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INTERACTIONS BETWEEN MALAYSIAN AND INDONESIAN PALM OIL INDUSTRIES: SIMULATING THE IMPACT OF LIBERALIZATION OF IMPORTS OF CPO FROM INDONESIA

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The presence of excess refining capacity in the refining sub-sector of the Malaysian palm oil industry is one of the challenges facing the industry. Market driven adjustments within the refining sub-sector that have taken place in the last few years (e.g. cessation of refining operations) have incurred significant costs to the industry. These costs would have been avoided if greater supply of crude palm oil (CPO) were made available either through increase in domestic production or imports. However, expansion of domestic production of CPO has been constrained by land and labour shortage. This paper investigates the impact on the industry from the liberalization of imports of CPO from Indonesia. A structural econometric model of the Malaysian palm oil industry will be used to simulate the effect of import liberalization. It is argued that import liberalization not only improves capacity utilization within the refining sub-sector, but also that the higher supply of CPO would help sustain the development of domestic downstream activities in the long run. As palm oil has been identified by the Industrial Master Plan (1985) as one of the resource-based industries to be developed, the simulation results would be useful to palm oil producers, policy makers and investors. However, import liberalization would require a more liberal trading stance to be adopted by both countries. As such, collaborative efforts would be beneficial to both sides given the fact that the market for fats and oils is a growing market.

INTRODUCTION

The fiscal measure of imposing export duty on palm oil exports has been utilized by the Malaysian government to stimulate the growth of downstream processing of palm oil (Mad Nasir Shamsudin et al., 1997). The rate of export duty declines with the degree of processing done to the raw materials. There has been a noticeable reduction in CPO exports from the early 1970s. In 1970, CPO accounted for 70% of total exports compared to less than 1% in 1995. There has been a significant shift in the composition of palm oil export towards processed palm oil products. The development of downstream processing is aimed at further expanding the activities of the industry – adding value-added to the product, enhancing product development and technological advancement in palm oil processing. Leading the development has been the expansion of the refining sub-sector of the industry.

The problem of excess refining capacity began to appear in the late 1980s. In 1992, the refining capacity in operation was 10.7 1 million tonnes of CPO per year, with CPO production at 6.37 million tonnes. The refining capacity in operation in 1995 was 10.15 million tonnes of CPO compared to the year's production of 7.81 million tonnes. The average rate of capacity utilization was 84.6% compared to 82% in 1994. Even though capacity utilization has improved since 1992, the situation still indicated that the refining sector of the industry was not utilizing its capacity optimally. In addition, the market driven adjustments within the refining sub-sector have incurred significant costs to the industry. Greater availability of supply of CPO from domestic production and imports would have avoided such costs.

Malaysia needs to solve the problem of excess refining capacity. Excess refining capacity occurs partly because of the lack of coordination at the initial stage between the two ministries that are involved in approving the establishment of refineries and monitoring their development. Excess refining capacity also occurs because expansion in local production is limited by input constraints such as labour and land shortages. One way to enhance the local supply of palm oil in Malaysia is by liberalizing palm oil imports. Malaysia could import CPO from Indonesia which is currently exporting mainly CPO. Indonesia, at the moment, has not yet fully established its refining sector. The country does not plan to delve into product development that will result in various and diverse products portfolio for its customers to choose from. Palm oil is mainly used in the production of cooking oil to satisfy the large domestic market. Before 1979, coconut oil was the main source of cooking oil in Indonesia. But with the shift in policy on export of oils and fats, palm oil is channelled for domestic consumption, while coconut oil is mainly for export. Palm oil has been increasingly used as a buffer against imbalance between supply and demand for vegetable oils. Exports declined especially after the introduction of the government's allocation policy in 1981 (Moll, 1987). A recent development is that the authorities would implement a quota on the export of CPO and palm olein in order to stabilize the domestic requirements for cooking oil (Bisnis Indonesia, 14 November 1997). The ex-factory price of palm olein has increased about 50% between July and early November 1997 as a result of a sharp increase in exports following a reduction in CPO export duty and depreciation of the rupiah against the US dollar.

