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THE FACTORS INFLUENCING ON CONSUMPTION OF PALM COOKING OIL IN INDONESIA

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Abstract

Cooking oil is one of the most sensitive basic needs in Indonesia. The aims of the research are to analyze factors influencing consumption of cooking oil, the cooking oil price, and the Crude Palm Oil price in Indonesia. Using simultaneous equation model, the study show that palm cooking oil consumption is significantly affected by domestic palm cooking oil price and number of population. Whilst palm cooking oil price is significantly influenced by the cooking palm oil production and the domestic Crude Palm Oil price. Finally, the domestic Crude Palm Oil is significantly affected by international Crude Palm Oil price.

Keywords: consumption, cooking oil price, crude palm oil price and cooking oil
JEL Classification: E21, L66

INTRODUCTION

Cooking oil is one of the staple food consumed by all segments of Indonesian society, both in the rural and urban. Therefore, cooking oil can also be categorized as a strategic commodity, because the experience so far indicates that the shortage of cooking oil can have an significant impact economically and politically for the national economy. Accordingly, to ensure the availability of domestic cooking oil for the public, the government implemented a special policy regarding oil trading and commerce.

In general, Indonesians consume two types of cooking oil in terms of the type of raw materials, namely vegetable oil and animal oil. The consumption level of animal oil is relatively small compared with the consumption level of vegetable cooking oil. Furthermore vegetable oil can be categorized into two major groups namely coconut cooking oil and palm cooking oil.

Before the New Order and the Long Term Development Planning (PJP) I, cooking oil consumption was dominated by coconut cooking oil. However, since the 1970s along with the increasing production of palm oil, coconut cooking oil was displaced by palm cooking oil. In the last decade, in line with the decline in the production of coconut, the production of palm oil increased thus the consumption of palm cooking oil continued to increase.

The development of national oil consumption continues to increase. From 2000 to 2006 the national oil consumption increased by 23.07% or from 2,922,970 tons in 2000 increased to 3,799,483 tons in 2006. Increased oil consumption is in line with population growth and per capita consumption of cooking oil in Indonesia (the Directorate General of Plantation, 2007).

The availability of cooking oil for domestic consumption are still experiencing

problems because of fluctuations in oil prices in Indonesia, especially the price of palm cooking oil. From the supply side, rising oil prices was starting from the sky-rocketing price of palm oil (as the main raw material of oil) on the world market (the case in 1994 jumped to 80%), and the higher palm oil prices on world markets boost palm oil export on a large scale. With increasing export of palm oil, the supply of cooking oil for domestic industry is less and the price of palm oil in the country experienced an increase following the price of world market. As a result the price of cooking oil in the country also rose. From the demand side, rising oil prices is caused by increased public demand for cooking oil, especially before the days of holy days and the new year.

Imbalance between supply and demand in domestic cooking oil price caused sharp fluctuation and tends to increase. Government worried about this condition will lead to inflation and increase the burden of households that have already burdened the higher prices of basic needs.

This study aims to determine the factors that affect oil consumption, the real price of cooking oil (palm) and the real price of Indonesian palm oil, and to validate models to see whether the model used capture the behaviour of historical data with accuracy. To answer the purpose this research is conducted by econometric approach which describes the relationship of each explanatory variables to the endogenous variables (dependent variables), which uses simultaneous equations model consisting of three structural equations.

LITERATURE REVIEW

The use of palm oil is not only as an oil raw material/fat food (edible oil and fat), like cooking oil and margarine, but also to meet the needs of other industrial fields. The various uses of palm oil are ranging for foodstuffs, cosmetics and drugs, and light and heavy industries (Syahza, et al, 2000).

Cooking oil is one of the nine basic commodities that are quite important role in Indonesian economy. The importance of these commodities in the Indonesian economy can be seen from weighting in inflation, meeting calories needs for the consumers/community, a source of foreign exchange and creation of employment.

