Market power and subsidies in the Indonesian palm oil industry[1]

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Abstract

Cooking oil is known as an essential commodity in Indonesia. Having such an important role, the Indonesian government often interfered the cooking oil market to assure its price remain low. To do so, the government uses a subsidy policy as one of its instruments. A dynamic duopoly model is applied to evaluate the impact of subsidies given the structure of the industry. Estimation results suggest an evidence of both an increase in the consumer surplus but a decrease in aggregate welfare due to market power. A possible reason is proposed, but, in order to obtain a clear explanation, further research is required.

Keywords: market power, subsidy, Indonesian palm oil industry

1. Introduction

Palm oil industry is known as an important industry in the Indonesian economic, hence there has been a high degree of government interventions in this industry. The main purpose of these interventions has been to ensure that the cooking oil price remains stable. To do so, subsidies are imposed either in the upstream industry, the Crude Palm Oil (CPO) industry, or in the downstream industry, the cooking oil industry. Subsidies were given when the domestic market price significantly increased as the demand increased, such during festive seasons. Usually the amount of subsidies was about 25 to 30 per cent of the market price. CPO subsidy was distributed to the cooking oil refineries, while the cooking oil subsidy was either indirectly distributed to the end consumer through retail distributor directed by the government, or directly distributed to a target

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group—people that were considered poor—through market operations arranged by the government or private companies.

The subsidies expenses could either guarantee by the government or CPO and cooking oil producers. Who and how much of the subsidies should be guaranteed by each of them have been a long debate. On one hand, producers argue that subsidies increase their cost of production, hence decrease their profits. On the other hand, the structural conditions of the industry raise concern about the existence of market power. With market power, producers enjoy supra rather than normal profit; hence subsidies would not really decrease their profit. To analyse such possibilities, this paper is designed to measure market power and the impact of subsidies to the Indonesian palm oil industry. .

This paper is organised as follows. In the next section, the Indonesian palm oil industry will be described. Then the model will be introduced in section 3. Section 4 shows the data and procedures used in estimating the model, followed by the analysis of the results. Finally, it will be concluded in section 5.

2. Overview of the palm oil industry

The palm oil industry is a fresh fruit bunches (output from the oil palm/ *Elais guineensis sp*. tree) based industry which produces a huge range of commodities. Among the various commodities, cooking oil—which is an essential commodity in Indonesia— appears to be the most important one to the Indonesian economic sector. From 1993 to 2003, on average, the cooking oil industry accounted for 75 per cent of palm oil usage (CIC 1994, 1997, 2003, 2004). In addition for being the essential commodity, the importance of the palm oil industry in the Indonesian economy arises from at least two other conditions. First, CPO is one of the main contributors to Indonesia's export revenue. Second, the industry employs a large number of workers. This is important in Indonesia where a high unemployment rate is still a problem, especially since the economic crisis.

In Indonesia, palm oil producers can be divided into three different groups: the government, private companies and smallholders groups. The government group comprises 10 government estates with a single Joint Marketing Office. The private group is dominated by 10 conglomerates, but unlike the government estate, they do not have a single marketing office. On average, the size of a government or private group individual plantation is approximately 10,000–25,000 ha, and it is usually a part of larger plantation estate ranging from 100,000 to 600,000 ha (Casson 2000). Both groups appear to be highly vertically integrated, have good access to capital markets, new technologies and information. However, government estates tend to be more bureaucratic, less adaptable to changes and consequently less efficient (Barlow *et al.* 2003, pp. 10-13; van Gelder 2004, pp. 31-45; LONSUM 2005).

Smallholders do not have any joint marketing associations, and have area less than 200 ha. In 2001, the government helps smallholders to establish their own association called Indonesian Association of Palm Oil Farmers (*Assosiasi Petani Kelapa Sawit Indonesia/ APKASINDO*). It accommodates some of the smallholders' inspiration, but this association is unlikely deal with marketing arrangements. Together with the perishable characteristic of the Fresh Fruit Bunches and lack of processing facilities, smallholders appear to be price takers. Therefore, although the total size of smallholders has reached 40 per cent of market share, we could argue that they are effectively a (high-cost) competitive fringe. Hence, this group is not considered as one of the strategic groups in the industry.

