IMPACTS OF CRUDE PALM OIL (CPO) EXPORT TAX POLICY ON ECONOMIC WELFARE IN INDONESIA

TESIS

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DEPOK
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Diajukan sebagai salah satu syarat guna memperoleh gelar Magister Sains Ekonomi pada Program Studi Ilmu Ekonomi Program Pascasarjana Fakultas Ekonomi Universitas Indonesia

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SEPTEMBER 2008

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Telah berhasil dipertahankan di badapan Dewan Penguji dan diterima sebagai bagian persyaratan yang diperlukan untuk memperoleh gelar Magister Sains Ekonomi pada Program Studi Pasca Sarjana Ilmu Ekonomi Fakultas Ekonomi, Universitas Indonesia

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ABSTRAK

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Tesis ini mengevaluasi dampak pajak ekspor minyak kelapa sawit (CPO) Indonesia terhadap kesejahteraan perekonomian di Indonesia selama periode April 1998 sampai dengan Desember 2005 dengan membangun sebuah model ekonometrik industri CPO. *Welfare effect* pajak ekspor di sini mencakup *distribution effects* pada harga CPO domestik, persediaan CPO, permintaan domestik dan luar negeri dan juga pada harga petani kelapa sawit. Simulasi, berdasarkan data periode September 2000 sampai dengan Desember 2006, digunakan untuk mengidentifikasikan berbagai dampak dari beberapa tingkat pajak ekspor. Hasil penelitian menunjukkan kenaikan pajak ekspor CPO menyebabkan penurunan harga CPO domestik, harga petani, produksi CPO dan permintaan luar negeri. Sebaliknya, pemberlakuan pajak ekspor CPO mempunyai efek positif pada permintaan domestik dan memberikan *net welfare gain* bagi Indonesia, tetapi keuntungan konsumen relatif kecil dibandingkan kerugian produsen. Penentuan nilai pajak ekspor pada tingkat yang tepat adalah diperlukan karena makin tinggi pajak ekspor, dapat menyebabkan makin rendahnya penerimaan pajak sekaligus berkurangnya *net gain* bagi kesejahteraan Indonesia. Kebijakan pajak ekspor bisa efektif untuk menjamin persediaan CPO yang memadai di pasar domestik. Pajak ekspor juga dapat membantu untuk menurunkan harga CPO meskipun tidak begitu besar pengaruhnya dan kemungkinan tidak cukup untuk menstabilkan harga minyak goreng.

Kata Kunci : Pajak ekspor, elastisitas harga, asumsi *large-country*, *economic welfare*.

ABSTRACT

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Title : Impacts of Crude Palm Oil (CPO) Export Tax Policy on Economic Welfare in Indonesia

This study evaluates the impacts of Indonesian Crude Palm Oil (CPO) export tax on economic welfare by formulating an econometric model of the CPO industry in Indonesia for the period April 1998 to December 2005. The welfare effects of export tax cover distribution effects on CPO domestic price, domestic supply, domestic and foreign demand and also farmer price. The simulation, based on average data for the period September 2000 to December 2006, was used to identify the impacts of different export tax rates. The results show that an increase of CPO export tax rate has caused a decrease in CPO domestic price as well as farmer price, CPO domestic production and foreign demand. On the other hand, the imposition of CPO export tax has positive effect on domestic demand and results in net welfare gain to Indonesia. The gain of consumers is relatively less than the loss of producers. Determining export tax rate at appropriate level is necessary, because the higher the export tax, the lower the tax revenue and net gain to Indonesia welfare. Furthermore, export tax policy could be an effective instrument to guarantee an adequate supply in domestic market. It may also help to lower the CPO domestic price, although the effect is not considerable and probably inadequate to stabilize the cooking oil price.

Key words: Export tax, price elasticities, large-country assumption, economic welfare.

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CHAPTER 1
INTRODUCTION

Crude palm oil (CPO) is a very important product for Indonesia's economy for several reasons. CPO is useful as a raw material of cooking oil, an essential domestic commodity and also many derivative products have various benefits. The industry contributes to employment and national economic growth. During 1998-2006, value of palm oil export contributed 4.1 percent of the total national export. In the same period, about 60 percent of Indonesian CPO production and its derivatives were exported, providing important foreign exchange earnings. As the world's second largest producer in 2006, Indonesia accounted for around 44 percent of world palm oil production and its export share of the world market was around 43 percent. Indonesia is expected to be the largest producer, by getting a head Malaysia which contributed 43 percent of production with a net share of export 48 percent (Oil World, 2007; United States Department of Agriculture [USDA], 2008).

The larger amount of exported quantity is caused by the lower absorption of CPO for domestic consumption related to limited capacity of CPO downstream industries (Institute for Development of Economics and Finance [INDEF], 2007). In addition, world demand for CPO increases every year because CPO recently is useful for biofuel as an alternative energy source.

However, this new phenomenon may have negative impacts on the domestic economy. The high world demand and the decrease in CPO world production due to climate factor have increased CPO world price. This happened in mid 2007, when CPO world price rose to about 750-800 US$/ton from 500-550 US$/ton in 2006. The increase of world price would be followed by rise up of CPO domestic price more than 700 US$/ton or more than Rp. 6,900,000/ton. The increase of CPO world price raised cooking oil price up to Rp.8,500/kg on beginning May 2007 from Rp.6,000/kg before May 2007.

The government of Indonesia has tried to control increases in the price of CPO and cooking oil through some intervention policies, e.g., a cooking oil price

stabilization program was conducted through market operations to achieve a target price. Another policy was Domestic Market Obligation (DMO) to determine CPO quota in domestic market. This required a quota of 4.5-5 million tons of CPO per year to be filled by producers for domestic need. This quota can produce 3.8-3.9 million tons cooking oil per year in Indonesia (Ministry of Industry as cited in *Media Indonesia Online*, 2007).

However these policy instruments have not been effective in stabilizing the cooking oil price because the target cooking oil price of Rp. 6,800/kg or around Rp. 5,500,000/ton for equivalent CPO domestic has not been realized. There are some reasons for this failure. First, to achieve the target price, market operation needs a lot of funds and a large CPO supply ; in fact, the targeted CPO supply was not met (Susila, 2005 ; Ministry of Trade as cited in *Lembaga Pendidikan Perkebunan*, 2007). Second, the domestic market obligation can be effective only if enforcement is implemented (INDEF, 2007). When the world CPO price increased quickly, suppliers tried to avoid this obligation, preferring to sell the commodity on the world market and even resorting to smuggling (Harini, 2007; Khaerudin 2007).

Another government policy is the export tax. The government imposes a higher export tax on CPO in order to guarantee the availability of raw material for the cooking oil industry and to stabilize domestic prices of cooking oil (Decree of Ministry of Finance No.61/PMK.011/2007). A few investigations have focused on the effectiveness of CPO export tax on CPO domestic supply, CPO domestic price and cooking oil price with qualitative studies (Marks, Larson and Pomeroy, 1998; Dradjat, 2007) and a quantitative study (Susila, 2004). However, previous quantitative research utilized yearly data and disregarded the monthly changes of CPO export tax rate. It remains unclear whether the export tax is really effective in solving the domestic lack of CPO and in controlling the price of CPO and cooking oil in domestic market.

Taking into account the importance of CPO for Indonesia, this paper tries to investigate the effectiveness of the CPO export tax policy on the economic welfare in Indonesia with a different model from previous studies. It aims:

- to formulate an econometric model of the CPO industry in Indonesia using monthly data for the period 1998-2005 ;
- to estimate the impacts of an increase in CPO export tax on economic welfare in Indonesia, covering the impacts on farmer price, consumer (domestic) price, domestic supply (production), domestic demand and foreign demand ; and
- to identify those impacts of CPO export tax on welfare distribution through simulations assuming different rates of CPO export tax.

CHAPTER 2
LITERATURE REVIEW

2.1. Theoretical Framework

The imposition of the export tax in a trade model of one commodity is illustrated in figure 2.1. S_d is the domestic supply curve and D_d is the domestic demand curve. The foreign demand curve is D_f and the export supply curve S_x is obtained from the horizontal difference between S_d and D_d.

The export tax, a levy on goods exported, will act like a barrier to export. When the tax rate increases, the exporter may find it more profitable to sell the goods domestically, so Sx shifts upward to S'x causing a decrease in export volume to X_1. As a result, domestic sales will expand which subsequently decrease the domestic consumer price from PD_0 to PD' and this effect may depress the price level at which farmers sell their products. Export taxation raises domestic demand from DD_0 to DD_1. Producers will lose through lower price leading domestic supply declines to SD_1. There will be a loss in producer surplus by area PD_0HGPD' and gain in consumer surplus by area PD_0ABPD'. The sum of area ABC and FGH which is equal to JKL is the domestic deadweight efficiency loss due to the price distortion (Appleyard, Field & Cobb, 2006).

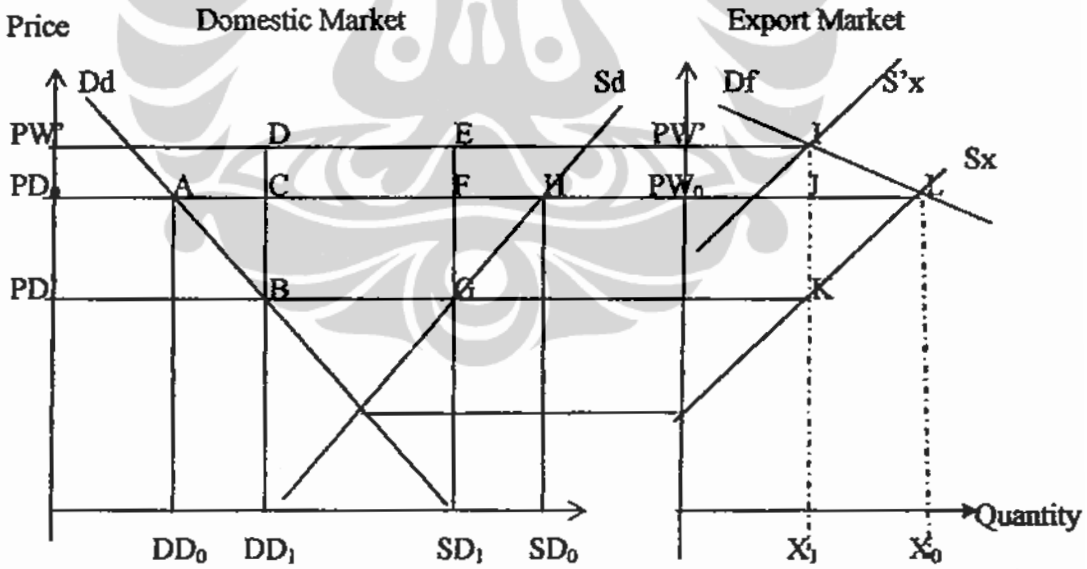
The welfare effect of this tax on a small country is different from a large country. [1] In the small country case, the export tax revenue is only area BCFG. In the large country case which faces imperfectly elastic foreign demand (Wong, 1978), export tax leads to an increase in world price to PW'. If import price is constant, then the terms-of trade (P_{export}/P_{import}) will rise. Government collects total tax revenue by area BDEG which is the sum of tax revenue at the domestic producer expenditures of BCFG and gain in terms of trade of CDEF (or equals to PW_0 JIPW') transferred from foreign countries. Because of fall in export quantity,

[1] The large exporting country is a country whose export is so large as to significantly influence the world price while small country has little ability to affect the world price (Choeun, Godo & Hayami, 2006).

the loss of foreign exchange earning is expressed by area loss of export revenue minus terms of trade gain (Choeun, Godo & Hayami, 2006). Deadweight loss in international market is area IJL.