This article reports an analysis of the impact on the Malaysian palm oil industry from the liberalization of imports of CPO from Indonesia. A structural model of the Malaysian palm oil industry will be used to simulate the effect of the import liberalization. The structural model reported in Mohammad Haji Alias et *al.* (1997) is modified for this purpose.

The structure of the paper is as follows. Following the introduction, we briefly describe the background of the Malaysian and Indonesian palm oil industries. This is followed by a description of the structural model of the Malaysian palm oil industry. The interaction between the Malaysian and Indonesian palm oil industries is through trade, i.e., import of CPO from Indonesia. Data sources and definitions of variables and empirical results follow. The direct and indirect effects of liberalization of CPO imports to the Malaysian palm oil industry are analysed. The final section gives the policy implications.

BACKGROUND

Malaysia and Indonesia are the two main producers of palm oil in the world. Malaysia produced about 52% of world supply of palm oil in 1996, while Indonesia produced another 28% (*Table 1*). As such, Malaysia is currently the largest producer with Indonesia trailing in the second place. The combined production share of these two countries accounted for about 80% of the total world production of palm oil.

Malaysia and Indonesia are also the two major exporters of palm oil in the world (*Table 1*). Being the largest exporter, Malaysia exported about 7.2 million tonnes (MT) of palm oil or 66.9% of world trade of palm oil and Indonesia exported about 2.0 MT or 18.6% of total world export. Together, they accounted for about 85.5% of world exports of palm oil and 32.1% of world exports of fats and oils in 1996 respectively.

TABLE 1. PRODUCTION AND EXPORTS OF PALM OIL 1996 (million tonnes)

Country	Production		Exports	
	Volume	Share (%)	Volume	Share (%)
Malaysia	8.4	52	7.2	66.9
Indonesia	4.5	28	2.0	18.6
Others	3.2	20	1.6	14.5
Total	16.1	100	10.8	100

Source: Oil World Annual 1997

As a result of the significant contributions by Malaysia and Indonesia, palm oil now becomes the second largest produced oil in the world, after soyabean oil (*Table 2*). Palm oil was the ninth largest produced oil in 1960. High productivity of the oil palm crop, lower cost of production and other factors contributed to the rapid increase in production as more palms

TABLE 2. PRODUCTION AND EXPORTS OF OILS AND FATS 1960-1996 ('000 t)

Oils and fats	Production			Exports		
	1960	1996	Growth rate (%)	1960	1996	Growth rate (%)
Soyabean	3 355 (3)	20 213 (1)	5.1	668 (2)	5 690 (2)	6.1
Palm oil	1318 (9)	16 073 (2)	7.2	622 (3)	10 799 (1)	8.3
Rapeseed oil	1 164 (11)	11 503 (3)	6.5	46 (16)	1 745 (5)	10.9
Sunflowerseed oil	1 788 (8)	9 289 (4)	4.7	216 (12)	2 714 (3)	7.3
Tung oil	116 (17)	0 (18)	–	65 (15)	0 (-)	–
Corn oil	0 (18)	1 792 (13)	1.0	230 (11)	830 (9)	–
Olive oil	1 295 (10)	1868 (12)			(11)	1.0
Groundnut oil	2 282 (6)	4 300 (8)	1.8	319 (7)	255 (13)	-0.01
Cottonseed oil	2 366 (5)	4 061 (9)	1.5	256 (9)	224 (14)	0
Tallow	3 436 (2)	a 441 (5)	2.2	1077 (1)	2 120 (4)	1.9
Lard	3 142 (4)	6 028 (6)	1.8	462 (5)	159 (15)	-0.03
Butter	4 215 (1)	5 801 (6)	0.9	488 (4)	521 (10)	0.2
Fish	470 (13)	1337 (14)	2.9	364 (6)	772 (8)	2.1
Coconut oil	1 949 (7)	2 930 (10)	1.1	273 (8)	1404 (6)	4.7
Palm kernel oil	432 (14)	2 097 (11)	4.5	57 (14)	911 (7)	8.0
Sesame oil	419 (15)	753 (15)	1.6	0 (-)	23 (17)	–
Castor oil	199 (16)	482 (17)	2.5	122 (13)	264 (12)	2.2
Linseed oil	886 (12)	675 (16)	-0.01	247 (8)	132 (16)	0
Total	28 832	96 643		5 511	28 685	