Given the important role of cooking oil, to ensure price stability at an affordable price level by the community, the government has issued several policies that regulate both the level of raw material supply of cooking oil as well as at the level of the oil prices and distribution of the cooking oil (Amang, et al, 1998).

One of the main indicators of economic stability is inflation. In 1994 the role of oil in the Consumer Price Index (CPI) was 4.1 percent. So the 20 percent of oil price increase occurred during 1994 contributed to 0.8 percent inflation. Oil price increase by 11 percent in 1995 has contributed to inflation up to 0.4 percent. Based on facts the cooking oil price affects economic stabilization in Indonesia (Amang, et al, 1998).

Susanto (2000) states that if the oil commodities contribution to the inflation associated with the share of per capita food expenditure, then a lot of people is negatively impacted by the increase in oil prices especially rural low-income households. It is because the cooking oil consumption is the biggest shares of total food expenditure i.e. 3, 8 percent. Thus, the management of oil prices have significance in securing the welfare of low-income communities. Controlling oil prices is particularly useful for protecting low-income population both in urban and in rural areas.

The need for cooking oil for domestic increased further along with population and per capita consumption growth. Theoretically, the increasing trend in aver-

age per capita consumption of cooking oil was caused by changes in consumption patterns of population, per capita income, and to some extent it is also influenced by development in the culinary culture (Amang, et al, 1998).

Palm oil production in the country is absorbed by the food industry especially the oil industry and non food industries such as cosmetics and pharmaceutical industries. However, the greatest potential absorption is from the cooking oil industry. The potential can be seen from the increasing number of population which in turn increase food demand, especially oil. Eventually it will drive the growth of the domestic cooking oil industry. In 1997 it was recorded 70 palm oil producers with production capacity of 6.6 million tons per year. Estimated number of palm oil producers will increase further since more and more businessmen invest in the sector. In line with growing demand for energy, prices of palm oil in the country tend to increase. The price of palm oil in the country is influenced by various factors, especially the prices of other non palm oil in the world (Fauzi, et al, 2002).

Dominant factor that will affect the demand is the price of palm oil. Fluctuations in palm oil prices is in turn also influenced by several factors, i.e. international oil reserve stock; world reserves stock of palm oil substitution such as soybean oil, sun flower, rapeseed oil, coconut oil, groundnut oil, linseed oil and others; world reserves of grain as raw material of vegetable oil such as soybean, cotton seed, groundnut, rapeseed, sesame seed, linseed, and castor seed; size of the world consumption of vegetable oils and fats; the availability of shipment carrying capacity (space) in the region or the sending countries (Syahza et al, 2000).

As one of the major producers of palm oil in the world, Indonesia has a large enough potential to continue playing a role in the world market. In the 1980s Indonesia palm oil exports was concentrated to Western Europe, but the last few years the demand for Indonesian palm-oil also came from other countries such as China, India, Pakistan, Myanmar, Kenya, Tanzania, and South Africa (Fauzi, et al, 2002).

Palm oil prices are influenced by the price of cooking oil from other materials such as soybean oil, olive, and oil rapeseed. In addition to these influences, the price of palm oil is also influenced by the production of palm oil and domestic policies of the world's major palm oil producers such as Malaysia and Indonesia (Fauzi, et al, 2002).

Supply of palm oil will be associated with the production of fresh fruit bunches (FFB). In accordance with the trend of FFB production and the world palm area, the development of world palm oil production also showed the rising trend each year (Syahza et al, 2000).

The demand theory explains the relationship between the amount of demanded and its prices. Demand for a certain good is determined by many factors i.e. the price of the goods themselves; the price of other goods related to these items; income level; the pattern of income distribution; taste; the number of population; expectation about the situation in the future (Sukirno, 2005). Demand for a product is primarily influenced by its price level. So the theory of demand analyse the relationship between the number of quantity demanded and its prices in which other factors than the prices is unchanged (cateris paribus). This law of demand is essentially a hypothesis that states the lower the price of goods is more demand for these goods, by contrast, the higher the price of goods the less demand for these goods (Sukirno, 2005).