The country's gain or loss of welfare from imposing export tax depends on the price elasticity of domestic supply, domestic demand and export demand. (Wong, 1978; Choeun et al., 2006; Appleyard et al., 2006). Those elasticities determine the relative burden borne by domestic producers and by foreign consumers. According to Appleyard et al. (2006), in a small country, the less elastic domestic supply and demand are, the greater the net welfare gain to the nation. The more elastic domestic supply and demand, and the less elastic foreign demand are, the greater gain in the large country.

In addition, the large country will gain (loss) from export tax if government revenue from terms of trade gain (PW_0JIPW') is larger (smaller) than the domestic deadweight loss (JKL) associated with export tax. In the large country, there is optimum export tax which maximizes the net domestic welfare gain.



Note : PD_0 : Domestic price without export tax = PW_0 : World price without export tax;
PD' : Domestic price after tax increase ; PW' : World price after tax increase

Figure 2.1. Impact of Export Tax on Welfare Distribution

Source : Wong (1978); Choeun, Godo, & Hayami (2006)

The economic welfare and transfer effects of the export tax in the large country case shown in figure 2.1 can be calculated by formula:

Loss in producer surplus = ½ $\Delta SD\,\Delta PD + SD_1\Delta PD$ (a)

Gain in consumer surplus = ½ $\Delta DD\,\Delta PD + DD_0\,\Delta PD$ (b)

Total tax revenue = $(SD_1 - DD_1)\,\Delta PD + (SD_1 - DD_1)\,\Delta PW$: (c)

- Tax revenue paid by domestic producer = $(SD_1 - DD_1)\,\Delta PD$ (d)
- Terms-of-trade gain = $(SD_1 - DD_1)\,\Delta PW$ (e)

Domestic deadweight loss = $\frac{1}{2}\Delta SD\Delta PD + \frac{1}{2}\Delta DD\Delta PD$ = (a)-(b)-(d) (f)

Net loss or gain for the country = (e) – (f) (g)

Loss of foreign exchange earning = $(\Delta DD + \Delta SD)PD_0$ – (e) (h)

Deadweight loss in international market = $\frac{1}{2}\,\Delta X\Delta PW$ (i)

2.2 Previous Relevant Studies

Empirical studies of the effect of an export tax on palm oil on the distribution of income in Indonesia have been done by Marks et al. (1998) using static model and small country assumption for the period 1994 to 1997. Their result showed that export tax has lowered cooking oil prices temporarily, at least at the ex-factory level but not at final consumers. They found expected impact on domestic consumer and producer, and also on reduced government revenues, because state-owned oil palm estates suffered the impact of lower CPO price.

Other research observed the effect of an export tax on competitiveness using vector autoregressive (dynamic) model (Hasan, Reed, & Marchant, 2001). This study indicated that an export tax on the Indonesian palm oil industry as a small country had negative effect both on export performance and competitiveness in the long run.

Susila, Wayan R. (2004) studied the impacts of export tax on several aspects of the CPO industry with simultaneous equation system. His research used the effective tax rate instead of nominal tax rate and data from 1987 to 2003.[2] He founded that Indonesia's CPO export tax policy has reduced the growth rate of oil

[2] Susila utilized effective tax as the nominal tax rate of the difference between world price and the minimum price taxed.

palm mature area, CPO production, CPO export, and oil palm farm income. His result showed that export tax was an effective tool to stabilize domestic CPO price and cooking oil price.

Ernawati, Fatimah, Arshad, Shamsudin, & Mohamed (2006) analyzed the impact of trade liberalization (reduction in export tax and import tariff) on export demand of Indonesian palm oil to India, China, Europe and the rest of world (ROW). Their finding showed that reduction of palm oil export tax and import tariff of importing countries simultaneously and partially lead to increase in export demand.

The effectiveness of export tax imposed by government in 2007 was analyzed descriptively by Dradjat (2007). He founded that the CPO export tax depressed CPO domestic price and farmer price, but was not effective to stabilize cooking oil price because of high CPO price in international market.

CHAPTER 3
RESEARCH METHODOLOGY

This paper reports an empirical study, by using econometric analyses of the trade model of one commodity. Regression analyses were done to estimate how much CPO export tax will affect economic welfare covering the impact on farmer price of oil palm, domestic CPO price, domestic supply (production), domestic demand and world demand of Indonesian CPO.

The trade model of one commodity was used to measure quantitatively the welfare transfer effect of CPO export tax in terms of consumer surplus, producer surplus, tax revenue, and the size of net gain or loss of the country. The calculation of welfare and distribution effects of export tax was conducted by applying linear approximation to the curves with formula shown in figure 2.1. [3]

3.1. The Specification of Model and Simulation for Indonesia Crude Palm Oil

In order to analyze quantitatively the effects of imposing and changing the export tax on farmer price, CPO domestic price, CPO domestic supply, CPO domestic demand and CPO export demand, a model was formulated by separate equations in log-linear transformation form. The estimated slope coefficients can be interpreted as elasticity. The model used in this study consists of six equations: oil palm (farmer) price equation, CPO domestic (consumer) price equation, CPO domestic supply equation, domestic demand equation, relative world price of CPO to soya oil equation, and foreign demand equation.

Figure 3.1 demonstrates the basic structure of the theoretical model consisting of four exogenous variables, three intermediate variables and three final endogenous variables. The hypothetical relationships between variables or factors involved in equations are illustrated in figure 3.1.

[3] It should be noted that, despite its simplicity, the use of linear approximation may incur some overestimated or underestimated results.

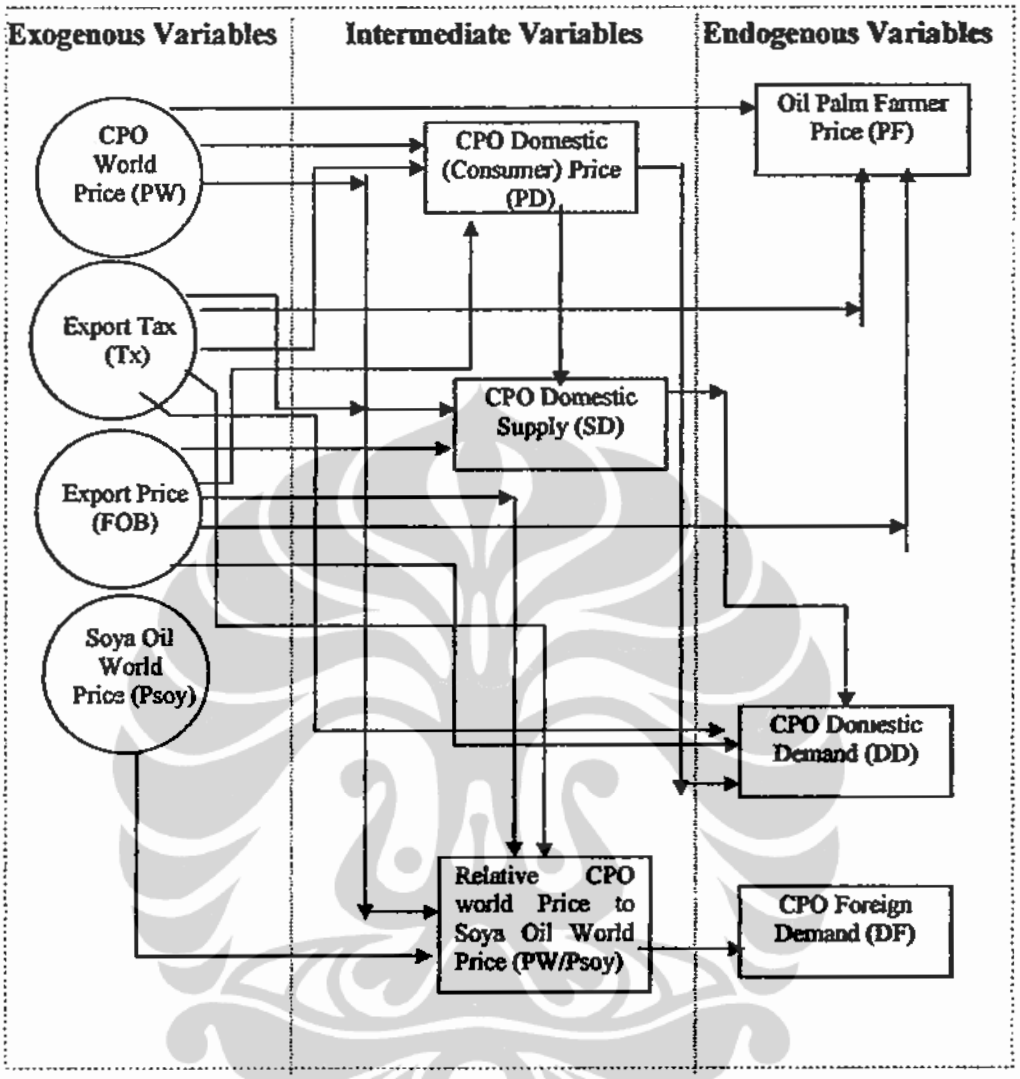


Figure 3.1. Flowchart of Key Variables in Indonesia Crude Palm Oil

As shown in figure 3.1, the model for Indonesia CPO can be expressed as follows:

Oil Palm Farmer Price Equation

$$\ln PF_t = a_0 + a_1 \ln(FOB^*Tx)_t + a_2 \ln PW_t + a_3 \ln PF_{t-1} + \varepsilon_{1t} \quad (3.1)$$

CPO Domestic Price Equation

$$\ln PD_t = b_0 + b_1 \ln(FOB^*Tx)_t + b_2 \ln PW_t + b_3 \ln PD_{t-1} + \varepsilon_{2t} \quad (3.2)$$

CPO Domestic Supply Equation

$$\ln SD_t = c_0 + c_1 \ln(FOB^*Tx)_t + c_2 \ln PD_t + c_3 \ln SD_{t-1} + \varepsilon_{3t} \quad (3.3)$$

CPO Domestic Demand Equation

$$\ln DD_t = d_0 + d_1 \ln(FOB^*Tx)_t + d_2 \ln PD_t + d_3 \ln SD_t + \varepsilon_{4t} \quad (3.4)$$

Relative World Price of CPO to Soya Oil Equation

$$\ln(Pw/Psoy)_t = e_0 + e_1 \ln(FOB^*Tx)_t + e_2 \ln(Pw/Psoy)_{t-1} + \varepsilon_{5t} \quad (3.5)$$

CPO Foreign Demand Equation

$$\ln DF_t = f_0 + f_1 \ln(Pw/Psoy)_t + f_2 \ln DF_{t-1} + \varepsilon_{6t} \quad (3.6)$$

Where :

PD = Domestic (consumer) wholesale price of CPO (Rp/ton),

PF = Farmer (producer) price of fresh fruit bunch (FFB) of oil palm (Rp/ton),

SD = Domestic supply (production) of Indonesia's CPO in large estate crop (ton),

DD= Domestic demand of CPO (ton),

DF = Foreign Demand of Indonesia CPO (ton),

Pw/Psoy = Ratio of CPO and soya oil world price (US$/ton),

PW = CPO world price (US$/ton), CIF Rotterdam,

Psoy = Soya Oil World Price (US$/ton), FOB Argentina,

ε = Error term,

t = Time period,

Some dependent explanatory variables in lagged one period (t-1) [4], and

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[4] In general, autoregressive model is used because in the monthly period, the effect may not be directly shown in same period. The use of lag period in some variables is due to producer behavior for deciding production, oil palm farmer price, CPO domestic and world price, and also due to foreign consumer behavior for deciding demand. Because of imperfect competitiveness market of CPO both in domestic and international market (which have oligopolistic market structure) lead price may not change immediately. As well as CPO production, it depends on oil palm input which is relatively fixed supply, so that a change in production may not be shown instantaneously. Since the model represents a kind of distributed lag (autoregressive model), there is possibility of serial correlation in the error term (Gujarati, 2003, p.677-678). The robustness of the model should be checked first. Lagrange multiplier (LM) statistic is used to test for serial correlation of residuals and the result shows that the null hypothesis of no autocorrelation cannot be rejected, therefore OLS can be applied, except for equation (3.1) (see LM test in appendix B5). There appears to be serial correlation in equation (3.1). Using OLS procedure would produce the estimated farmer price equation inefficient but this is not spurious regression. Augmented-Dickey Fuller (ADF) test on the residuals of farmer price equation indicates that the hypothesis of the residuals are stationary cannot be rejected at the 1% confidence level (further explanation shown in appendix B6).