Note: numbers in parentheses represent ranking.
Source: Oil World Annual 1997 and Oil World: 1963-2012.

reached their maturity stage. A massive oil palm planting programme in Malaysia in the past three decades contributed to the growth of the industry. Furthermore, the long productive life span of the oil palm ensures the world of continuous and steady production of the oil. As shown in *Table* 2, world production of palm oil grew by 7.2% per year over the 1960-1996 period. This is the fastest rate of growth among the oils and fats, The largest produced oil, soyabean oil, grew by 5% and rapeseed oil grew by 6.5%. As a result of the fast rate of growth, palm oil production is gradually catching up with the level of production of soyabean oil, which was 20.2 MT in 1996.

Palm oil is also currently the largest traded oil in the world, registering an export volume of 10.8 MT in 1996. It was the third largest 36 years ago with export volume of only about 0.62 MT. Malaysia, the largest exporter, exported about 90% (7.2 MT) of its production in 1996 which also constituted about 66.9% of the world's palm oil trade. The big export volume from Malaysia relative to supply is due to the small population of the country, and hence domestic consumption. Indonesia, on the other hand, consumes a larger proportion of local production Malaysia started to participate in refining activities in 1975 when the need to develop its own downstream activities arose. The refining industry was also the first step to greater involvement in the manufacture of value-added palm oil products which fulfill the customers' needs Importing countries like India, Pakistan, and many other developing countries are in dire need for oils and fats in processed forms due to the lack of refining facilities in these countries. As a result of greater emphasis on refining activities, there is a noticeable reduction in crude palm oil exports. As a consequence, there is an apparent shift in the composition of Malaysian palm oil exports toward processed palm oil products.

MODEL SPECIFICATION

The structural econometric model of the Malaysian palm oil industry specified in this study consists of nine behavioural equations and two identities (*Table* 3). A description of the model is given in more detail in Mohammad Haji Alias *et* al. (1997). The behavioural equations describe the determination of CPO production (not aggregated by production units), domestic consumption and exports of CPO, domestic and world price of CPO, estate and smallholding mature area equations and processed palm oil (PPO) exports. One identity defines total production of CPO as the sum of Peninsular Malaysia estate and smallholding productions, which are endogenously determined, and Sabah and Sarawak CPO production, which is treated as exogenous. Treating Sabah and Sarawak CPO production as exogenous is for convenience only. We cannot estimate production functions for CPO production in the two states because of the absence of data on production inputs.

The second identity defines capacity utilization of refining capacity (CU). This is defined as the ratio of the market availability of CPO (current production plus imports) to refining capacity.

The direct effect of an increase in import of CPO on the Malaysian industry is through the identity defining capacity utilization [equation (11)]. An increase in imports of CPO enhances market supply of CPO, leading to higher capacity utilization in the refining sub-sector. With an increase in CU, indirect effects on the industry are via the CPO domestic price [equation (8)]. We postulate an inverse relationship between domestic price of CPO (CPOP) and CU. With an increase in market supply of CPO, there is less competition among refiners for tbe available CPO. As a consequence, there is a downward pressure on price, other things remaining constant,