3. The model

The model is based on Karp and Perloff (1993), who apply the state-space game model to measure symmetric duopolists' market power in the coffee export market. In the Indonesian palm oil industry, the duopolists represent the government and private groups. These groups are unlikely to be identical: the government group appears to be more bureaucratic, less responsive to change and less productive than the private group.

Therefore, the symmetric assumption of the model is relaxed. In each period, duopolists choose the rate of their output as the control variable. Being a perennial crop means that firms run a long-run production process. In the long-run, inputs such as land or plant capacity are no longer fixed and could be changed or adjusted. These inputs are held constant in the short-run due to the high cost of adjustment. The greater the size or speed of adjustment, the higher the costs should be expended. Therefore, firms are assumed to make changes or adjustments gradually.

The objective function of firm i is to maximise its discounted profit stream

Equation 1 $\sum_{t=1}^{T} \delta^{t-\varepsilon} \left(p_t - c_i\left(t\right)\right) q_{it} - \left(\gamma_{it} + \frac{\theta_i}{2} u_{it}\right) u_{it} \varepsilon$

subject to $q_t = g + G q_{t-\varepsilon}$

where δ is the discount factor, p_t is the linear inverse demand, $c_i\left(t\right)$ is the constant marginal production cost, q_{it} is the output, and $\left(\gamma_i + \frac{\theta_i}{2} u_{it}\right) u_{it} \varepsilon$ is a convex adjustment cost. γ_i and θ_i are the adjustment cost parameters, $u_{it}\varepsilon \equiv q_{it} - q_{it-\varepsilon}$ is the rate of adjustment, and ε is the three-year length of maturation period. $q_t = g\left(t\right) + G q_{t-\varepsilon}$ is the adjustment system, where $g\left(t\right)$ is a column vector, and G is a 2x2 matrix with elements G_{ij} $\left(i, j = 1, 2\right)$.

The adjustment cost parameter θ and market power index v are calculated by providing the estimates of the slope of the adjustment system G matrix, elements of which are G_{ij} , and the slope of the inverse demand b. The solution needs to satisfy three properties, which in this duopoly case are:

(a) the system needs to be stable: $-2 < G_{11} + G_{22} < 2$ and $-1 < G_{11}G_{22} - G_{12}G_{21} < 1$

(b) the market power index needs to be interpretable: $-1 < v_i < 1$; and

(c) the adjustment cost function needs to be convex: $\theta_i > 0$.

Imposing these three properties using a classical approach would be extremely difficult, if not impossible. However, the Bayesian approach provides a relatively easy technique to do so (Griffiths 1988; Karp and Perloff 1993, p. 452). Appendix 1 shows the estimation process, which is based on Chalfant *et al*. (1991).

Utilise the recursive principle, assuming $\gamma_{it} = 0$, $\varepsilon = 1$ and constant marginal costs, the discounted profit stream can be re-written as

Equation 2 $$\Pi_i = (p_t - c_i) q_{it} - \frac{\theta_i}{2}(q_{it} - q_{it-1})^2 + \delta\left[(p_{t+1} - c_i) q_{it+1} - \frac{\theta_i}{2}(q_{it+1} - q_{it})^2\right]$$

Defining $\frac{\partial Q_t}{\partial p_t} = \frac{\partial Q_{t+1}}{\partial p_{t+1}} = \frac{\partial \bar{Q}}{\partial \bar{p}} = b$ and $\frac{\partial q_{jt}}{\partial q_{it}} = \frac{\partial q_{jt+1}}{\partial q_{it+1}} = \frac{\partial q_j}{\partial q_i} = v_i$, the maximisation of the discounted profit stream firm i will be:

Equation 3 $$\frac{\partial \Pi_i}{\partial q_{it}} = \frac{1}{b}(1+v_i) q_{it} + p_t - c_i - \theta_i q_{it} + \delta \frac{1}{b}(1+v_i) q_{it+1} + \delta p_{t+1} - \delta c_i - \delta\theta_i q_{it} = 0$$