FOB*Tx = CPO export tax revenue/unit.

FOB = Export price (US$/ton) which is approximated with export value divided by export volume.

Tx = nominal tax rate of CPO (%), an ad valorem tax of exported good.

In order to get better result, those equations use CPO export tax as variable of FOB*Tx which is obtained by multiplying export price (FOB) by CPO export tax rate (Tx), because the export tax rate was constant for some periods. It can be seen in appendix A that the correlation between export price (FOB) and export tax rate (Tx) is 0.5. Hence, it is assumed that FOB price and export tax are not strongly correlated. The correlation is strong if its value is greater than 0.8 (Gujarati, 2003; Nachrowi & Usman, 2006).

Those six equations were estimated by Ordinary Least Square (OLS) for linear regression model. Equation (3.2) to (3.4) and equation (3.5) to (3.6) are recursive systems (each equation exhibits a unilateral causal dependence). There is no interdependence among the endogenous variables, thus OLS can be applied to each equation individually with the assumption that error term in different equations are uncorrelated. [5]

Equation (3.1) examines the impact of CPO export tax on the farmer of fresh fruit bunch (FFB) of oil palm in smallholder estate in terms of farmer price. The increase in export tax rate is expected to be negatively related to farmer price since tax depresses the CPO domestic prices. [6]

Equation (3.2) indicates that the domestic consumer price of CPO is affected by world price and export tax. As shown in the equation, the CPO domestic price and CPO world price have positive relation, while CPO domestic price and export tax rate have negative relation.

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[5] Correlation between CPO export tax (FOB*Tx) and world price (PW), also (FOB*Tx) and domestic price (PD) are not strong, as shown in appendix A. This indicates that the equation (3.1) to (3.4) do not exhibit multicollinearity.

[6] Here we implicitly assume a positive correlation between CPO domestic price and farmer price.

In order to capture the degree of direct effect of CPO export tax on domestic supply of Indonesia CPO and to find price elasticity, equation (3.3) is developed as a function of CPO export tax and domestic consumer price (which could be the substitute for CPO producer price). In equation (3.3), domestic supply of CPO is production in large estate crop owned both by government and private companies. It is expected that the higher the CPO price, the higher CPO production will be. Conversely, the higher the export tax, the lower will be production.

In equation (3.4), the domestic demand is a function of CPO domestic consumer price, export tax and CPO production. Similarly to domestic supply equation, the export tax is included in domestic demand model to see the direct impact of CPO export tax on domestic demand of CPO. Domestic demand is the amount of CPO which is available domestically. Its value was estimated by the formula DD = SD – DF. Import and stock are omitted here because CPO import and stocks are relatively small. [7] The sign of domestic price coefficient should be negative. Export tax rate and CPO production is expected to be positively related to domestic consumption. The correlation between production of CPO and domestic consumption is assumed to be positive, because domestic consumption (example, for cooking oil industry) decreases when production of CPO decreases.

Equation (3.5) assumes that the relative world price of CPO to soya oil (Pw/Psoy) can be explained by export tax. This equation can be used to predict the impact of export tax on CPO world price to capture effect of large country assumption. This equation is the price transmission for equation (3.6) to know the indirect impact of export tax on foreign demand. The relationship between export tax and the relative price is expected to be positive.

Equation (3.6) expresses export demand for Indonesia CPO in the world market. Since there are no data regarding world demand for Indonesian CPO, the foreign demand (DF) is approximated by data of Indonesian CPO export volume. To estimate the price elasticity of foreign demand, the relative price CPO to soya oil is chosen. If the relative world price (PW/Psoy) rises, foreign demand is expected to decline. The impact of CPO export tax on foreign demand can be

[7] CPO is perishable, and can not be stored for more than three months (Chalil & Esfahani, 2006)

captured indirectly through equation (3.5).[8] The expected impact of export tax imposition is a fall in foreign demand.

To evaluate and estimate the impact of the level of Indonesian CPO export tax, the model was simulated with 3 scenarios of nominal export tax rates at 3, 5 and 10 percent. These rates are based on previous export tax that had been imposed mostly by Indonesia.

The simulation of different cases of export tax was conducted using conditional expectation value of each dependent variable given independent variables, denoted by:

E(ln dependent variable | other independent variables, Tx = a%).

3.2. Data and Sources

The data used for anaiysis in this paper were time series data collected from BPS (Badan Pusat Statistik), Statistics Indonesia, and Indonesia Ministry of Agriculture for data CPO export, production, consumption and FFB farmer price. CPO export tax rates were taken from Indonesia Ministry of Finance. CPO world price, CPO domestic price and also FFB farmer price figures were taken from Bank of Indonesia and PT. SMART, TBK. Data for soya oil world prices were obtained from Oil World publication. Data collections are listed in Appendix F.

The period of analysis used monthly data from April 1998 to December 2005 when the CPO export tax was imposed again after the CPO export ban was ended. The simulation utilized the data from September 2000 until December 2006, the period after Indonesia's recover from the economic crisis. Regression analysis in this paper was performed by computer-statistic program EViews 5.1.

[8] CPO export tax is not included in foreign demand model because of the existence multicollinearity between CPO export tax (Tx) and PW/Psoy (appendix A). Therefore equation (3.5) is developed as price transmission to equation (3.6).

CHAPTER 4
RESULT AND DISCUSSION

4.1. Statistical Results of Estimation

Generally, the estimation results of CPO model support the hypotheses regarding to the sign conditions of coefficients. The summary results of the equation estimation with the associated standard errors and relevant statistics measurements are provided in Table 4.1. The t-statistics for all coefficients are significant at level 1%, except for the intercept of the CPO domestic supply equation in table 4.1(3). The complete estimation results can be seen in appendix C.

Table 4. 1. Results of Estimation in the Indonesian Crude Palm Oil Model

No.	ESTIMATED EQUATION RESULTS					
1	$\ln PF_t =$	2.21	- 0.1 $\ln(FOB^*Tx)_t$	+ 0.51 $\ln PW_t$	+ 0.62 $\ln PF_{t-1}$	
	t-stat :	(4.66)	(-5.98)	(6.75)	(11.54)	$R^2 = 0.90$
	se :	(0.47)	(0.01)	(0.07)	(0.05)	
2	$\ln PD_t =$	3.18 –	0.03 $\ln (FOB^*Tx)_t$	+ 0.37 $\ln PW_t$	+ 0.64 $\ln PD_{t-1}$	
	t-stat :	(4.3)	(-3.26)	(4.68)	(8.88)	$R^2 = 0.88$
	se :	(0.74)	(0.01)	(0.08)	(0.07)	
3	$\ln SD_t =$	0.39**)	– 0.07 $\ln (FOB^*Tx)_t$	+ 0.3 $\ln PD_t$ +	0.64 $\ln SD_{t-1}$	
	t-stat :	(0.49)	(-3.94)	(3.81)	(8.44)	$R^2 = 0.84$
	se :	(0.81)	(0.02)	(0.08)	(0.08)	
4	$\ln DD_t =$	4.46	+ 0.21 $\ln (FOB^*Tx)_t$	- 0.55 $\ln PD_t$ +	1.21 $\ln SD_t$	
	t – stat :	(2.78)	(5.66)	(-3.37)	(7.67)	$R^2 = 0.45$
	se :	(1.60)	(0.04)	(0.16)	(0.16)	
5	$\text{Ln } (Pw/Psoy)_t =$	-0.09	+ 0.02 $\ln (FOB^*Tx)_t$ +	0.68 $\text{Ln } (Pw/Psoy)_{t-1}$		
	t-stat :	(-3.8)	(3.62)	(9.11)		$R^2 = 0.84$
	se :	(0.02)	(0.01)	(0.07)		
6	$\text{Ln } DF_t =$	6.04 –	3.3 $\ln (Pw/Psoy)_t$ +	0.48 $\ln DF_{t-1}$		
	t – stat :	(6.8)	(-4.84)	(6.29)		$R^2 = 0.70$
	se :	(0.89)	(0.68)	(0.08)		

Note ; **) The intercept is not significant at level 10%

4.1.1. Oil Palm Farmer Price

The estimation result in table 4.1(1) suggests that the CPO export tax and CPO world price affects significantly oil palm price received by farmer. From the estimated elasticity, an increase of 1% of CPO world price, farmer price will increase by 0.51%. However, the export tax rate negatively affect oil palm farmer price. Farmer price will decline by 0.1% with regard to 1% increase in export tax rate.

4.1.2. CPO Domestic (Consumer) Price

As presented in Table 4.1(2), CPO export tax and CPO world price significantly influence CPO domestic price. An increase in world price of 1% raises domestic price to 0.37%. CPO domestic price is negatively related to export tax, as expected. Increase in 1% export tax rate will decrease domestic price by 0.03 %.

The CPO world price elasticity of domestic price is larger than export tax elasticity, so that domestic price seems to be more affected by CPO world price rather than export tax it self. The substantial reduction in Indonesian CPO prices was the result from the world price reduction rather than the introduction of the export tax on CPO.

The effect of export tax on domestic price could be small because of some reasons. Export supply function upwardly shifts, following the increase in export tax, and then as result, world CPO price will rise up. Due to a positive correlation between CPO domestic and world price shown in table 4.1(2), the effectiveness of export tax can be small. Such effect may lead cooking oil price not seen significant decline to the targeted price. Beside that, cooking oil industry is oligopolistic in market structure, thus cooking oil price is determined by many cooking oil producers not by the free market.[9] This argument confirms Marks et

[9] Cooking oil industry as oligopoly structure has also been confirmed by Federation Peasant of Union (FSPI). The numbers of cooking oil (made of palm oil) companies in Indonesia were 106 (Large and Medium Manufacturing Statistics Volume II BPS, 2004) and they were mastered by limited number of group conglomerates, while CPO companies were about 300 which controlled by 30 largest business groups and oil palm plantation were about 880 large estates in 2003 (Jan Willem Van Gelder, 2004 ; BPS, 2006). The scheme of palm oil industry is shown in Appendix E.

al. (1998) and Hasan et al. (2001) that the fall of CPO domestic price does not directly pass to the consumers of cooking oil.