The lower price has a negative impact on estate mature area after a lag of three periods [equation (3)]. On the other hand, the lower price boosts domestic consumption of CPO [equation (5)]. Inclusion of the capacity utilization variable in the. price equation is a modification to the price determination equation While we note that price is basically determined in the world market for CPO, the inclusion of CU is to test the significance of an important local factor, *viz.* capacity utilization in the refining sub-sector, in price determination. Dynamic responses are modelled via partial adjustment mechanisms. The interrelationships among the variables of the model are depicted in *Figure 1.*

TABLE 3. MODEL LISTING

Production

Log CPOEPM, = f_1 [log EMAPM,, log LABE, TIME] (1)

Log CPOSHPM, = f_2 [log SHMAPM,, TIME] (2)

Mature Area

$EMAPM_t$ = f_3 [NRP_{t-3}, $CPOP_{t-3}$, $EMAPM_{t-1}$] (3)

SHMAPM, = f_4 [GOVRDE,,, SHMAPM,,] (4)

Crude Palm Oil Consumption and Exports

CPOC, = f_5 [$CPOP_t$, MGDP,, $CPOC_{t-1}$] (5)

$CPOX_t$ = f_4 [$CPOC_{t-1}$, CPOWP,, $POPW_t$, SOYABP,, TIME] (6)

Processed Palm Oil Exports

$PPOX_t$ = f_7 [$PPOX_{t-1}$, CPOWP,, SOYABP,, TIME1 (7)

Crude Palm Oil Domestic and World Prices

$CPOP_t$ = f_8 [$CPOP_{t-1}$, CPOWP,, CU_t) (8)

CPOWP, = f_9 [CPOWP,,, $SOYABP_t$] (9)

Identity

CPOM, = CPOEPM, + CPOSHPM, + CPOO, (10)

CU, = [$CPOM_t$ + $MCPOM_t$]/REF_t (11)

Note: definition and classification of variables are given in Table 4.

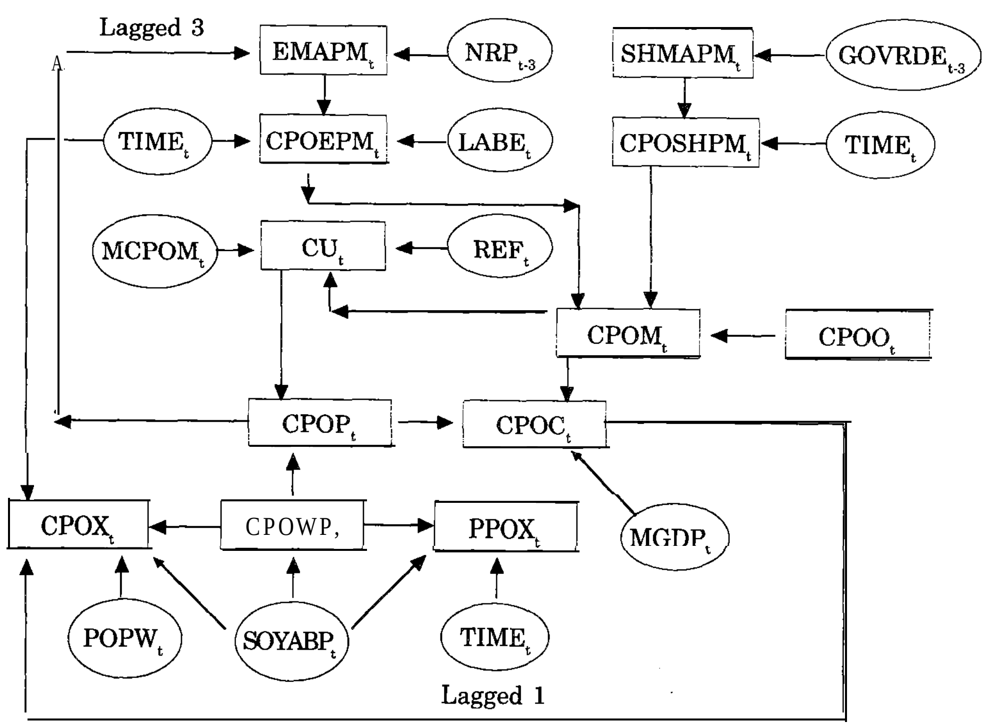

Figure 1. Flow chart of the model.