and the current price will be

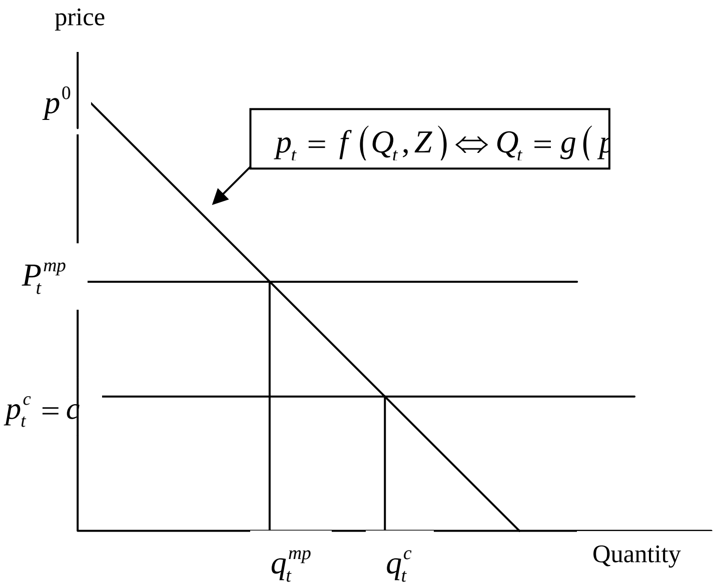
Equation 4 $$p_t^{mp} = -\frac{(1+v_i)}{b}\left[q_{it} + \delta q_{it+1}\right] + (1+\delta) c_i + (1+\delta)\theta_i q_{it} - \delta p_{t+1}$$

While if $v_i = 1$, the slope of marginal revenue is twice the slope of inverse demand, and the monopoly mark up is observed. If $v_i = -1$, marginal revenue equals price, and there is no mark up, reflecting a competitive condition. If $v = -1$, Equation 4 can be written as

Equation 5 $p_t^c = (1+\delta)c_i + (1+\delta)\theta_i q_{it} - \delta p_{t+1}$

Changes in welfare can be illustrated by Figure 1.

Figure 1. Changes in consumer surplus



Consumer surplus without subsidies and firms behave competitively will be

Equation 6 $CS^c = \int_0^{q_t^c} f(Q_t)dQ_t - p_t^c q_t^c = \int_{p_t^c}^{p^0} g(p_t)dp_t$

while that with subsidies will be

Equation 7 $CS^c = \int_0^{q_t^{mp}} f(Q_t)dQ_t - p_t^{mp} q_t^{mp} = \int_{p_t^{mp}}^{p^0} g(p_t)dp_t$

Using Equations 6 and 7, the change in consumer surplus caused subsidies will be

Equation 8

$$\Delta CS = CS^c - CS^{mp} = \int_{p_t^c}^{p^0} g(p_t)dp_t - \int_{p_t^{mp}}^{p0} g(p_t)dp_t = \int_{p_t^c}^{p_t^{mp}} g(p_t)dp_t = G(p_t^{mp}) - G(p_t^c)$$

4. Estimation and Result

The model was estimated using annual data for the period of 1968–2003. Discount rates and exchange rate data are from the International Finance Statistics. CPO domestic demand data were not available: CPO consumption data listed in the Oil World were used as a proxy. CPO domestic prices were constructed from two sources—the Indonesian Department of Agriculture and Oil World—while the crude oil coconut and palm cooking oil domestic prices were from the Indonesian Bureau of Statistics and Suharyono (1996). All price data were deflated by the Indonesian Consumer Price Index data reported by the Indonesian Bureau of Statistics.

The price of CPO, crude coconut oil, cooking oil and a dummy variable for economic crisis were chosen as regressors in the CPO demand function. In addition, an interactive term between the price of CPO and crude coconut oil was included to capture the possible market power effect (Bresnahan 1982). Except for the price of CPO, all of these variables were treated as exogenous variables. The price of CPO was suspected to be endogenously determined with the quantity of CPO through the CPO supply function. Therefore, the demand equation was then estimated using the instrumental variable technique, in which endogeneity of the CPO price was rejected by the Hausman test [3].

Three different specifications, namely the linear, the double-log and the linear-log forms were estimated. In the last two forms, variables used in the adjustment systems are not linear, but their relationships are clearly linear. In other words, all of them state a linear relationship between the control u_t, or in parallel q_t, and the state q_{t-1}. They can be seen as types of the linear equation of motion, which specification is chosen in the theoretical and empirical models. Using time series data, a unit root and cointegration tests were conducted in order to avoid a spurious regression. The CPO demand data need to be in the same order and cointegrated with all the regressors. The Dickey–Fuller unit root test shows that all data are non-stationary.

[3] The price of estate worker data, which contributes about 30 per cent of the production costs, was used as the instrumental variable in the Hausman test. The rationale is because the price of estate worker is correlated with the CPO price, as it is part of the production costs, but not with the CPO demand.