4.1.3. CPO Domestic Supply

The sign of coefficients in equation at table 4.1(3) are consistent with hypothesis. Domestic supply or production of CPO is negatively related to the export tax rate. CPO domestic (consumer) price have positive effect on the production significantly.

The result in Table 4.1(3) shows that the price elasticity of CPO domestic supply is 0.30. It means that increases in domestic price, for instance by 10%, will increase the CPO production by 3%. Thereby, production will not be so sensitive to the price factor. It may be due to the production of CPO is relatively fixed supply.

The result also shows that the elasticity of domestic supply of CPO with regards to change in export tax rate is 0.07. This means that, 1 percent increase in export tax rate will decrease domestic supply (production) of CPO by 0.07 percent. Susila (2004) also found a negative relation between export tax rate and domestic supply of CPO.

4.1.4. CPO Domestic Demand

The domestic demand equation in table 4.1(4) indicates that CPO export tax, domestic price and production not only have the expected signs, but also are statistically significant. An increase of 1% in export tax will increase domestic demand of CPO significantly by 0.21%. It implies that domestic demand is not so responsive to change in export tax.

The price elasticity of domestic demand is 0.55, i.e. when price increases by 1%, domestic demand will decrease by 0.55%. This indicates that a decrease of domestic demand is relatively small. This is consistent with the fact that CPO and its derived products are necessities for Indonesian people. The result also shows that 1% changes in domestic supply leads to more than 1% changes in domestic

demand (consumption). In this equation, domestic consumption of CPO is much more influenced by domestic supply of CPO than by domestic price.

The estimated domestic demand equation shows that a fall in CPO domestic price will reduce farmer's and CPO producer's revenue. It is due to the small price elasticity of domestic demand, where the price effect dominates the quantity demanded effect (Krugman & Wells, 2006).

4.1.5. Relative Price of CPO to Soya Oil in World Market

Finding presented in Table 4.1(5) shows that relative price of CPO world price to soya oil world price is affected significantly by CPO export tax and lagged of relative CPO price to soya oil. An increase 1% in export tax will increase relative price of CPO (Pw/Psoy) by 0.02%, *ceteris paribus*. It can be concluded that increase in export tax through export supply has effect to increase the CPO world price although the effect is relatively small. Even tough Indonesia's CPO has a big share in the world vegetable oil market, there are many competing substitutable commodities such as soybean oil and sunflower oil. This insignificant effect of Indonesian net export shares of world palm oil supply on the relative world price to export price is also found by Hasan et al. (2001).

4.1.6. CPO Foreign Demand

Equation in table 4.1(6) suggests that the ratio of world CPO price relative to soya oil price significantly influences the foreign demand of CPO. An increase of 1% in the relative price will decrease the quantity export demanded by 3.3%, holding other things constant. It suggests that world demand is relatively responsive to the change in the relative price of CPO. This also indicates that soya oil is a substitutable good for CPO in the international market. The reduction of foreign demand due to higher export tax will decrease Indonesia's market share in international market. It means that Indonesian CPO will lose its competitiveness.

The price elasticity of foreign demand (3.3) is higher than that of domestic demand (0.55) showing that palm oil in world market could be substituted easily

with soya oil. While in domestic market, CPO could not be easily changed by other products, in other words, CPO does not have perfectly substitute goods.

Increasing CPO export tax by 1% will negatively influence foreign demand through relative price of CPO by 0.07 %.[10]

4.2 Simulation Result of Distribution Welfare Effect

The measurement of welfare effect assumes that Indonesia is a large exporting country, because Indonesia has a large share in the world CPO export market. The Indonesian net shares of palm oil export in world market in 2006 were around 43% and world palm oil exports were about 55% of world vegetable oil. Therefore, Indonesian export palm oil represented around 23%, above 22% share of soybean oil, in the world vegetable oil market (USDA, 2008).

The hypothetical case of the impacts of CPO export tax policy on economic welfare in Indonesia summarized in Table 4.2 through estimating average values of domestic price, world price, supply, and demand variables for the period September 2000 to December 2006. The simulation of tax introduction takes into account, the fact that equation (3.2) to (3.4) and equation (3.5) to (3.6) are recursive systems with conditional expectation value in section 3.1. The welfare transfer effects in table 4.2 are estimated using formula (a) to (i) in figure 2.1. The simulated changes in price (ΔP), quantities produced (ΔSD) and consumed (ΔDD) are predicted by using initial export tax at 0 % and assumed increase in export tax to 3%, 5 % and 10% respectively, as modest scenario. Technique of computation can be seen in appendix D. [11]

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[10] The elasticity of foreign demand with respect to export tax = 0.07 can be derived by plugging estimation result of equation in table 4.1(5) to 4.1(6), the result is:
$LnDF_t = 6.34 - 0.07 Ln(FOB^*Tx)_t - 2.24\ Ln(Pw/Psoy)_{t-1} + 0.48\ LnDF_{t-1}$

[11] Under no export taxation, assume CPO domestic price is equal to the CPO world price. In the fact, there are differences in prices because of, for example, transportation cost and exchange rate factor.

Table 4.2. Estimation of the Impacts of CPO Export Tax, Large Country Case (Sept 2000-Dec 2006)

		Simulation Tax (Tx) = 0%	3%	5%	10%
		Initial condition	Estimated percentage changes due to export tax (%)		
CPO domestic (consumer) price		Rp. 3,224,846/ton	- 6.71	- 8.12	-10.01
Oil palm farmer price		Rp. 754,521/ton	-20.7	-24.65	-29.69
CPO domestic supply		695,335 ton	-14.9	-17.89	-21.78
CPO domestic demand		266,282 ton	33.27	42.08	54.97
CPO foreign demand		288,524 ton	-14.08	-16.93	-20.64
Welfare effects of export tax (Billion Rupiah)					
Loss in producer surplus	(a)		139.15	165.87	200.11
Gain in consumer surplus	(b)		67.15	84.44	109.63
Total export tax revenue :	(c) = (d) + (e)		166.61	151.64	118.20
- Paid by domestic producer	(d)		51.22	50.46	42.39
- Terms-of-trade gain	(e)		115.39	101.18	75.81
Domestic deadweight loss	(f) = (a)-(b)-(d)		20.78	30.97	48.09
Net gain for Indonesia	(g) = (e)-(f)		94.61	70.21	27.72
Loss opportunity in foreign exchange earning ((billion Rp) (h)			504.41	661.29	884.56
Deadweight loss in international market (billion Rp) (i)			46.82	62.1	86.01

When CPO export tax (Tx) increases from 0% to 10 %, CPO domestic price depress by 10.01% or reduce by Rp 322,959 / ton. An increase 5 % of export tax causes CPO price at average to be 8.12 % lower compared to that without export tax (Appendix D). Naturally, the lower CPO price has consequence to decrease the price of cooking oil, as observed by Susila (2004). [12] Therefore, this export tax may help to control the raising up of cooking oil price in domestic market.

The worst impact of this export tax policy is on smallholder farmers. If CPO export tax increase by 10%, farmers gate price of FFB of oil palm will drop largely by 29.69 % or Rp.224,060 / ton. If export tax increases by 5%, average farmer price will be 24.65% lower than no export tax scenario (Appendix D). Compared to CPO domestic price, oil palm price is reduced more due to an increase in export tax. This indicates that the burden of CPO export tax will be borne heavily by farmers rather than by CPO producers or processors. This

[12] Susila argued that an increase of a 1% effective CPO export tax will reduce 1.03% price of cooking oil.

finding confirms the finding by Susila (2004). The price of FFB is only about 1/6 of CPO price at average because oil palm fruit is raw material of CPO. Beside that, farmers have weak bargaining power to the CPO processor industry because the condition of limited infrastructure and difficult transportation compelled farmers to sell their product only to the nearest company (INDEF, 2007). When CPO domestic prices decline, the profit of companies also decline. In order to counteract the loss, the large company purchases FFB to the farmers with lower price. [13]

Decrease of CPO and FFB price induced by increase of CPO export tax becomes disincentive for farmers or labors working in palm oil sector. Indeed, production will decline. If government imposes export tax at 10 %, CPO production will reduce by 21.78% or 151,427 ton. When CPO export tax increases from 0% to 5%, the average estimation of domestic supply during period 2000-2006 falls by 17.89% (Appendix D).

The positive impact of export tax policy on domestic demand is significant. An increase 3% of the tax rate increases domestic consumption by around 33.27% or 88,594 ton. For example, if government increases CPO export tax by 5% then average domestic demand (consumption) will also increase by 42.08% (Appendix D). It is clear that export tax policy has benefited consumers.

On the other hand, if government imposes a 10 % tax rate, there will be a loss of foreign demand of around 20.64% or around 59,564 ton. It can be said that if an increase of 5% export tax will cause decrease average export demand by 16.93% (Appendix D). With declining foreign demand, the export supply is diverted to domestic market. This policy could be an effective instrument to control the availability of CPO in domestic market as raw material of cooking oil price.

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[13] Oil palm producers are divided by three groups: government group, private companies and smallholder (farmers) group. Government group (consists of 10 owned estates with area of oil palm plantations was around 632 thousand ha) sold their products to Joint Marketing Office. Ten conglomerates of private estates dominated oil palm plantations around 2.6 million ha. Smallholders, which have area 1.6 million ha, do not have any joint marketing associations and sold their products to large estate. Because of the perishable characteristic of the FFB and shortage of processing facilities of CPO Mills, smallholders seem to be price takers. (BPS, 2005 ; Chalil, 2008).

Table 4.2 also contains the estimation result regarding impacts of export tax policy on economic welfare distribution. There are four players in Indonesia economic welfare, i.e. CPO producer, domestic consumer, government and foreign consumer. There are welfare transfers from producers to consumers and government. If government increases export tax by 5 %, producer surplus will suffer a loss of about 165.87 billion rupiah per month or 1,990.49 billion rupiah per year, while consumer surplus will increase by around 84.44 billion per month or 1,013.28 billion rupiah per year. Producer's loss is greater than consumer's gain. It indicates that the impact of export tax is not so substantial for consumers but huge for producers. This small gain by CPO consumers is caused by the consumer price declines slightly. In order to achieve the targeted CPO domestic price of Rp. 5.5 million / ton, the price should be declined by around 20%.

The government collects total tax revenue from export tax of 5% as much as 151.64 billion rupiah/month or 1,819.71 billion rupiah/year. This tax revenue is partly at expense of domestic producers as 50.46 billion rupiah/month and international transfer from foreign consumers as 101.18 billion rupiah/month. The increase in export tax between 3% and 10% will reduce tax revenue from 166.61 billion to 118.2 billion rupiah per month or from 1,999.3 billion to 1,418.42 billion rupiah per year. [14] The tax revenue reduces due to the declining in quantity exported as foreign buyers shift their demand to competitor product. World price may increase due to upward shift of CPO export supply function, but the quantity effect dominates.

Part of production loss which is not transferred to anyone in the economy becomes welfare cost. This domestic deadweight efficiency loss is as much as around 30.97 billion rupiah per month or 371.66 billion rupiah per year, as a result of export tax at 5%.