TABLE 4. DEFINITION AND CLASSIFICATION OF VARIABLES

a. Endogenous Variables

1. CPOC = Local disappearance of crude palm oil (CPO) ('000 t)
2. CPOEPM = Estimates of estate CPO production in Peninsular Malaysia ('000 t)
3. CPOM = Malaysian production of CPO ('000 t)
4. CPOP = Domestic price of CPO (RM t^{-1})
5. CPOSHPM = Estimate of smallholders' production of CPO ('000 t)
6. CPOWP = World price of CPO (US$ t^{-1})
7. CPOX = Malaysian exports of CPO ('000 t)
8. CU = Refining sector capacity utilization (%)
9. EMAPM = Estimate of estate mature area of oil palm in Peninsular Malaysia ('000 ha)
10. LCPOEPM = Logarithm of estate CPO production in Peninsular Malaysia
11. LCPOSHPM = Logarithm of smallholders' production of CPO in Peninsular Malaysia
12. PPOX = Malaysian exports of processed palm oil ('000 t)
13. SHMAPM = Estimate of smallholders' mature area of oil palm in Peninsular Malaysia ('000 ha)

b. Exogenous Variables

1. CPOO = Malaysian production of CPO from Sabah and Sarawak ('000 t)
2. GOVRDE = Government agricultural and rural development expenditure (RM million)
3. LABE = Estate total employment ('000 persons)
4. MCPOM = Malaysian imports of CPO ('000 t)
5. MGDP = Malaysian GDP at 1990 prices (RM million)
6. NRP = Price of natural rubber (RM t^{-1})
7. POPW = World population (millions)
8. REF = CPO refining capacity ('000 t yr^{-1})
9. SOYABP = World price of soyabean oil (US$ t^{-1})
10. TIME = Time trend variable

DATA SOURCES AND DEFINITIONS OF VARIABLES

The primary sources of data used to estimate the econometric model are from Palm Oil Registration and Licensing Authority (PORLA) and Malaysian Department of Statistics. Annual data for the period 1975-1995 are used. The first three observations are lost to construct values of variables lagged three periods.

Data for some variables need to be constructed. Published data on estate and smallholdings mature area are not available on a consistent basis. However, total mature and immature areas under oil palm for Peninsular Malaysia, Sabah and Sarawak are available for the sample period. To construct observations for the variable $EMAPM_t$, we multiplied the share of estates' production to total production (Peninsular Malaysia) with the total mature area under oil palm (Peninsular Malaysia). This yielded an estimate of $EMAPM_t$. The total mature area minus $EMAPM_t$ yields $SHMAPM_t$.

Published data on domestic consumption of crude palm oil (which is basically refining activity) are also not available. Export figures on processed palm oil plus estimates of domestic consumption of processed palm oil do reflect domestic consumption of CPO. As the model estimation requires data on CPOC, and this is not available, we used the following identity to construct the data:

$$CPOC_t = MCPOS_{t-1} - MCPOS_t + CPOM_t - CPOX_t + MCPOM_t$$

where $MCPOS_t$ and $MCPOM_t$ are CPO end of period stocks and imports of CPO respectively.

The identity defines the available market supply of CPO nett of exports that can be refined. See also Pletcher (1991), who treated local consumption of CPO as being synonymous with refining activity.

ANALYSIS OF EMPIRICAL RESULTS

The estimates of the structural model are given in *Table 5.* The non-linear two stage least squares (N2SLS) method is used. Some of the equations are well determined. In general, the signs of the coefficients are consistent with a priori expectations, and some of them are statistically significant (5% level).