In the linear forms, the time-series data have different orders of integration, and hence cointegration relationships do not exist. In the double-log and linear-log forms, the time-series data have the same orders of integration and cointegration. However, most coefficients in the former were insignificant, while most of the latter were significant. Therefore, the linear-log form is used for the final demand equation. The Durbin–Watson statistic was inconclusive, and thus the LM test was used as an alternative. The result shows no serial correlation in the system, and the $\bar{R}^2$ value is high. Results are as follows:

Equation 9 $Q = 4835.28 - 1166.55P - 2280P_1 + 493.73PP1 + 354.09P_2 + 41.53D$

$$(6.05)^{***} \quad (-2.28)^{**} \quad (-7.23)^{***} \quad (7.91^{***}) \quad (1.23) \quad (2.04)^{**}$$

$\bar{R}^2 = 0.98$ *LM test, F-statistics* $= 6.06*$

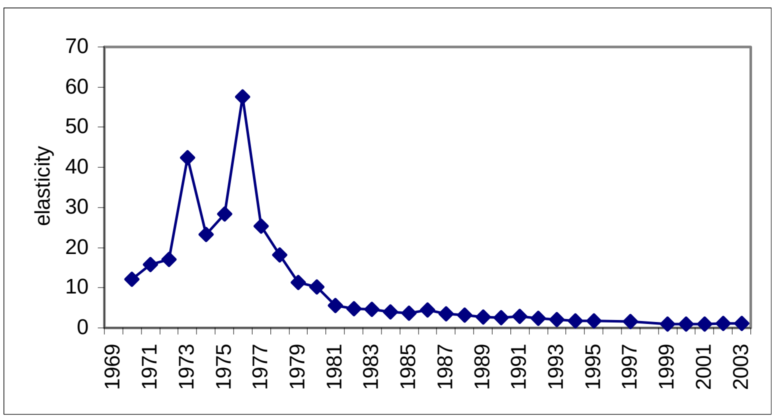
*** and ** shows one and five per cent level of significance

where P is the log of the domestic price of CPO, P_1 is the log of the domestic price of crude coconut oil, P_2 is the log of the domestic price of palm cooking oil, D is a dummy variable that represents the economic crisis period of 1997–1998 (Before 1997 it is zero, otherwise it is one) and numbers in parentheses are *t*-values. Except for P_2, all estimates are significant at the one or five per cent levels. The insignificant result of the coefficient of the price of palm cooking oil P_2 might be explained by the government intervention in setting the market prices. Larson (1996, p. 18) found that the export tax changed the relationship between the CPO and the cooking oil prices.

The coefficient of P was also used to calculate the slope of the CPO inverse demand b (see footnote 12), which is needed to estimate the adjustment cost parameter in the next section. The slope changes with the changes of CPO price P over time. However, even with a constant slope, calculation the adjustment cost parameter and the market power index in an asymmetric dynamic model are for complicated enough. Therefore, for computational ease, the average value of CPO price was used to calculate the constant slope (Gujarati 1999, p. 263). The difference between the maximum and minimum values of the slope is relatively small; hence using the average value is fairly reasonable.

The coefficient of P and PP_1 were used to calculate the own price elasticity of CPO demand[4]. Figure 2 shows that the own price demand elasticities appear to be positive, indicating the nature of net price variable (Brown et al 1974). In this case, the net price refers to the actual price paid by the consumers, which is the CPO market price minus the subsidy. Due to the lack of subsidy data, the market price data used in the estimation do not subtract by the subsidy data; hence they are not the net price variable. Therefore, an increase in the market price does not necessary means an increase in the real price paid by the consumers. If in fact, the net price is actually decreased, an increase in the market price might lead to an increase in the quantity demanded. Hence, a positive own price demand elasticity would be observed. Figure 2 also shows that the CPO elasticity changed significantly towards more inelastic demand, reflecting the increase in the CPO dominancy as the raw material for cooking oil.

Figure 2 CPO own price elasticities of demand, 1969–2003



Source: Author's calculations.