When CPO world price increase due to export tax at level 5%, the foreign deadweight loss is 62.1 billion rupiah per month or 745.19 billion rupiah per year. This result that foreign efficiency loss is greater than domestic efficiency loss

[14] The impact of export tax on tax revenue is based upon the elasticity of foreign demand with respect to price.

indicates that foreign consumers bear burden of tax more heavily than Indonesian CPO producers.

Beside that, Indonesia loses a tremendous opportunity of getting foreign exchange earnings because of the fall in export quantity as much as 661.29 billion rupiah per month or 7,935.49 billion rupiah per year due to 5% of tax rate. It is likely to have an adverse impact on trade balance as export is discouraged.

From the result in table 4.2, the terms of trade gain is higher than domestic deadweight loss. This implies that international transfer from foreign consumers offsets the domestic efficiency loss. Thus, Indonesia's welfare is improved by the CPO export tax. As a whole, the impact of increase in export tax policy at 3%, 5% and 10% will bring a gain in Indonesia's welfare in one month of around 94.61 billion rupiah, 70.21 billion rupiah and 27.72 billion rupiah, respectively, compared to the case of zero export tax. It can be also assumed that if government imposes CPO export tax from 0% to 3%, 0% to 5%, and 0% to 10%, then in one year, net gain of welfare in Indonesia are around 1,135.35 billion rupiah, 842.50 billion rupiah, and 332.69 billion rupiah, respectively. This simulation result that the higher export tax, the lower gain of welfare is consistent to the finding by Wong (1978) that the gain of welfare in domestic country is necessarily positive at low rates of export tax but may turn negative at high rates.[15]

[15] The simulation shows that the welfare gain with 3% tax rate is greater than that with 5% or 10% tax rate. However, it can not be interpreted that 3% is the optimal tax rate. Such result is simply due to the linear specification of the equation.

CHAPTER 5
CONCLUSION AND POLICY IMPLICATION

In this paper, econometric analysis of trade model of one commodity was applied to evaluate the impacts of CPO export tax policy on economic welfare in Indonesia for period April 1998 – December 2005. The welfare effects of export tax cover various effects on domestic price, domestic supply, domestic demand and foreign demand and also farmer price. Simulation based on average data for the period September 2000 - December 2006 was used to identify the impacts of different export tax rates.

The estimation results confirm that the imposition of export tax has several impacts. An increase in export tax leads to a reduction in foreign demand for Indonesian CPO. When Indonesian CPO producers see a decrease in foreign demand, they switch their selling to domestic market. This policy may lead to a disadvantage to Indonesia through reducing CPO export share in world market. If the higher export tax is imposed, CPO domestic price will decline subsequently. There will be trade-off of benefits between consumer and producer of CPO. The consumers, mainly cooking oil producers, will gain and increase domestic demand (consumption) because there will be more domestic provision of CPO at lower price. On the contrary, CPO producers will be hurt, mainly small-holder farmers would suffer from this policy because of lower price of CPO and FFB. Lower price of CPO may become disincentive for domestic CPO production. Whether this policy would have further effect in lowering cooking oil prices will depend on cooking oil domestic market structure.

The simulation results based on large country assumption reveal that the introduction of export tax will generate the situation in which consumer's gain is smaller than producer's loss. This is because of the reduction in domestic CPO price has not been so substantial. This, again, may be related to the CPO market structure in Indonesia. From the simulation of 3% to 10%, the higher the CPO export tax may induce government revenue decrease. Because of imposition of CPO export tax, there will be welfare transfer from CPO producers to consumers

and to government and will create efficiency loss both in domestic and international market. Based on the size of the deadweight loss, foreign market loss is larger than that in Indonesia. The simulation also shows that Indonesia's welfare will be improved with a net gain. However, the higher export tax, the lower net gain in welfare to Indonesia would be. Further, the loss in foreign exchange is large enough and this may lead to problem in the trade balance.

The CPO export tax policy would be effective to guarantee CPO domestic provision and it seems that this policy instrument could help lowering the CPO domestic price, but such effect would not be so significant to decline CPO and cooking oil price. The result also shows that the CPO domestic price will be influenced by external shock such as increase in world price. Moreover, if simultaneously CPO export tax and world demand increases (for example due to demand of biofuel energy), CPO world price will increase substantially. This high world price will set the big constraints on the role of export tax policy to control the price of domestic CPO and cooking oil. A substantial reduction in CPO domestic price would be possible through a higher export tax rate. Imposing a high tax rate in this context would not be good when considering the decrease in welfare gain. On the other, a relatively small tax rate, while effective to increase domestic availability, would not be so effective to reduce domestic price. Based on the result that higher export tax implies the decrease in tax revenue, the goal of CPO export tax will not be effective to increase government revenue.

To avoid loss in producer surplus, low revenue and loss in foreign exchange earnings, government should impose as small as possible export tax rate. There might be an optimal tax rate which could maximize the net welfare gain. Finding this optimal rate is beyond the scope of this paper, so further research is worthwhile to consider this level of export tax.

Even tough export tax could guarantee the availability of CPO in domestic, CPO smuggling to the world market may happen and could intensify the larger disparity between CPO domestic and world price. Thereby, extension of trade control by government is indispensable.

To protect the cooking oil consumers from the high price, government should pay more clear attention to the oligopolistics market structure of domestic palm oil, so that palm oil sector will not be dominated by some players. Government could provide incentive, through investment policy or infrastructure support, for the development of downstream industry of CPO such as cooking oil industry as essential commodity and other derivative products (bio fuel, margarine, soap, etc). When the government needs to use the export tax instrument, it is recommended to keep export tax at low rate in order to encourage investors opening palm oil industry. The development of this industry is also necessary to absorb CPO for domestic need. With the development of downstream industry, there can be integration between upstream sector of CPO and downstream sector and of course, can create opportunity job. In addition, government can implement subsidization policy for poor people such as direct payment transfer or with giving cooking oil coupon. To realize this policy, good management, accurate data and the optimal usage of tax revenue distribution are very expected.

There might be alternative policies to overcome the loss of CPO producers and farmers. The government could impose tax exemption for producers and subsidization for farmers. With value added tax free, the CPO price would decline and pass on the cooking oil price bringing down.

Finally, some qualifications should be pointed especially regarding to utilization of the most classical type of welfare's calculation such as simply adding the producer surplus and the consumer surplus. Further work with considering other variables and market structure of cooking oil industry is necessary to improve the model and to acquire the best result.

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Appendix A. Correlation Matrix Between Variables

	LN FOB	LN TX	LN PW
LN FOB	1.000000	0.529439	0.960226
LN TX	0.529439	1.000000	0.486235
LN PW	0.960226	0.486235	1.000000

	LNDD	LNDF	LNSD	LNPD	LNPF	LN(FOB*Tx)	LNPW	LN(PW/PSOY)
LNDD	1.000000	-0.107097	0.493893	0.289489	0.229181	0.031295	0.183835	-0.041647
LNDF	-0.107097	1.000000	0.684527	0.050411	0.453835	-0.815158	-0.323399	-0.743171
LNSD	0.493893	0.684527	1.000000	0.406982	0.652075	-0.558559	0.049719	-0.552036
LNPD	0.289489	0.050411	0.406982	1.000000	0.611532	0.334244	0.838033	0.147671
LNPF	0.229181	0.453835	0.652075	0.611532	1.000000	-0.278803	0.434033	-0.263862
LN(FOB*Tx)	0.031295	-0.815158	-0.558559	0.334244	-0.278803	1.000000	0.639073	0.832606
LNPW	0.183835	-0.323399	0.049719	0.838033	0.434033	0.639073	1.000000	0.420947
LN(PW/PSOY)	-0.041647	-0.743171	-0.552036	0.147671	-0.263862	0.832606	0.420947	1.000000

Note : correlation between CPO export tax (FOB.Tx) and CPO world price (PW) =0.6 is not strong , also CPO export tax (FOB.Tx) and CPO consumer price (PD) = 0.3 has weak correlation, while CPO export tax (FOB.Tx) and relative world price (PW/Psoy) has strong correlation = 0.8. It confirms Gujarati (2003), Nachrowi & Usman (2006) that the strong correlation is more than 0.8

Appendix B1. Lagrange Multiplier Test for Serial Autocorrelation in Domestic Price (Ln PD) equation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.042390	Prob. F(1,87)	0.837359
Obs*R-squared	0.044804	Prob. Chi-Square(1)	0.832364

Appendix B2. Lagrange Multiplier Test for Serial Autocorrelation in Domestic Supply (Ln SD) equation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.987178	Prob. F(1,87)	0.162201
Obs*R-squared	2.054457	Prob. Chi-Square(1)	0.151761

Appendix B3. Lagrange Multiplier Test for Serial Autocorrelation in Ratio of CPO World Price to Soya Oil World Price (Ln PW/Psoy) equation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.047733	Prob. F(1,88)	0.155975
Obs*R-squared	2.092128	Prob. Chi-Square(1)	0.148060

Appendix B4. Lagrange Multiplier Test for Serial Autocorrelation in Foreign Demand (Ln DF) equation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.176310	Prob. F(1,88)	0.675587
Obs*R-squared	0.183956	Prob. Chi-Square(1)	0.667995

(Lanjutan)

Appendix B5. Lagrange Multiplier Test for Serial Autocorrelation in Farmer Price (Ln PF) Equation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	6.684002	Prob. F(1,87)	0.011393
Obs*R-squared	6.563855	Prob. Chi-Square(1)	0.010407

Appendix B6. ADF Test Result for Cointegration Test for Farmer Price (Ln PF) equation

Null Hypothesis: ECMPF has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.685128	0.0000
Test critical values:	1% level	-3.504727	
	5% level	-2.89956	
	10% level	-2.584126	

Note :

Equation in table 4.1(1) contains serial correlation between error (shown by LM test in appendix B5) and the regression of non-stationary time series variables may result a spurious regression. Its estimation will give misleading result of interpretation. Co-integration test is a method to examine whether the equation is spurious regression or not by using Engel-Granger test or ADF test (Gujarati, 2003; Nachrowi & Usman, 2006). Using ADF test, the Engle-Granger value is -7.68 and significant at level 1 percent and it can be concluded that the residuals from regression of equation in table 4.1(1) are stationary. It means the equation is co-integration regression, in other words, all variables are co-integrated or they have a long-run equilibrium. Thereby, a regression of farmer price would be meaningful (not *spurious regression*) and the equation in table 4.1 (1) can be an estimator.

