theory of demand stated- when the price of Indonesian palm oil export increases the quantity demanded for Indonesian palm oil export will decrease. Or when the price of Indonesian palm oil export decreases the quantity of demanded for Indonesian palm oil export will increase. The results showed that the value of export price elasticity was 0.54 in the short-run which means that if there is increasing of Indonesian palm oil export price by 1% the quantity demanded for Indonesian palm oil export will increase by less than 1% (0.54). In the long-run, the export price elasticity is smaller than in the short-run which the value is only 0.41. The sign of foreign income in the short-run and in the long-run are positive sign as were expected. This means that when the foreign income decreases the quantity demanded for Indonesian palm oil export will also increase. The income elasticity in the short-run has value 0.61 which is larger than its value in the long-run.

Table 4: Short-run and long-run estimates of the export demand

Period	Constant	Export price	Soybean oil price	Income	Error correction	Result
Short-run	-0.01 (-0.31)	-0.54 (-1.96)**	0.31 (0.94)	0.61 (16.83)***	-0.69 (-9.38)***	R2 = 0.735358 DW = 2.06078
Long-run	10.68 (-22.68)	-0.41 (-2.71)***	-0.31 (-1.62)	0.49 (39.80)***	-	

Numbers in parenthesis are t-values. ***, **Significant at 1% and 5% probability levels, respectively

This means if there is increasing of income of five key importing countries of Indonesian palm oil export; the quantity demanded will increase only by 0.61 in the short-run and only by 0.31 in the long-run. In short the results of this study suggest that the price and income elasticity for Indonesian palm oil export in the short-run are larger than in the long-run. The results are interesting because previous research has suggested that the elasticity of export demand in the long-run should be larger than in the short-run. Furthermore the econometrics result showed that soybean oil price was insignificant both in the short-run and in the long-run. It can be pointed out that as there is no substitution effect of soybean oil price both in the short-run and in the long-run, the own price elasticity in the long-run is smaller than in the short-run reflects that foreign consumer has preference and taste to demand palm oil more than soybean oil.

Even though results cannot simply be compared to the previous studies (our study was on aggregate level while the previous studies were based on annual data and focused on the cases of specific importing countries) it is also useful to see their findings. The export price elasticity result differs from those which were reported by the previous studies. Shariff *et al.* (2006) for example, found that the own price elasticity for Malaysian palm oil in the case of India, was elastic both in the short-run and in the long-run. While in the case of China it was not significant in short-run but was elastic in long-run. Moreover, Yulismi and Siregar (2007) found that the estimated export price elasticity for Indonesian palm oil export, in the case of India was inelastic both in the short-run and in the long-run and elastic for the case of China.

A study conducted by Niemi (2003) also found that Indonesian palm oil export has income elasticity of export demand in the short-run was 0.89 and was perfectly elastic in the long-run. The price elasticity of export demand in the short-run was not found and in the long-run was 1.14. Moreover, Ernawati *et al.* (2006) also found that Indonesian palm oil export has elastic price elasticity for the cases of India, China and the rest of the world and inelastic for the case of EU, European Union.

Therefore, the price elasticity of demand for Indonesian palm oil export on present study is similar with results was found by Susila (2004) and Rifin (2010b). The first study was used simultaneous approach to estimate the impacts of CPO export tax on several aspect of Indonesian economy. This study found that export price elasticity of Indonesian palm oil export was inelastic. Moreover the second study by Rifin (2010b) who utilized AIDS, Almost Ideal Demand System to estimate the price elasticity and income elasticity for Indonesian and Malaysian palm oil export. The result of second stage of AIDS showed that Indonesia had price elasticity both in the short-run and in the long-run were in-elastic. But the income elasticity was in-elastic in the short-run and was elastic in the long-run.

The price elasticity of Indonesian palm oil export demand implies the response of quantity demanded to the price change for palm oil export from Indonesia while the income and other factors are constant. When the price elasticity of demand is less than 1 (inelastic) it means that if the price for Indonesian palm oil export changes by 1% the quantity demanded for Indonesian palm oil export will change by less than 1%. Theoretically the effect of the price change can be categorized into two kinds: income effect and substitution effect. The income effect of the price change simply means there is change of purchasing power due to the change of price while others factors are constant. The inelastic price elasticity of demand for Indonesian palm oil implies that the proportion of total expenditure for palm oil in the total expenditure of the foreign consumer is small. The change in purchasing power parity, due to the price change, will not cause so much change in quantity of Indonesian palm oil demanded. Furthermore the substitution effect of the price change