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[4] The demand elasticity is the own price elasticity, formula of which is $\frac{\partial Q}{\partial P}\frac{P}{Q}$. Given the demand equation as $Q = \alpha_0 + \alpha_1 \log P + \alpha_2 \log P_1 + \alpha_3 \log P \log P_1 + \alpha_4 \log P_2 + \alpha_5 D + \varepsilon$, its derivative $\frac{\partial Q}{\partial P}$ is $\left(\alpha_1 \frac{1}{\ln 10}\frac{1}{P} + \alpha_3 \log P_1 \frac{1}{\ln 10}\frac{1}{P}\right)$, hence the own price elasticity is $\frac{1}{Q \ln 10}\left(\alpha_1 + \alpha_3 \log P_1\right)$.

The adjustment system was estimated using the SUR. With a similar argument used in the estimation of demand function, two different specifications, namely the linear and the double-log forms, were estimated. For each group, output data were regressed on the three year-lag of its own and the other group output data. As both of the time series level data are non-stationary, $\overline{R}^2$ value appears to be extremely high. Unless the time series data are cointegrated, the relationship between them will be spurious. The unit root test shows that all of the time series data are I(1), but the Johansen cointegration test result indicates that a cointegration relationship appears only in the double-log form. Therefore, it was used for the final estimation. As lagged dependent variables were included in the model, the Durbin–Watson test for autocorrelation is no longer applicable and needs to be replaced by Durbin's h-test. The result shows that there is no autocorrelation. Two dummy variables for the time of the economic crisis and the time of concessionary credit were also included. Results are shown in Table 1

Table 1 Estimation of the adjustment system

	Government	Private
Constant	0.45	0.31
	(3.32)***	(1.35)
Economic crisis 1997	-0.10	0.06
	(-3.68)***	(1.25)
Concessionary credit 1986–1996	-0.04	0.17
	(-2.14)**	(5.32)***
Own lagged output	0.90	0.70
	(16.24)***	(8.12)***
Other lagged output	0.05	0.25
	(0.89)	(2.61)***
Adjusted R-squared	0.99	0.99
Durbin–Watson	1.27	1.79
Durbin's h	12.07***	3.5***

Note : Numbers in parenthesis refer to *t*-statistics

*** and ** shows 1 and 5 per cent level of significance, respectively.

The G matrix was constructed from coefficients of the own lagged (G_{11}, G_{22}) and other lagged output (G_{12}, G_{21}) of the government and private groups. All elements of the G matrix, except G_{12}, are significant at the one per cent level. G_{11} and G_{22} are positive, indicating increasing growth in both the government and private output. The insignificant G_{12} indicates a lack of response from the government group to the previous action of private group, while the positive G_{21} shows that the private group always accommodates the previous action of government group, and hence a leader–follower relationship is detected.

While both dummy parameters of the government group are negative, those of the private group appear to be positive. The difference in the credit dummy estimates might stem from the amount and effectiveness of the credit received by each group. The government and the private groups received 15 per cent and 26 per cent of the total credit, respectively. While a one per cent increase in the credit boosted the government plantation area by 0.4 per cent, that of the private can be expand by 1.5 per cent (ADB 1997). On the other hand, the difference in the economic crisis dummy estimates might stem from the market distribution and in the efficiency of each group. During the economic crisis, the international–domestic CPO price ratio significantly increased, making exports more profitable. The government sector did not fully enjoy such a benefit because most of its output needed to be supplied to the domestic market. Although such a restriction was not imposed on the private group, a similar barrier exists from the high export taxes imposed during the periods of economic crisis. However, many sellers appeared to smuggle their CPO to the international market, and thus enjoyed the increase in export values (Marks *et al.* 1998, pp. 53-54). At the same time, being more efficient, the private group may also have minimised the increase in production costs due to the increase in imported input prices (Arifin *et al.* 1999).

Using the Bayesian estimation procedure (see Appendix 1), the mean, standard deviation and numerical standard error (NSE) of the market power index v and the cost of adjustment parameter θ were calculated. The results are shown in Table 5.4.

Table 2 Bayesian estimates

Parameters	Selected samples = 1310 , Probability = 0.0034		
	Mean	Standard deviation	NSE
θ_1	1.39E5	5.18E4	5E32
θ_2	1.77E3	278.99	4.98E29
v_1	-0.46	0.75	3.26E31
v_2	-0.72	0.15	6.29E26

Table 2 shows that jointly imposing three properties reduces the selected samples to only 1310 out of the 200,000 replications. The standard deviation of the adjustment cost parameters and market power index are relatively small, but their numerical standard errors are very large. Therefore, the estimation of mean values of the adjustment cost parameters and the market power index are still used with caution.