According to Sukirno (2005) the demand solely has been not a sufficient condition to bring market transaction. The demand can be satisfied only if the seller

can provide that necessary goods. The desire of sellers to offer goods at different price levels are determined by several factors including the price of the goods themselves; the price of other related goods; the cost of production; companies operating goals; and the level of technology used.

According to Salvatore (1997) supply of a commodity can be divided into firm supply and market supply level. Firm supply is the number of commodity single producer is willing to offer during a certain time period. Meanwhile, the market supply is the sum of the single suppliers within a certain time period at various alternative prices for all producers in the market. The law of supply then states that the higher the price of certain good, the greater number of the item will be offered by the seller. Conversely the lower is the price of good the fewer is amounts of goods supplied (Sukirno, 2005).

According Soepranto (1984) a system of simultaneous equations is a set of equations where the dependent variables in one or more equations also affect the other independent variables in other equations. At the same time a variable has two roles as the independent and dependent variable in a system of equation, and then the equation model used in this study is the model of simultaneous equations.

There are two types of variables in the model of simultaneous equations, namely an endogenous variable and the predetermined variables. Endogenous variable is a variable where the values are specified from the model while the predetermined variable is a variable whose values are determined from outside the model. Predetermined variable is divided into 2 categories, namely a current and lagged exogenous variable, and lagged endogenous variables. According Manurung, et al (2005) model of simultaneous equations can be formulated as follows:

$$Y_1 = a_0 + a_1 Y_2 + a_2 X + U_1 \quad (1)$$
$$Y_2 = b_0 + b_1 Y_1 + b_2 X + U_2 \quad (2)$$

where :
Y_1 and Y_2 = endogenous variables
X = exogenous variable
U_1 dan U_2 = error

Three main issues in models of simultaneous equations namely: a. Mathematical models. It is a complete mathematical model if the model has similar number of equation to number of endogenous variables; b. Identification of each equation in the model to determine whether the equation used is identified; c. Interpretation of each equation in the model (Sumodiningrat, 1994).

Gujarati (1988) mentions structural equation describing the structure of an economy model or the behaviour of economic agents, in this case is the producer. There is a structural equation to each endogenous variable in the model.

METHODS

The data used in this study is time series data from 1987 until 2006. The sources of data are from the Central Bureau of Statistics, Department of Plant Agriculture, Department of Trade and Industry, Department of Agriculture, Bank Indonesia, Ministry of Agriculture, Ministry of Commerce and other related institutions. The data required in the study include the price of palm cooking oil Indonesia, the consumption of cooking oil in Indonesia, palm oil production in Indonesia, Indonesian palm oil prices, international palm oil prices, the population of Indonesia, and Indonesia exchange rate.

The data have been collected in advance in accordance with the needs of tabulation, and then built a model of simultaneous equations i.e. 2 SLS (Two Stage Least Square). Data are processed by SAS computer program version of 6:12.

Equation model was built according to the following research objectives:

Indonesian Cooking Oil Consumption

Equation of Indonesian cooking oil consumption is defined as follows:

$$CMG_t = a_0 + a_1 RPMGt + a_2 JPJ_t + U_1 \quad (3)$$

Where:

CMG_t = Indonesian cooking oil consumption in year t (tonnes)

$RPMG_t$ = Real price of cooking oil (palm) in year t (USD / ton)

JPJ_t = Total population of Indonesia in year t

U_1 = Error

Cooking Oil Real Price (Palm) Indonesia

Equation of real price of cooking oil (palm) Indonesia is formulated as follows:

$$RPMG_t = b_0 + b_1 QMG_t + b_2 RCPOD_t + U_2 \quad (4)$$

Where:

QMG_t = production of cooking oil (palm) in year t (tons)

$RCPOD_t$ = real price of palm oil in Indonesia in year t (USD/ton)