The results suggest that the mature area (a proxy for capital input) is important in determining CPO production for both estates and smallholdings (coefficients are significant at the 1% level). The coefficient for the TIME trend variable for both equations is negative and insignificant. The contribution of disembodied technological change to output growth is not detected. The latter is achieved mainly through expansion in the planted area. In the estate sector, labour was found to be significant in determining production. Labour shortage will have a negative impact on estate CPO production. A 1% reduction in labour would result in a 1.25% reduction in estate CPO production, *ceteris paribus.*

For the mature area equations, estates and smallholdings, lagged adjustments are indicated by the significance of the lagged dependent variables. Adjustments are slow with the coefficients of adjustment of 0.021 and 0.025 respectively. The coefficients of CPOP and NRP lagged three periods have the correct signs but are not significant. The variables are retained on *a priori* grounds. Similarly, the variable GOVRDE is retained in the smallholding matured area equation although its coefficient is not significant as it has the correct sign.

Reviewing the estimates of the equations in the supply component, the growth of production in both estates and smallholders was achieved mainly through area expansion. Productivity through technological improvements, however, was not traced. With the present constraint in area expansion, increase in production through technological improvements (biotechnology and farm management) needs to be given greater emphasis. The results showed that the character of estate production is indicative of market orientation; EMAPM was shown to be not responsive to CPO price changes (CPOP) and CPOEPM was influenced by labour availability (LABE). For smallholder production operation, the influence of market forces such as price (CPOP), and labour availability was not traced. This is expected as smallholder production planning and scheduling are structured through government development programmes, the production motive is not based solely on profit making. In both production sectors, mature area short run adjustments were rigid which suggest constraints on factor adjustments, biological considerations and lags in decision making to market changes.

The CPO domestic consumption equation is specified based on a Marshallian demand function, and the results suggest that adjustments proxied by the lagged dependent variable and domestic CPO price are significant in determining domestic consumption. CPO consumption is slow to adjust to the desired level of consumption as indicated by its adjustment coefficient of 0.266. The own price elasticity of demand for CPO is inelastic with an estimated elasticity of -0.02.

For the CPO export demand function, the coefficient of the lagged dependent variable is significant at the 5% level. The estimated adjustment coefficient of 0.3604 shows that actual export demand is slow to adjust to its desired level. Other relevant variables considered based on sound theoretical judgement and retained in the equation are CPO world price (CPOWP), world population (POPW), soyabean oil price (SOYABP) and time trend variable (TIME). Their estimated coefficients are however not statistically significant even though their signs are consistent with a *priori* expectations.

From the above two estimated demand functions, short run adjustments appeared to be rigid. The estimated domestic demand equation showed that consumption level changes in response to CPO price changes are relatively limited. Hence, falling CPO prices played a limited role in demand expansion. CPO export is shown to decline with time and this is being experienced by the industry as downstream industrial activities such as refining and oleo-

TABLE 5. NON-LINEAR 2SLS ESTIMATES OF THE STRUCTURAL MODEL

$$\widehat{LCPOEMP}_t = \underset{(-1.49)}{-4.756} + \underset{(4.85)}{1.077}\log(EMAPM)_t + \underset{(1.89)}{1.246}\log(LABE)_t - \underset{(-1.55)}{0.031}\,TIME$$

D.W. = 2.62 R^2 = 0.96

$$\widehat{LCPOSHPM}_t = \underset{(0.62)}{0.5617} + \underset{(6.77)}{1.1178}\log(SHMAPM)_t - \underset{(-0.48)}{0.0068}\,TIME$$

D.W. = 2.45 R^2 = 0.98

$$\widehat{SHMAPM}_t = \underset{(2.07)}{48.444} + \underset{(0.34)}{0.008195}(GOVRDE)_{t-3} + \underset{(15.5)}{0.9632}(SHMAPM)_{t-1}$$

D.W. = 2.2 R^2 = 0.98

$$\widehat{EMAPM}_t = \underset{(-0.13)}{-10.7275} + \underset{(1.14)}{0.0736}(CPOP)_{t-3} - \underset{(-0.43)}{0.00869}(NRP)_{t-1} + \underset{(16.33)}{0.9817}(EMAPM)_{t-1}$$