The market power indices v_i which estimations appear to be more than -1 indicates that market price is higher than firms' marginal costs. To test this, three different scenarios (reflecting three different conditions in the analysis period) were simulated. Given two dummy variables, referring to the economic crisis and the concessionary credits, the period of analysis can be divided into period 1 of 1969-1985, in which $D_1 = D_2 = 0$; period 2 of 1986-1996, in which $D_1 = 0$ and $D_2 = 1$; and period 3 of 1997-2003, in which $D_1 = 1$ and $D_2 = 0$.

Using the first scenario, in which $D_1 = D_2 = 0$, implying no economic crisis and concessionary credits, the adjustment system can be re-written as

Equation 10 $$q_{1t+1} = 0.45 + 0.90 q_{1t} + 0.05 q_{2t}$$

$$q_{2t+1} = 0.31 + 0.25 q_{1t} + 0.70 q_{2t}$$

Given the results of demand function and adjustment system estimations, the difference between the subsidised and competitive prices faced by the government will be

Equation 11 $p_t^s - p_t^c = -0.00071 - 0.003233 q_{1t} - 0.000078 q_{2t}$

and that faced by the private will be

Equation 12 $p_t^s - p_t^c = -0.00025 - 0.0002 q_{1t} - 0.001515 q_{2t}$

The relationship between q_{1t} and q_{2t} is obtained by combining Equations 11 and 12

Equation 13 $q_{1t} = 0.151665 - 0.4727 q_{2t}$

Substituting this into Equations 12 and 13 gives

Equation 14 $p_t^s - p_t^c = -0.00120 + 0.001450 q_{2t}$

and

Equation 15 $p_t^s - p_t^c = -0.00028 - 0.0014205 q_{2t}$

Finally, combining Equations 14 and 15 gives

Equation 16 $q_{2t} = 0.32$

Due to the lack of subsidy data, market price data are not the net price data and could be treated as the subsidised price, hence the average price $\bar{p}$ was then used as an approximation of p_t^s (see Figure 1). Plug $\bar{p} = 128120.97$ either into Equation 14 or 15, gives the competitive price $p_t^c = 128121$**.** Following the same steps as in scenario 1, gives the same results for the competitive price in scenarios 2 and 3. Therefore, it could be concluded that the competitive price p_t^c appears to be higher than $\bar{p}$.

While average market price is higher than the competitive price, estimation results indicate that both producers still enjoy some degree of market power. This might in part, be related to the imposition of subsidies either in CPO or cooking oil prices. With a subsidy, the sellers' price might exceed the buyers' price (Pindyck and Rubinfeld 2001, p. 317).[5] Due to the lack of subsidy data, the market price data used in the estimation are not differentiated with prices really received by the producers. In such conditions, negative margins do not necessarily show a negative profit for the firm. If fact, the amount of subsidies are greater than the competitive and market prices margin, sellers would receive price higher than the competitive price and enjoy gain some degree of market power.

The estimation result shows that the slope of demand b is positive. While this can be explained by the nature of net price variable, positive b values make competitive market prices higher than non competitive market prices. Recall Equation 4

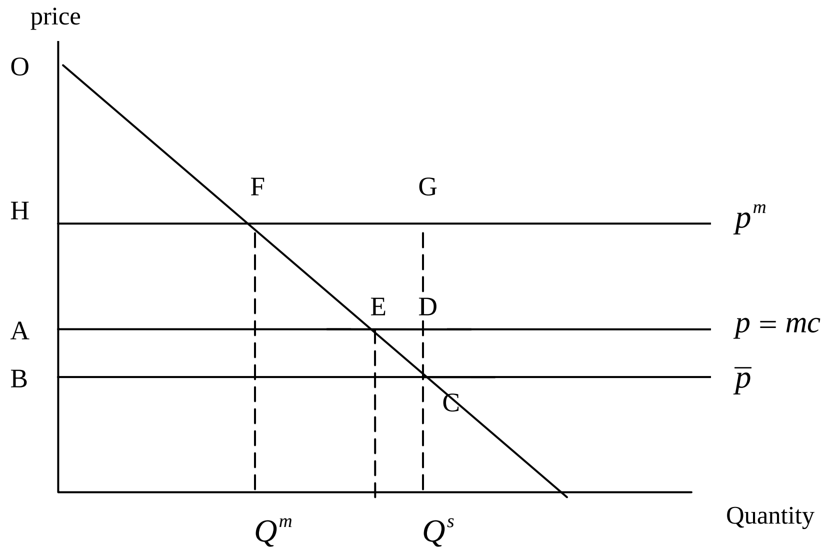
$$p_t^{mp} = -\frac{(1+v_i)}{b}\left[q_{it} + \delta q_{it+1}\right] + (1+\delta)c_i + (1+\delta)\theta_i q_{it} - \delta p_{t+1}$$