U_2 = Error

Real Price Indonesian Palm Oil

The real price of Indonesian palm oil is formulated as follows:

$$RCPOD_t = c_o + c_1 RCPOI_t + U_3 \quad (5)$$

Where:

$RCPOI_t$ = international real price of palm oil inyear t (USD / ton)

U_3 = error

Hypothesis or the expected signs of the coefficients are:

$a_1 < 0$, $a_2 > 0$

$b_1 < 0$, $b_2 > 0$

$c_1 > 0$

In econometric, there are two possible circumstances that arise from the identification process. They are equation is not identified, equation correctly identified and over identified. If a model is not identified it is not possible to predict all the parameters with econometric techniques. If the equation is correctly identified the approach used to estimate is the ILS method, and if it is over identified, the approach used to estimate is either 2 SLS or 3 SLS (Three Stage Least Square).

To see an equation is identified is identifying the structural form of the model called "order condition" which the requirement is the number of endogenous variables minus one or can be formulated as follows:

$$(K-M) \geq (G-1) \quad (6)$$

Where:

G = Number of equations

K = Number of variables in the model (endogenous and predetermined)

M = Number of endogenous and exogenous variables included in a particular equation.

From equation (6), if:

(KM) < (G-1) means that the equation is "under identified"

(KM) = (G-1) means that the equation is "exactly identified"

(KM) > (G-1) means that the equation is "over-identified"

The structural model formulated above consists of 3 endogenous and 3 exogenous variables. The 3 identifications of structural equation using order condition are as follows:

Identification cooking oil consumption in Indonesia

K = 7

M = 3

So 7- 3 > 3-1 *(over identified)*

Identification of the real price of cooking oil (palm) in Indonesia
K = 7
M = 3
So 7-3 > 3-1 *(over identified)*
Identification of the real price of Indonesian palm oil
K = 7
M = 2
So 7-2 > 3-1 (*over identified)*

After the stage of model identification, it is known that the structural equations in the model are over identified. Then the leading econometric theory that predict the equation parameters can be performed with the 2 SLS technique.

Theil (1965) in Tety (2002) mentions the purpose of model validation which is to see how far a model representing the real world. Validation of the model is carried out by using RMSE (Root Mean Square Error), RMSPE (Root Mean Square Percent Error), and U (Theil's inequality coefficient) which is defined as follows:

$$RMSE = [1//T\sum_{t=1}^{T}(Yp - Ya)^2]^{0,5} \quad (7)$$

$$RMSPE = [1//T\sum_{t=1}^{T}(Yp-Ya/Ya)^2]^{0,5} \times 100\% \quad (8)$$

$$U = [1//T\sum_{t=1}^{T}(Yp-Ya)^2]^{0,5}/[1//T\sum_{t=1}^{T}(Yp)^2]^{0,5} + [1//T\sum_{t=1}^{T}(Ya)^2]^{0,5} \quad (9)$$

Where:
Yp = model predicted value
Ya = value of observation samples
T = number of years of observation samples

The smaller the RMSE value <RMSPE, and U the better the model is expected. U values are ranging between zero and one, if U = 0 then the model prediction is perfect, and vice versa if the value of U = 1 then the prediction model is not perfect thus needs to be revised.

U statistics can be broken down into components of bias, variance, and covariance that the total is equal to one. Another consideration is the percentages component of the value of U statistics, namely: the bias portion (UM) indicates a systematic error, the expected value in this case is zero; vari ance portion (US) indicates the model's ability to replace a variation of the dependent variable. The desired value of this statistic is zero indicating the model the exactly replace the variation of the independent variables; covariance portion (UC) measures the random error. The expected statistical value is one, which indicates that the simulation error is fluctuating due to random. Statistical values generated can be broken down into the component of bias, regression, and disturbance in which the summed value equal to one. If the regression intercept is equal to zero, then the bias is zero. If the slope parameter is one, then the regression component is one. Optimally, bias and regression components are zero, and the disturbance component is one.