D.W. = 3.2 R^2 = 0.95

$$\widehat{CPOC}_t = \underset{(2.39)}{831.35} + \underset{(3.97)}{0.743}(CPOC)_{t-1} - \underset{(-1.82)}{0.874}CPOP_t + \underset{(1.33)}{0.015}MGDP_t$$

$$\widehat{CPOX} = \underset{(-0.36)}{-3129.43} - \underset{(-1.53)}{0.5638}CPOWP_t - \underset{(-0.39)}{71.815}TIME + \underset{(3.38)}{0.6541}(CPOX)_{t-1} + \underset{(0.37)}{0.784}POPW_{t-1} + \underset{(0.87)}{0.356}SOYABP_t$$

$$\widehat{PPOX}_t = \underset{(2.79)}{1232.86} + \underset{(0.91)}{0.326}(PPOX)_{t-1} - \underset{(-1.91)}{3.1312}CPOWP_t + \underset{(1.37)}{2.4927}SOYABP_t + \underset{(1.56)}{189.9086}TIME$$

D.W. = 2.1 R^2 = 0.98

D.W. = 2.3 R^2 = 0.83

$$\widehat{CPOP}_t = \underset{(1.75)}{308.754} + \underset{(0.65)}{0.13}(CPOP)_t + \underset{(5.18)}{1.795}(CPOWP)_t - \underset{(-2.16)}{411.508}CU$$

D.W. = 0.84 R^2 = 0.68

$$\widehat{CPOWP}_t = \underset{(-1.86)}{-120.541} + \underset{(7.22)}{0.9934}SOYABP_t + \underset{(1.37)}{0.1696}(CPOWP)_{t-1}$$

D.W. = 1.58 R^2 = 0.84

chemical production have been shown to be on the rise.

Export of processed palm oil (PPOX) is significantly influenced by world CPO price (CPOWP), a proxy for the world price for PPO. Its coefficient is significant at the 10% level. The estimated export price elasticity of demand is -0.36. On theoretical considerations, other variables included in the equation are lagged PPOX, world price of soyabean oil (SOYABP) and a TIME trend variable. The TIME trend coefficient is significant at the 10% level showing a positive trend in PPO export demand perhaps due to rising consumer preference for palm oil. The coefficient of the lagged dependent variable is not significant (even at the 10% level), hence indicating instantaneous adjustment of actual to desired demand. The coefficient of SOYABP has the correct sign but is insignificant.

The processed palm oil export demand is significantly influenced by its own price (proxied by CPOWP). However, the demand elasticity for export of processed palm oil was shown to be inelastic, both in the short and long run. Hence, falling prices play a limited role in demand expansion. However, there is a clear rising trend for utilization of Malaysian processed palm oil in the foreign market and the reverse trend for CPOX. This is in line with the rapid development of the downstream activities in the industry.

The estimated CPO domestic price equation (CPOP) suggests that CPOP is significantly influenced by the world CPO price (CPOWP) and capacity utilization (CU_t) with the expected relationships. The world price of CPO is significantly influenced by the soyabean oil price. This is consistent with earlier studies such as that by Mohammed Yusof (1988). The coefficient of the lagged dependent variable is not significant, indicating instantaneous adjustment.

From the price equations (CPOP and CPOWP), the local CPO price (CPOP) is endogenously determined within the local market system. Capacity utilization, CU, is significant in determining CPOP, in addition to the world price CPOWP. An increase in capacity utilization as a result of an increase in market suppl of CPO will result in a fall of CPO price, othe things remaining constant. On the other hanc a fall in market supply of CPO leads to a lowe level of CU, given the level of refining capacit With excess capacity facing refineries, comp tition for the available CPO tends to drive u the domestic price of CPO.