Given positive values of q and δ, with negative b and $v > -1$ (which refers to the non competitive conditions), the first term $-\frac{(1+v_i)}{b}\left[q_{it} + \delta q_{it+1}\right]$ would be positive , hence competitive prices would be higher than the non competitive ones. In the estimation process b was calculated using the average market price $\overline{p}$. v_i values were obtained through the estimation of firms adjustment process and were not determined by the b value. The separate estimations of b and v_i values might lead to the condition of high competitive price.

With market power, subsidies are unlikely to have a desired effect. This can be illustrated in Figure 3. Suppose the price and quantity without subsidies are p^m and Q^m, with subsidies are $\overline{p}$ and Q^s, and marginal cost is mc.

[5] The seller's price refers to price being equal to the seller's marginal cost and the buyer's price is the same as the market price.

Figure 3 Subsidies and welfare



Without subsidies, consumers could only receive surplus as much as OHF, whereas that with subsidies could be as much as OBC. This means that subsidies increase consumer surplus as much as ABCE. However, the expense of subsidies $\left(p^m - \overline{p}\right)Q^s$ (which equals BCGH) is greater than the increase in consumer surplus. The difference CGF indicates that with market power, subsidies could reduce the aggregate welfare.

In Indonesia, the subsidies could be either covered by the government or the producer (either government or private companies). Without subsidies, producer surplus is $\left(p^m - mc\right)Q^m$ (see Figure 1). If the subsidies are covered by the government and the government does not know the producers' marginal cost, paying all the difference between the producer and the consumer prices, producers still receive prices at p^m. In such a condition, the subsidy does not change the producers' margin, and still enjoy some degree of market power. The producer's surplus increase as much as $\left(p^m - mc\right)Q^s$.

In contrast, if all of the subsidies are covered by the producers, producers receive prices at p^s, hence their price-cost margin will be negative and their surplus decrease as much as $\left(mc-p^{s}\right)Q^{s}$. Finally, the expenses of subsidies could also be divided between the government and producers. If government expenses for subsidies are great enough to lead to a positive price-cost margin, producers still enjoy some degree of market power. Such a condition might appear in the Indonesian palm oil industry, as policy makers have incomplete or no information about the groups' cost functions and the amount of subsidies given is unlikely to be determined by the difference between price and marginal costs.

If producers have different marginal costs due to the difference in efficiency, the subsidies might provide some degree of market power to the more efficient producer. The efficient producer has lower marginal costs, say $mc' < \overline{p} < mc$, than those who are less efficient. In this case, producers still gain extra profit and enjoy market power even they have to cover all of the subsidies. In fact, the public producers appear to be less efficient than the private companies. On average, the production costs of the government group were 36 per cent higher than those of the private group.[6] Therefore, in order to be effective, government price intervention needs to be based on the marginal cost information of efficient producers.

In addition, subsidies would encourage the less efficient producers to remain in the industry. Green (1987, p. 487) suggests that there are two conditions that allow less efficient firms to remain in a market. First, there are no better potential entrants. In the palm oil industry, this might be attributable to barriers to entry that stem from the high investment levels required to establish a sufficient scale of oil palm estates and CPO mills. In 1986 the government attempted to address this problem by providing potential entrants with some concessionary credits. On average, each of the private companies borrowed about 77 per cent of its total establishment cost and increased the oil palm plantation area almost seven-fold. However, after 1996 these concessionary credits were no longer available (Casson 2000). This implies that the more recent entrants faced

[6] De Fraja (1991) has used the average variable cost as the measurement of efficiency. The production cost of the private group is approximated by the real average costs of a firm listed in the Jakarta Future Exchange during 1994–2003, and that of the government groups is approximated by the real average costs of plantation firms surveyed by Bureau of Statistics, Indonesia during 1994–2000.