Appendix C. Regression Result for CPO Domestic Price (LNPD), Farmer Price (LNPF), Domestic Supply (LNSD), Domestic Demand (LNDD), Relative World Price of CPO to Soya Oil (LNPW/Psoy), and Foreign Demand (LNDF) Equation

Dependent Variable: LNPD
Method: Least Squares
Date: 01/28/08 Time: 21:47
Sample (adjusted): 1998M05 2005M12
Included observations: 92 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.177969	0.739165	4.299406	0.0000
LNPW	0.368910	0.078735	4.685474	0.0000
LN*(FOB*Tx)*	-0.033932	0.010404	-3.261386	0.0016
LNPD(-1)	0.645183	0.072682	8.876787	0.0000

R-squared	0.881367	Mean dependent var	14.91736
Adjusted R-squared	0.877323	S.D. dependent var	0.247922
S.E. of regression	0.086835	Akaike info criterion	-2.007100
Sum squared resid	0.663554	Schwarz criterion	-1.897457
Log likelihood	96.32661	F-statistic	217.9287
Durbin-Watson stat	1.947330	Prob(F-statistic)	0.000000

Dependent Variable: LNPF
Method: Least Squares
Date: 01/28/08 Time: 17:26
Sample (adjusted): 1998M05 2005M12
Included observations: 92 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.207665	0.473596	4.661497	0.0000
LN*(FOB*Tx)*	-0.095182	0.015905	-5.984251	0.0000
LNPW	0.511230	0.075695	6.753835	0.0000
LNPF(-1)	0.621020	0.053791	11.54511	0.0000

R-squared	0.901265	Mean dependent var	13.17220
Adjusted R-squared	0.897899	S.D. dependent var	0.303141
S.E. of regression	0.096863	Akaike info criterion	-1.788525
Sum squared resid	0.825661	Schwarz criterion	-1.678883
Log likelihood	86.27217	F-statistic	267.7576
Durbin-Watson stat	1.481119	Prob(F-statistic)	0.000000

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Dependent Variable: LNSD
Method: Least Squares
Date: 01/28/08 Time: 21:52
Sample (adjusted): 1998M05 2005M12
Included observations: 92 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.397345	0.812820	0.488847	0.6262
LNPD	0.302308	0.079283	3.813037	0.0003
LN*(FOB*Tx)*	-0.070356	0.017835	-3.944897	0.0002
LNSD(-1)	0.643640	0.076238	8.442525	0.0000

R-squared	0.836331	Mean dependent var	13.17663
Adjusted R-squared	0.830751	S.D. dependent var	0.292564
S.E. of regression	0.120361	Akaike info criterion	-1.354145
Sum squared resid	1.274826	Schwarz criterion	-1.244502
Log likelihood	66.29068	F-statistic	149.8899
Durbin-Watson stat	2.190346	Prob(F-statistic)	0.000000

Dependent Variable: LNDD
Method: Least Squares
Date: 01/31/08 Time: 22:18
Sample: 1998M04 2005M12
Included observations: 93

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.461672	1.604584	2.780579	0.0066
LNPD	-0.554184	0.164509	-3.368724	0.0011
LN(FOB*Tx)	0.208119	0.036756	5.662190	0.0000
LNSD	1.206848	0.157438	7.665566	0.0000

R-squared	0.451059	Mean dependent var	12.70304
Adjusted R-squared	0.432555	S.D. dependent var	0.317536
S.E. of regression	0.239197	Akaike info criterion	0.018997
Sum squared resid	5.092141	Schwarz criterion	0.127926
Log likelihood	3.116617	F-statistic	24.37676
Durbin-Watson stat	2.001179	Prob(F-statistic)	0.000000

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Dependent Variable: LNPw/Psoy
Method: Least Squares
Date: 02/01/08 Time: 18:17
Sample (adjusted): 1998M05 2005M12
Included observations: 92 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.090384	0.023800	-3.797656	0.0003
LN(FOB*Tx)	0.024974	0.006907	3.615587	0.0005
LNPw/Psoy(-1)	0.675590	0.074145	9.111773	0.0000

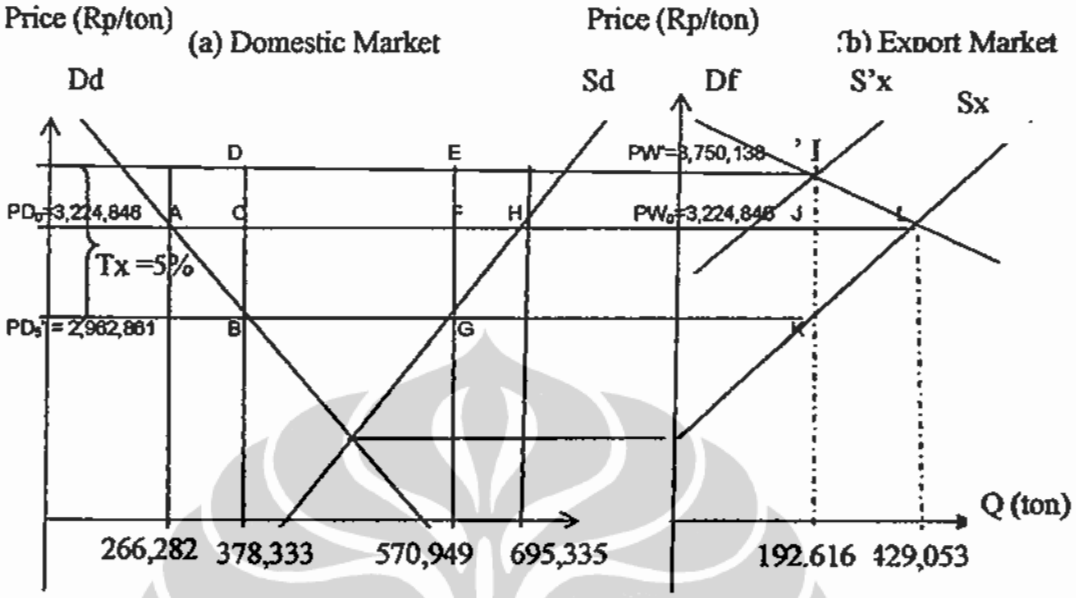
R-squared	0.839784	Mean dependent var	-0.052121
Adjusted R-squared	0.836183	S.D. dependent var	0.110546
S.E. of regression	0.044743	Akaike info criterion	-3.343706
Sum squared resid	0.178171	Schwarz criterion	-3.261474
Log likelihood	156.8105	F-statistic	233.2493
Durbin-Watson stat	1.767362	Prob(F-statistic)	0.000000

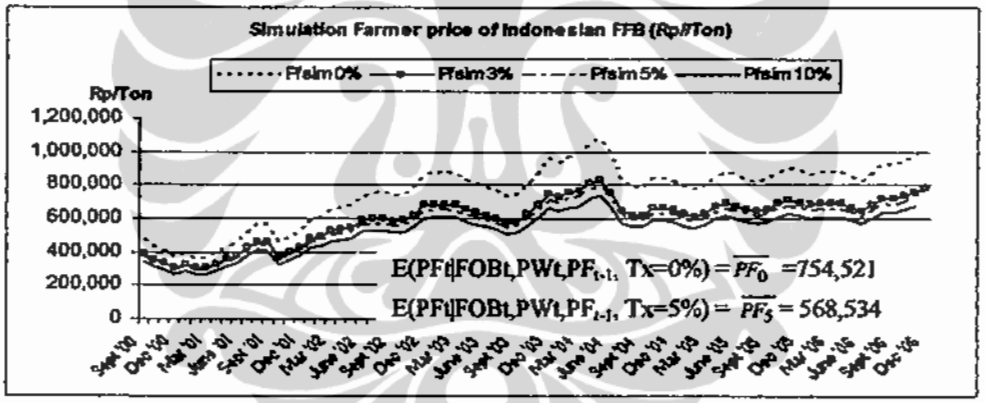
Dependent Variable: LNDF
Method: Least Squares
Date: 02/01/08 Time: 11:11
Sample (adjusted): 1998M05 2005M12
Included observations: 92 after adjustments

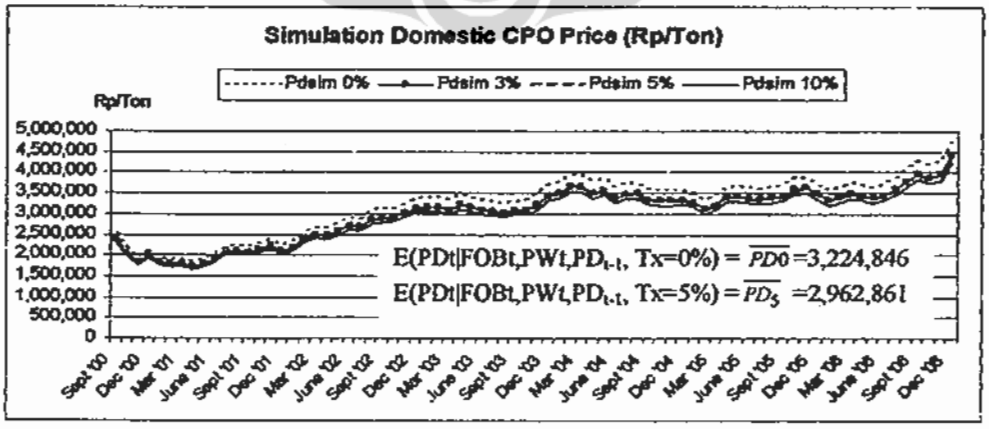
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.038406	0.888433	6.796692	0.0000
LNPw/Psoy	-3.295525	0.680150	-4.845291	0.0000
LNDF(-1)	0.481971	0.076584	6.293378	0.0000

R-squared	0.698052	Mean dependent var	11.94459
Adjusted R-squared	0.691267	S.D. dependent var	0.924895
S.E. of regression	0.513907	Akaike info criterion	1.538515
Sum squared resid	23.50490	Schwarz criterion	1.620747
Log likelihood	-67.77168	F-statistic	102.8764
Durbin-Watson stat	1.912582	Prob(F-statistic)	0.000000

Appendix D. Chart of Simulation Result of CPO Export Tax (Tx) Impact for Period September 2000 – December 2006