RESULTS DISCUSSION

In general, the result of two stage least square (SLS 2) shows that all parameters in each equation have signs consistent with expectations. The results of the model prediction on oil consumption shows that the coefficient of determination (adj R^2) ranged from 81% to 95%. This means that the variation of each endogenous variable can be best explained by their explanatory variables in each structural equation. Explanatory variables in each equation simultaneously explain the variation of endogenous variables shown by the F statistic values ranged from 41.744 to 337.36.

Indonesian Cooking Oil Consumption

Table 1 shows analysis of variance of F statistic is 159.555 which is significant 1% level. It means that a variation of cooking

oil consumption (endogenous variable) is significantly explained by their exogenous variables. Adjusted R^2 or the coefficient of determination is 0.9435 which mean 94.35% variation of cooking oil consumption can be explained by the price of palm cooking oil and the number of population. The other 5.65% is explained by other factors not included in the model. Variable of the price of palm cooking oil showed a negative effect in accordance with the expected direction. Whereas the population variable explains positive signs which is not different to the expected signs.

The price of palm cooking oil has significant effects on α = 1% on the consumption of palm cooking oil with a negative sign of -0.479. It means that Rp. 1/tones palm cooking oil price increases lead to lower its consumption up to 0.479 tonnes. This is consistent with the theory of demand and prices which states that if the price of a commodity increases, while other factors are considered fixed (cateris paribus), the consumption or demand for these commodities is to come down. Some households will stop buying, other households will reduce the amount purchased, or the other households will no change in their purchase. Therefore, the amount purchased will be reduced if the price of a commodity rises (Kadariah 1994).

Indonesia's population variables showed significant influence on the α = 1% on palm cooking oil consumption in which the variable has a positive sign for 0.034. It means that one more people in Indonesia resulted in 0.034 tonnes increased consumption of palm cooking oil.

Table 1: Model Estimation of Cooking Oil Consumption in Indonesia

1. CMGt (Cooking Oil Consumption in Indonesia)

Variable	Paramater	Standar Error	Probability
INTERCEP	-3260536		
RPMGt	-0,479	0,147	0,0046
JPIt	0,034	0,005	0,0001
Adj R-SQ	0,9435	Fhit 159, 555	DW 2,198

2. RPMGt (Real Price of Indonesia Palm Cooking Oil)

Variable	Paramater	Standar Error	Probability
INTERCEP	2143770		
QMGt	0,317	0,037	0,0001
RCPODt	0,634	0,143	0,0004
Adj R-SQ	0,8109	Fhit 41,744	DW 1,218

3. RCPODt (Real Price of Indonesia Palm Oil)

Variable	Paramater	Standar Error	Probability
INTERCEP	166893		
RCPOIt	0,727	0,039	0,0001
Adj R-SQ	0,9465	Fhit 337,363	DW 1,571

Note: F statistic is signficant at α=1%

Real Price of Palm Cooking Oil in Indonesia

From results of the analysis of variance (Table 1), F statistic is 41.74 which is significant at 1% level. It implies that palm cooking oil price is significantly influenced by their exogenous variables simultaneously. Value of adjusted R^2 or the coefficient of determination is 0.8109 which explains the 81.09% variation of palm cooking oil prices is described by the production of palm cooking oil and Indonesian palm oil prices. While for the other 18.91% is explained by other factors not included in the model.

The variable of palm cooking oil production show a negative sign in accordance with the expected sign and Indonesia palm oil prices show a positive signal in accordance with the expected sign. Production of palm cooking oil has significant effects at 1% level on the price of palm cooking oil with a coefficient of -0317. It means an 1 tonne increase in palm oil production will lead to lower prices of palm cooking oil up to Rp, 0.317 per tonne. If the oil production increases, supply will increase (cateris paribus) that will be an excess supply on the market thus declining on the oil prices. Indonesian palm oil prices show a clear influence at the α = 1% to the price of palm cooking oil with a coefficient of 0.634. It implies a Rp 1/tonne increase in Indonesian palm oil prices have an impact on Indonesia palm cooking oil prices up to Rp. 0.634/tonne. Since palm oil is the raw material in the manufacture of the cooking oil, the increase in the price of palm oil will cause increasing palm cooking oil prices.