higher costs to entry to the industry, and hence incumbents earned persistently higher profits than the potential entrants.[7] If such barriers can be removed, 'no one firm can succeed in the long run at earning profits that exceed costs without inducing additional entry'(Carlton and Perloff 2005, p. 77). Therefore, providing potential entrants with similar credits—so that firms can enter with identical cost—could lead the market to a more competitive condition, in which no inefficient firms can survive. This implies that the government group would be forced to increase its efficiency to remain competitive. While an inefficient public firm can still improve consumer welfare by selling output at below its marginal costs,[8] this is obtained through a transfer from the rest of economy (for example, through general taxation), rather than from increasing total social welfare. In contrast, with low marginal costs, an efficient public firm can set a low price, forcing private firms to cut their price, and hence increase the total social welfare (de Fraja 1991, p. 315).

The second condition allowing less efficient firms to remain in the market is the absence of competition among incumbent firms. Clarke (1983, p. 384) suggests that, in general, oligopolists have strong incentives to collude because they would gain profits by restricting their output and receiving a higher price. However, incentives to collude are often offset by the problems associated with detecting cheaters on the collusive agreement, which stem from the uncertain market conditions. One way to reduce market uncertainty is by homogenising the oligopolists' perception through a pooling mechanism, such as in the trade associations. Being a member of the same association (namely the Indonesian Palm Oil Producers Association) provides means for the government and private groups to improve their production or distribution processes as well as promoting technical or economic progress. However, at the same time, this allows the groups to homogenise their perception about the market condition and to share information about other firms. In the absence of the competitive behaviour, both the public and private producers may enjoy some degree of market power.[9]

[7] Carlton and Perlof (2005) defined such a condition as the long-run barrier to entry.
[8] Being instructed to maximise the social welfare is often used as a justification for the losses in the public firms (de Fraja 1991, p.316).
[9] Green (1994) calls this receiving a supra-normal profit.

Subsidies might also lead to a decrease in the elasticity of demand (Silvestre 1993, pp. 136-137). For example, if the demand has a straight line curve, moving down along the line leads to a decrease in the elasticity. Subsidies decrease prices that need to be paid by the consumers, hence increase quantity demanded by the consumers. In other words, subsidies move down the equilibrium point along the demand curve. For normal goods, an increase in their market price causes consumers to shift their demand to other substitute goods. However, with subsidies consumers pay either the same or a slightly higher price, and hence their demand might remain the same or only slightly decrease. This implies that a 'change' in output price does not change or only slightly changes the demand, so that producers could increase price without losing a significant amount of demand. This provides producers with a chance to increase price above marginal cost and enjoy the market power gain.

To conclude, while subsidies are imposed to increase the consumers' surplus, they might actually decrease the aggregate welfare due to market power. In order to provide subsidies that could remove the imperfectly competitive market condition, policy makers need information on the marginal cost of the efficient producers. If the amount of the subsidy is exactly the difference between price and costs, the competitive market price will be observed. If the amount of subsidy is greater than the difference between price and costs, producers will still enjoy some degree of market power.

5. Summary and Conclusion

Using a dynamic duopoly model, this study finds that producers in the Indonesian palm oil industry enjoy some degree of market power. Simulating three different scenarios, the results also show that the average market price is lower than the competitive price, lead to an increase in the consumer surplus. While such conditions seem contradictive, this might, in part, be explained by the existence of subsidies in this industry. Lacks of information about producers' marginal costs, subsidies are unlikely imposed to decrease the consumer price rather than to improve the market structure. As a result, although the subsidies appear to help the consumers, they are in fact, lead to a decrease in the aggregate welfare. Moreover, subsidies could encourage the less efficient producers to remain in the industry. Therefore, it is strongly recommended that before deciding how much to subsidy and who should guarantee the subsidy, policy makers need to have sufficient information, at least about the producers' costs.

To determine whether a firm does exercise market power or not is not always easy and practical. It is important to note that the findings of market power index suffer from low probability and high numerical standard errors. This might stem from the lack of subsidy data. Therefore, a richer data set in the future could potentially improve the estimation results. There might also be a modelling problem. Due to the indivisibility of inputs and discontinuity of adjustments, the model is found to be limited to a convex adjustment costs structure. Thus, future research that explores more flexible structures could provide further insights into modelling market power in the Indonesian palm oil industry.

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Appendix 1. The estimation procedure