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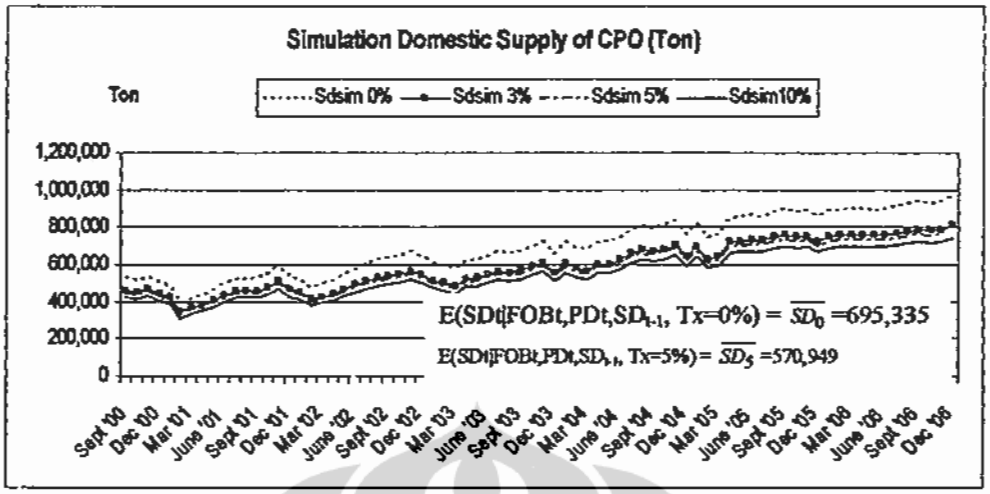
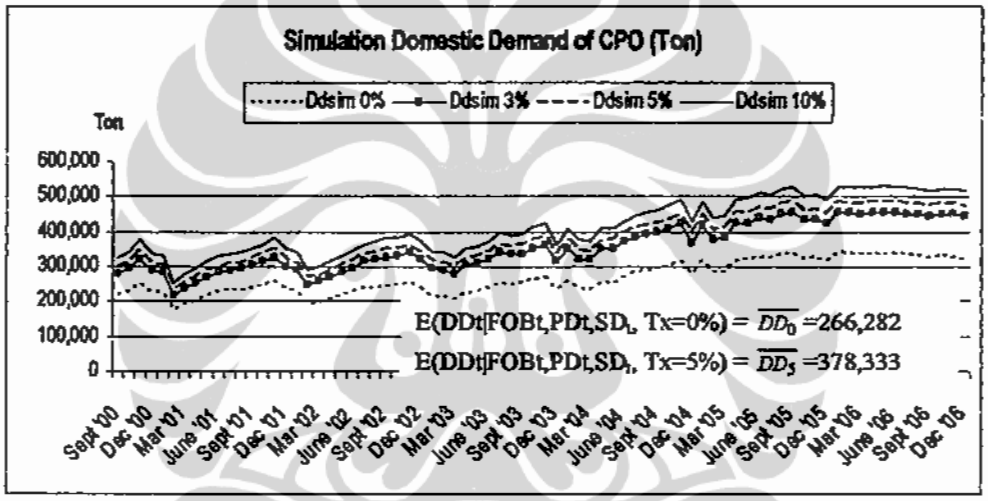
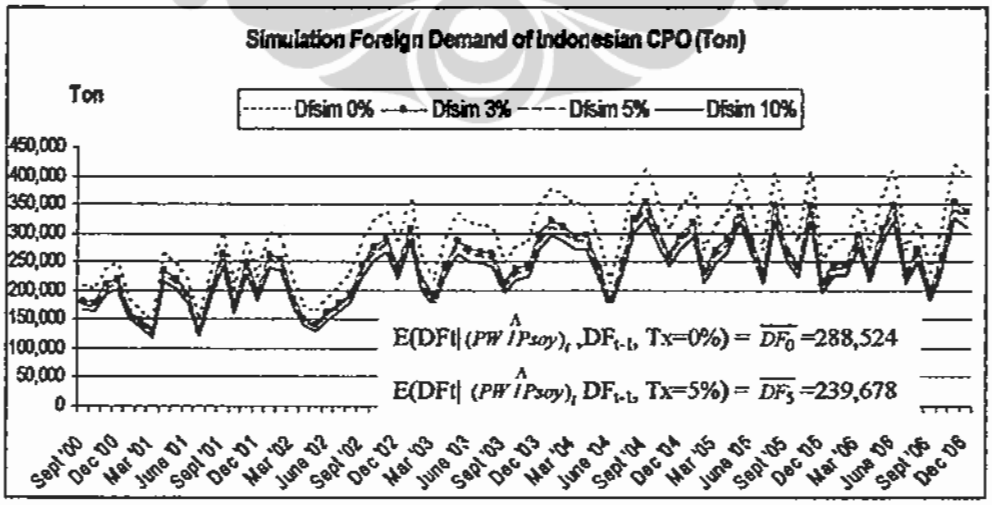
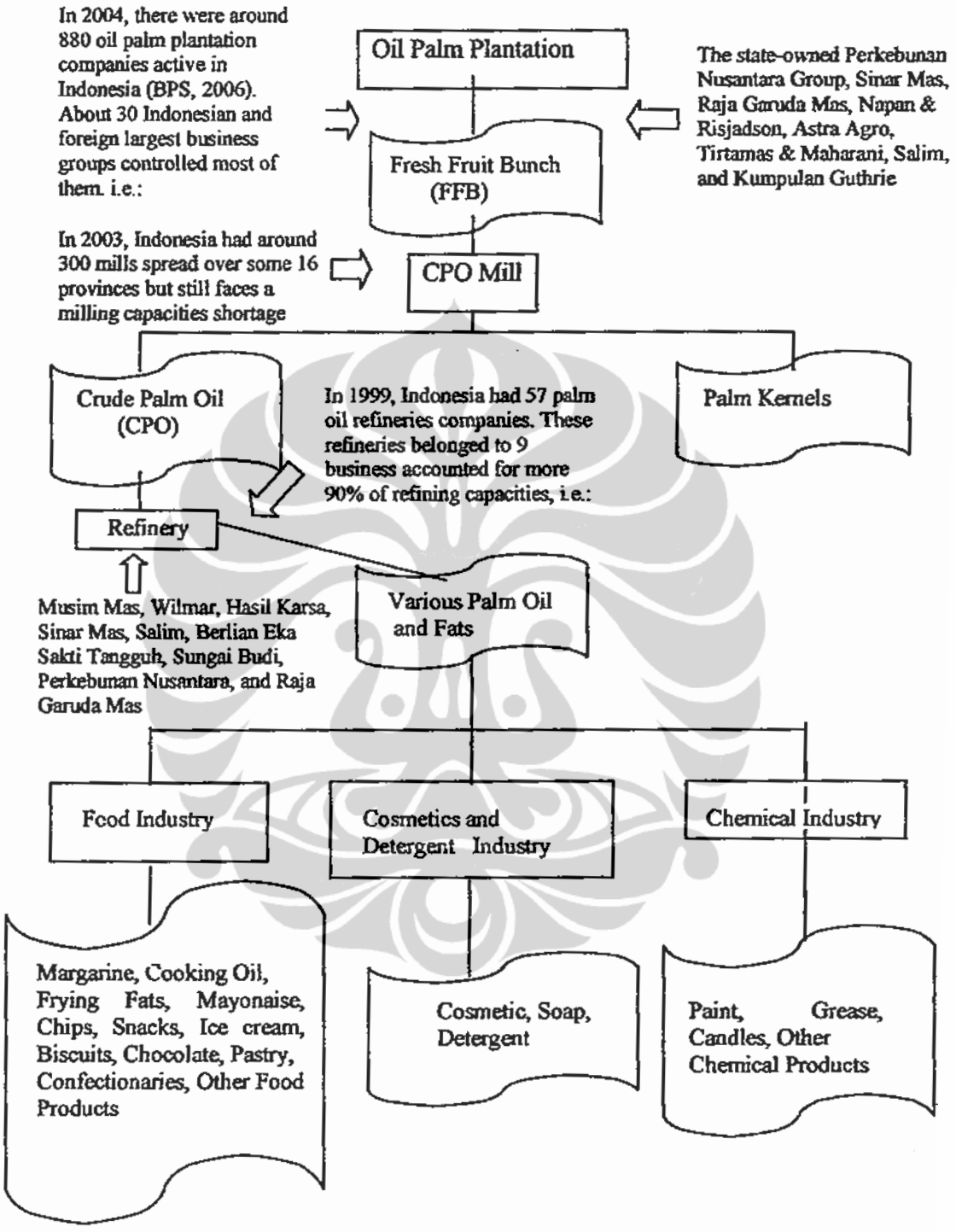






Appendix E. Diagram of Oil Palm Production Chain



Source : Jan Willem Van Gelder, 2004.

Appendix F. Data of Indonesian Crude Palm Oil (April 1998 –December 2006)

No	Month	Foreign Demand (Ton) DF	Domestic Supply (ton) SD	Domestic Demand (ton) DD	Export Tax (%) Tx	Export Price (US$/ton) FOB	World Price (US$/ton) PW	Soya Oil World Price (US$/ton) Psoy	Domestic Price (Rp/ton) PD	Farmer Price (Rp/Ton) PF
1	Apr '98	5,560.00	363,846.00	358,286.00	40	585.04	699.38	640.00	3,575,000.00	281,335.56
2	May '98	106,606.67	361,284.00	254,677.33	40	592.11	723.75	651.00	4,250,000.00	301,575.53
3	June '98	56,080.69	377,597.00	321,516.31	40	503.85	620.00	601.00	4,950,000.00	350,961.05
4	July '98	122,750.00	380,402.00	257,652.00	60	513.41	660.00	581.00	4,450,000.00	382,535.41
5	August '98	27,686.88	412,199.00	384,512.12	60	555.13	676.88	584.00	4,450,000.00	467,911.64
6	Sept '98	10,499.55	441,420.00	430,920.45	60	551.03	680.00	605.00	4,450,000.00	528,631.55
7	Oct '98	9,560.88	459,861.00	450,300.12	60	586.47	710.00	592.00	3,825,000.00	546,479.15
8	Nov '98	55,741.50	440,828.00	385,086.50	60	559.95	710.00	593.00	4,300,000.00	493,045.63
9	Dec '98	9,357.24	468,943.00	459,585.76	60	535.05	710.00	567.00	3,000,000.00	513,589.20
10	Jan '99	15,697.26	237,961.00	222,263.75	60	572.49	605.00	524.00	3,005,000.00	488,500.00
11	Feb '99	24,740.00	314,005.00	289,265.00	40	559.27	563.75	459.00	3,505,000.00	563,800.00
12	Mar '99	23,113.04	346,952.00	323,838.96	40	461.76	503.75	410.00	3,200,000.00	568,100.00
13	Apr '99	22,406.63	375,915.00	353,508.37	40	442.18	510.63	423.00	3,150,000.00	567,800.00
14	May '99	37,491.35	420,512.00	383,020.65	40	429.39	476.25	407.00	3,150,000.00	523,200.00
15	June '99	20,630.00	422,022.00	401,392.00	30	377.59	411.88	374.00	2,565,000.00	345,600.00
16	July '99	95,669.10	449,829.00	354,159.90	10	306.36	308.75	355.00	1,975,000.00	261,500.00
17	August '99	173,207.96	451,431.00	278,223.04	10	267.36	350.00	380.00	2,825,000.00	306,200.00
18	Sept '99	171,802.90	465,881.00	294,078.10	10	266.61	384.38	389.00	3,200,000.00	469,400.00
19	Oct '99	135,110.52	504,051.00	368,940.48	10	283.92	388.13	373.00	3,200,000.00	513,900.00
20	Nov '99	63,559.00	447,272.00	383,713.00	10	303.36	381.88	364.00	2,973,000.00	352,500.00
21	Dec '99	81,998.85	471,948.00	389,949.15	10	288.20	376.25	355.00	3,003,000.00	402,400.00