Real Price of Indonesian Palm Oil

Table 1 shows the variance analysis which F statistic is 337.363 and significant at 1% level. It means that variation of Indonesian palm oil prices (endogenous variable) is significantly explained by exogenous variables. The value of adjusted R Square or the coefficient of determination is 0.9465 which explains the 94.65% variation of Indonesian palm oil prices is explained by the international palm oil prices. While 5.35% is explained by other factors not included in the model.

The variables of international palm oil prices showed a positive signal in accordance with the expected sign. This variables have significant influence at the α = 1% on the Indonesian palm oil prices with coefficient of 0.73. It means an increase in international oil prices affect the increase in Indonesian palm oil prices. The increasing price of palm oil in international markets caused Indonesian palm oil producers are more interested in selling palm oil to other countries resulting in supply of Indonesian palm oil to decrease. Thus decreasing the domestic supply of palm oil (used as raw material for cooking oil) will raise the price of Indonesian palm oil.

Indonesian palm oil prices are not only influenced by the international palm oil prices but also influenced by other factors other like the exchange rate developments and policy on the commodities (palm oil export tax policy and the obligation to supply the domestic market). However, because of the limitations of the model used these other factors that influence the price of Indonesian palm oil was not examined.

All three models in this study are validated by looking at the value of Statistics of Fit and Theil Forecast Error Statistics. Validation results shown in Table 2 explain that the RMS% Error of the three models can be used as a forecast because all equations in the model have RMS% error value less than 13 percent. This means that the predictive value of data can follow historical trends with an error rate of 13 percent in RPMGt equation. The value of bias (UM), regression (UR) and Variance (US) close to the ideal value of zero. While the value of Disturbance (UD) and Covariance (UC) also

close to the ideal value of one. Theil U values also close to zero indicating that the simulation model follows the actual data very well.

Table 2: Model Validation on Factors That Affect Consumption Palm Cooking Oil, Palm Cooking Oil Price and Palm Oil Prices in Indonesia.

Model Validation	CMG_t	$RPMG_t$	$RCPOD_t$
Mean Error	31,6907	-1,4941	-0,2898
RMS% Error	5,3341	13,5563	0,7974
Bias (UM)	0,000	0,000	0,000
Reg (UR)	0,034	0,000	0,000
Var (US)	0,068	0,063	0,013
Dist (UD)	0,966	1,000	1,000
Covar (UC)	0,932	0,937	0,987
U Theil	0,0233	0,0541	0,0361

CONCLUSION

Variables that have real impact on cooking oil consumption is the price of cooking oil (palm) and the number of Indonesian population. The oil price increase will cause a decrease of cooking oil consumption of Indonesia. Cooking oil consumption has increased along with an increasing population. Variable of the cooking oil production and Indonesian palm oil prices have real impact on palm oil price variables in Indonesia. The increase in the price of palm oil as the main raw material of cooking oil will cause oil prices to rise and reversely the increase in palm cooking oil production will decrease palm cooking oil prices. Variables of international palm oil prices have real impact on the variable of Indonesian palm oil prices. The international oil price increased palm cooking oil prices in Indonesia. All three models used in the study may represent the behaviour of historical data very well.

Based on those results, the use of CPO allocated as raw material for cooking oil production should be increased in accordance with the production capacity of palm oil companies in Indonesia. In addition, Indonesian palm oil prices are not only influenced by the international palm oil prices but also influenced by other factors such as exchange rate developments and the various policies of palm oil commodities. Therefore, this research can proceed to see how the influence of these factors on the price of palm oil in Indonesia.

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