illustrates what happens to the purchase of other products when there is change in the price of Indonesian palm oil export. Inelastic price elasticity for Indonesian palm oil export implies that the substitution effect due to the price change is not so large. It suggests that the choice of other products to be used as substitute goods for Indonesian palm oil, are not in numerous number. Another important concern is that a theory suggesting that price elasticity of demand in the long-run is larger than in the short-run. This is related to the adjustment period which suggests two things. They are, first, the longer adjustment period, the larger magnitude of price elasticity should be; and second, the short-run price elasticity is larger than in the intermediate period. Our result is opposite to what the theory suggests. The price elasticity of demand for Indonesian palm oil export in the long-run is smaller than in the short-run. Theoretically, the price elasticity of demand in the long-run is supposed to be larger than in the short-run, because consumers will have more substituted good choices. The logical argument is our econometrics result shows that soybean oil price as one of substitute goods for palm oil does not significantly determine the quantity of palm oil export demanded from Indonesia both in the short-run and the long-run. The own price elasticity of demand will increase in the long-run as the quantity demanded for substitute oil increases as the price for palm oil increases. Furthermore, the commonly used assumption for the increasing own price elasticity in the long-run than in the short-run is because in the long-run the consumer has more available substitute good to be chosen. Moreover, in the case of Indonesian palm oil export, the price elasticity of Indonesian palm oil export in the long-run is smaller than in the short-run. It can be pointed out that as there is no substitution effect of soybean oil price both in the short-run and in the long-run, the own price elasticity in the long-run is smaller than in the short-run; this reflects that foreign consumers preference and greater demand for palm oil over soybean oil.

The other important elasticity of demand result is income elasticity of demand for Indonesian palm oil export. Income elasticity of demand predicts the response of quantity demanded for Indonesian palm oil export when there is a change in income of foreign consumer with the assumption that price and other factors are constant. Our results show that the income elasticity of demand for Indonesian palm oil export is inelastic. This sign is positive, both in short-run and long-run. The positive sign of coefficient of income elasticity of demand affirms that Indonesian palm oil export is normal good. The interpretation of inelastic income elasticity means that the change of quantity demanded for Indonesian palm oil export will be less than 1% when the foreign income changes by 1%. It implies that the change of budget share spent on palm oil decreases as the foreign consumer's income increases. These concords with Engel's law that describes the relationship between income and quantity demanded.

Other possible factors resulted the inelastic price and income elasticity of demand for Indonesian palm oil export are domestic and trade policies, domestic structure of importing countries and market share of Indonesia palm oil export of total world palm oil export. Government policies (domestic and trade policies) both in Indonesia and importing countries influence the elasticity of demand for Indonesian palm oil export. Theoretically, the more restrictive the policies to keep the export price below the domestic price in importing countries, the less elastic will be the demand for Indonesia palm oil export. Indonesian government has implemented export tax to control the domestic supply of palm oil to domestic market; the level of export tax is based on Rotterdam price as commonly used reference price for palm oil traders. The export tax effectively reduces the quantity of palm oil export from Indonesia for a certain period. With regard to market share which Indonesia has in the world market of palm oil, the demand for palm oil in the world is still

continuing. This will lead to an increase in world prices, thus cause responsiveness of price for Indonesian palm oil export become less elastic.

The domestic structure of importing countries also influences the price and income elasticity of demand for Indonesian palm oil export. The inelastic elasticity of demand for Indonesian palm oil export suggests three characteristics of the domestic structure of importing countries for Indonesian palm oil export. The inelastic elasticity indicates, firstly, that the availability of number substitutes is small; secondly, that the share of the budget for palm oil on the total expenditure of consumer in importing countries is small and thirdly that foreign consumers considers palm oil as a non-luxury good. Other factors in domestic structure of importing countries that can influence the elasticity of demand for Indonesian palm oil export are population and consumer's taste and preference. However, these are not captured in our econometrics model.

Turning to the market share factor for Indonesian palm oil export, for the period 2000 to 2008; Indonesia's market share for palm oil export is increasing. In, 2008 Indonesia had a market share of total world market palm oil, which is 46% of total world palm oil export (USDA, 2008). Indonesia is the largest palm oil exporter in the world. Theoretically, if a country has a large market share of total world exports, the elasticity of demand for the commodity from the country should be smaller or less elastic. The reasonable argument to support this theory is that the importer faces less opportunity to change the exporter due to the price change. Our analytical result is in agreement with what the theory suggests. We found that the price and income elasticity of demand for Indonesian palm oil export are inelastic. This is confirmed with market share that Indonesia has nearly a half of the market share of total world palm oil export.

CONCLUSION

Indonesia is the largest of palm oil producer and exporter in the world market. Export is the major use of palm oil production. Therefore, estimating price elasticity and income elasticity of demand for Indonesian palm oil export is important. Through this study, the price elasticity and income elasticity of demand for Indonesian palm oil export were inelastic both for the short-run and the long-run. Our findings are in agreement with what theory suggested in terms of market share, budget share, and the usage of palm oil as input for other final goods such as cosmetic, cooking oil, margarine and the availability of substituted good for Indonesian palm oil export. These findings are important for (1) marketing strategies such as the differentiation of products (value added products) creating special services for loyal consumer and increasing quality standard and (2) government policies (trade policies and domestic policies) should be implemented by the Indonesian government to support the palm oil expansion in Indonesia. Export tax is one of trade policies implemented by Indonesia on palm oil to control domestic price of cooking oil. For domestic policies can be implemented in various forms such as production subsidies, incentives programs on research on differentiation of product (value added products) and upgrading quality standard for Indonesian palm oil export. In the future, there is a need to analyze the price elasticity and income elasticity of products which use palm oil as input, looking at the desegregate sectors (differentiate between CPO and refined palm oil) on specific importing country cases and analyzing within the export supply and simultaneous models.

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