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No	Month	Foreign Demand (Ton)	Domestic Supply (ton)	Domestic Demand (ton)	Export Tax (%)	Export Price (US$/ton)	World Price (US$/ton)	Soya Oil World Price (US$/ton)	Domestic Price (Rp/ton)	Farmer Price (Rp/Ton)
22	Jan '00	65,534.96	254,430.00	188,895.04	10	304.02	368.75	366.00	2,830,000.00	400,000.00
23	Feb '00	83,369.74	339,998.00	256,628.26	10	289.68	329.38	345.00	2,830,000.00	404,200.00
24	Mar '00	145,875.26	355,079.00	209,203.74	10	273.55	353.13	338.00	2,175,000.00	427,300.00
25	Apr '00	143,274.33	390,766.00	247,491.67	10	294.01	368.33	353.00	2,175,000.00	459,600.00
26	May '00	83,967.00	419,931.00	335,964.00	10	278.95	324.38	309.00	2,350,000.00	529,600.00
27	June '00	162,833.02	441,998.00	279,164.98	10	282.29	310.63	297.00	2,375,000.00	400,000.00
28	July '00	192,627.04	451,620.00	258,992.96	10	273.24	309.38	297.00	2,375,000.00	384,600.00
29	August '00	256,591.58	472,228.00	215,636.42	10	266.01	310.00	300.00	2,680,000.00	380,400.00
30	Sept '00	202,414.43	485,025.00	282,610.57	5	255.30	286.88	288.00	3,199,689.66	362,500.00
31	Oct '00	186,694.15	542,307.00	355,612.86	5	236.32	249.38	274.00	2,278,000.00	325,400.00
32	Nov '00	188,700.77	476,049.00	287,348.23	5	217.90	256.25	287.00	1,877,000.00	278,800.00
33	Dec '00	105,782.10	465,424.00	359,641.90	5	218.77	260.00	288.00	2,139,000.00	300,200.00
34	Jan '01	102,566.26	330,704.00	228,137.74	5	207.62	256.30	273.00	1,860,000.00	290,800.00
35	Feb '01	60,823.00	372,218.00	311,395.00	5	194.51	240.60	270.00	1,883,000.00	280,000.00
36	Mar '01	165,367.97	399,930.00	234,562.03	3	196.05	250.00	296.00	1,838,000.00	323,100.00
37	Apr '01	150,913.48	438,530.00	287,616.53	3	197.44	241.30	282.00	1,791,000.00	396,900.00
38	May '01	109,956.36	467,890.00	357,933.64	3	194.91	224.40	267.00	1,955,000.00	393,000.00
39	June '01	64,153.98	491,055.00	426,901.02	3	204.63	253.10	283.00	2,029,000.00	388,000.00
40	July '01	197,913.25	493,348.00	295,434.75	3	209.09	325.50	348.00	2,032,000.00	464,400.00
41	August '01	223,070.84	506,854.00	283,783.16	3	220.25	316.10	372.00	2,090,000.00	486,400.00
42	Sept '01	137,415.52	528,169.00	390,753.48	3	244.16	302.00	330.00	2,077,000.00	378,400.00
43	Oct '01	211,468.47	576,140.00	364,671.53	3	254.77	265.10	307.00	2,365,000.00	360,800.00
44	Nov '01	158,158.86	508,871.00	350,712.14	3	229.20	315.40	351.00	2,283,000.00	410,800.00

(Lanjutan)

No	Month	Foreign Demand (Ton)	Domestic Supply (ton)	Domestic Demand (ton)	Export Tax (%)	Export Price (US$/ton)	World Price (US$/ton)	Soya Oil World Price (US$/ton)	Domestic Price (Rp/ton)	Farmer Price (Rp/Ton)
45	Dec '01	267,334.16	484,731.00	217,396.84	3	233.11	318.30	359.00	2,081,000.00	480,000.00
46	Jan '02	303,240.61	404,814.00	101,573.39	3	255.55	330.20	358.00	2,163,000.00	510,000.00
47	Feb '02	212,218.49	419,766.00	207,547.51	3	259.67	324.40	332.00	2,501,000.00	560,500.00
48	Mar '02	171,389.29	445,152.00	273,762.71	3	277.11	334.60	326.00	2,637,000.00	560,900.00
49	Apr '02	143,497.50	480,633.00	337,135.50	3	282.00	347.30	340.00	2,553,000.00	549,600.00
50	May '02	167,964.91	508,620.00	340,655.09	3	289.66	369.70	374.00	2,647,000.00	572,000.00
51	June '02	211,260.73	539,085.00	327,824.27	3	298.08	416.00	420.00	2,662,000.00	604,800.00
52	July '02	208,759.31	557,982.00	349,222.69	3	321.40	404.80	427.00	2,665,000.00	584,400.00
53	August '02	269,594.14	572,893.00	303,298.86	3	349.11	427.60	473.00	2,885,000.00	584,200.00
54	Sept '02	286,441.22	582,005.00	295,563.78	3	356.79	409.00	469.00	3,009,000.00	598,400.00
55	Oct '02	298,086.02	607,260.00	309,173.98	3	351.74	403.70	470.00	3,047,000.00	613,800.00
56	Nov '02	170,829.92	565,041.00	394,211.08	3	352.43	439.40	530.00	3,064,000.00	686,900.00
57	Dec '02	361,510.11	512,354.00	150,843.89	3	363.33	460.00	529.00	3,158,000.00	694,000.00
58	Jan '03	234,160.08	497,035.00	262,874.93	3	356.42	455.00	493.00	3,256,000.00	712,000.00
59	Feb '03	163,832.48	471,580.00	307,747.52	3	387.73	452.00	494.00	3,271,000.00	732,700.00
60	Mar '03	243,502.17	527,364.00	283,861.83	3	371.28	429.50	485.00	3,241,000.00	702,800.00
61	Apr '03	287,379.69	539,821.00	252,441.31	3	373.22	417.00	488.00	3,504,000.00	670,000.00
62	May '03	246,902.66	567,236.00	320,333.34	3	368.51	421.50	498.00	3,409,000.00	620,000.00
63	June '03	257,905.61	604,698.00	346,792.39	3	353.58	432.00	502.00	3,243,000.00	609,200.00
64	July '03	245,837.74	595,399.00	349,561.26	3	376.56	422.80	493.00	3,215,000.00	585,900.00
65	August '03	170,501.96	607,479.00	436,977.04	3	359.18	402.50	460.00	3,266,000.00	554,000.00
66	Sept '03	201,671.59	644,488.00	442,816.41	3	342.59	436.50	505.00	3,188,000.00	573,200.00
67	Oct '03	185,701.08	667,697.00	481,995.92	3	349.66	488.70	582.00	3,007,000.00	647,400.00

(Lanjutan)

No	Month	Foreign Demand (Ton)	Domestic Supply (ton)	Domestic Demand (ton)	Export Tax (%)	Export Price (US$/ton)	World Price (US$/ton)	Soya Oil World Price (US$/ton)	Domestic Price (Rp/ton)	Farmer Price (Rp/Ton)
68	Nov '03	295,209.16	557,140.00	261,930.84	3	370.15	501.70	593.00	3,160,000.00	744,300.00
69	Dec '03	359,526.06	643,573.00	284,046.94	3	384.62	512.10	603.00	3,472,000.00	730,200.00
70	Jan '04	276,292.93	584,248.00	307,955.07	3	406.13	497.36	609.00	3,620,000.00	725,600.00
71	Feb '04	261,469.77	567,308.00	305,838.23	3	399.88	535.25	651.00	3,738,000.00	733,600.00
72	Mar '04	356,438.42	637,024.00	280,585.58	3	432.56	552.52	628.00	3,667,000.00	824,200.00
73	Apr '04	233,605.38	634,668.00	401,062.62	3	409.78	537.50	612.00	3,449,000.00	883,500.00
74	May '04	171,763.13	681,140.00	509,376.87	3	463.87	527.43	563.00	3,663,000.00	869,400.00
75	June '04	265,256.24	731,010.00	465,753.76	3	416.25	440.61	494.00	3,674,000.00	668,800.00
76	July '04	351,927.24	753,658.00	401,730.76	3	350.33	431.51	510.00	3,875,000.00	621,700.00
77	August '04	448,687.04	760,491.00	311,803.96	3	358.89	433.68	506.00	3,877,000.00	609,400.00
78	Sept '04	413,388.50	783,237.00	369,848.50	3	356.52	442.00	493.00	3,597,000.00	690,400.00
79	Oct '04	300,944.00	827,712.00	526,768.00	3	359.79	431.31	479.00	3,607,000.00	683,800.00
80	Nov '04	382,975.70	703,831.00	320,855.30	3	346.58	433.18	481.00	3,584,000.00	682,400.00
81	Dec '04	357,178.28	814,935.00	457,756.73	3	321.84	423.88	496.00	3,668,000.00	667,300.00
82	Jan '05	213,702.28	705,358.00	491,655.72	3	349.10	401.20	454.00	3,668,000.00	640,700.00
83	Feb '05	330,103.26	720,624.00	390,520.74	3	335.45	400.75	442.00	3,397,500.00	628,900.00
84	Mar '05	327,778.56	836,404.00	508,625.45	3	337.21	434.68	495.00	3,387,500.00	714,300.00
85	Apr '05	452,746.35	842,125.00	389,378.65	3	344.85	423.35	488.00	3,786,500.00	761,000.00
86	May '05	359,294.90	867,128.00	507,833.10	3	340.16	415.05	465.00	3,874,400.00	745,500.00
87	June '05	225,415.71	857,299.00	631,883.29	3	356.35	411.85	461.00	3,803,400.00	704,100.00
88	July '05	537,640.06	897,370.00	359,729.94	3	349.55	414.70	462.00	3,763,200.00	696,700.00
89	August '05	319,695.80	909,612.00	589,916.20	3	355.03	404.70	451.00	3,854,300.00	703,400.00
90	Sept '05	288,464.58	863,043.00	574,578.42	3	355.79	418.85	455.00	3,872,300.00	719,300.00

(Lanjutan)

No	Month	Foreign Demand (Ton)	Domestic Supply (ton)	Domestic Demand (ton)	Export Tax (%)	Export Price (US$/ton)	World Price (US$/ton)	Soya Oil World Price (US$/ton)	Domestic Price (Rp/ton)	Farmer Price (Rp/Ton)
91	Oct '05	767,030.95	874,940.00	107,909.05	1.5	353.93	443.84	459.00	4,020,700.00	751,800.00
92	Nov '05	331,938.85	837,853.00	505,914.15	1.5	357.63	444.85	442.00	4,057,500.00	751,100.00
93	Dec '05	410,313.36	907,305.00	496,991.64	1.5	350.97	429.00	433.00	3,903,200.00	742,000.00
94	Jan '06	370,783.52	686,551.00	315,767.48	1.5	349.11	413.73	428.00	3,685,200.00	730,300.00
95	Feb '06	511,052.81	692,330.00	181,277.19	1.5	348.84	436.10	458.00	3,714,500.00	731,000.00
96	Mar '06	305,461.34	756,413.00	450,951.67	1.5	356.18	438.20	461.00	3,865,500.00	734,300.00
97	Apr '06	542,342.05	847,944.00	305,601.95	1.5	363.44	435.20	459.00	3,799,100.00	695,300.00
98	May '06	535,460.77	961,820.00	426,359.23	1.5	369.78	436.18	488.00	3,721,900.00	665,500.00
99	June '06	251,621.76	1,126,101.00	874,479.24	1.5	371.35	429.93	470.00	3,823,200.00	682,500.00
100	July '06	397,355.62	974,564.00	577,208.38	1.5	375.09	465.83	498.00	3,934,500.00	695,000.00
101	August '06	288,603.34	970,925.00	682,321.66	1.5	391.55	512.33	509.00	4,015,000.00	711,200.00
102	Sept '06	433,893.72	1,016,366.00	582,472.28	1.5	395.73	503.63	517.00	4,392,900.00	732,900.00
103	Oct '06	680,409.76	1,009,988.00	329,578.24	1.5	401.04	505.60	542.00	4,197,100.00	740,000.00
104	Nov '06	393,990.29	921,406.00	527,415.72	1.5	426.32	532.65	629.00	4,241,800.00	744,300.00
105	Dec '06	488,311.90	904,957.00	416,645.10	1.5	438.28	574.35	665.00	4,793,500.00	885,500.00

Source : BPS, Statistics Indonesia, Bank of Indonesia, Ministry of Finance, PT. Smart TBK, Oil World publication from various issues

Note : Production and consumption in year 2006 are preliminary figures