In the estimated model (*Table 5*), we hav retained explanatory variables that are foun to be insignificant We retained them on *a prio* ground, *i.e.* we believed that the variables a relevant, but because of possible data ar econometric problems, accurate estimates a not possible. They are also retained because t model is able to simulate better the historic values of the endogenous variables (see discu sion in Pyndyck and Rubinfeld, 1998).

Simulation on a Sustained 500 000 t Increase of CPO Import

Baseline simulation values were develops from the model based on the historical data f the period 1991 to 1995. To gauge the impa of liberalizing CPO import into the Malaysi market, a sustained 500 000 t import volur was imposed on to the model and simulat values of all the endogenous variables we traced and compared to the baseline soluti (*Table 6*).

TABLE 6. AVERAGE SIMULATED VALUES (1991-1995) OF KEY ENDOGENOUS VARIABLES, BASELINE, COMPARED TO IMPORT LIBERALIZATION

Variables	Baseline	With import liberalization	Change (%)
CPQEPM	2 587.73	2 584.88	-0.11
CPOSHPM	3 296.37	3 296.37	0
CPOC	7 417.03	7 451.02	0.46
CPOX	33.37	33.37	0
CPOP	1 044.55	1 026.29	-1.75
CPOWP	478.66	478.66	0
EMAPM	730.02	729.28	-0.10'
SHMAPM	937.46	937.46	0
CPOM	7 120.43	7 117.57	-0.04
PPOX	6 022.23	6 022.23	0
c u	0.58	0.63	6.79

The model is able to simulate the impact of a sustained 500 000 t increase in CPO import on the key endogenous variables of the industry. The directions of response are, in general, consistent with the predictions of theory. The increase in CPO import leads to a 6.7% increase in CU, on average, during the simulation period. The CPO price is expected to fall by about 1.7% or RM 18.26 t^{-1}. This translates to a decline of about RM 127.82 million $year^{-1}$ in CPO value. This is expected to benefit consumers as domestic consumption is expected to rise by 0.5%.

The fall in CPO price with the CPO import liberalization results in a fall of about 0.1% in estate mature area during this period. This, in turn, results in a fall in estate CPO production by about 0.11% (about 3000 t annually on the average) during the period. The country's CPO production during the period also showed a fall of about 0.04% (about 3000 t). The smallholders' mature acreage and production were shown to be unaffected by the liberalization as production decisions are less market oriented compared to the private estate sector. [The predicted decline in estate mature area cannot be regarded as conclusive as the estimated coefficient of $CPOP_{t-3}$ in the EMAPM equation is not statistically significant (*Table 5*).]

POLICY IMPLICATIONS

The liberalization of imports of CPO from Indonesia is viewed in this article as one of the ways to overcome the excess refining capacity problem. The direct effect of the liberalization is an increase in capacity utilization, hence productively utilizing the slack in capacity. Economies of scale in refining can also be achieved. Adjustment of the industry would be less painful, as the alternative would be to close operation of refineries that are operating at sub-optimal levels. A longer term approach to close the gap between refining capacity in operation and domestic production of CPO is to increase the latter through development of suitable land in Sarawak and Sabah. At the same time, expansion (new investment) and divestment decisions on refining capacity should be scrutinised and regulated by the relevant agencies.

Indirect effects on domestic price and domestic consumption of CPO are seen to be limited. The simulated decline in price is small. Hence, producers of CPO should not be overly worried over import liberalization. What is important is the positive effect of price decline on domestic consumption of CPO. As the latter is basically refining activity, import liberalization helps to lower the cost of production for producers in downstream activities. This would enhance their international competitiveness.

With the expected surge in CPO production in Indonesia, providing a production link to the Malaysian palm oil market could yield mutual benefits for both countries. Realization of the benefits would require a more orderly marketing arrangement and a more liberal, market-oriented trading stance from both countries.

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REFERENCES

BISNIS INDONESIA (1997). Ekspor CPO & Olien Pakai Kuota. 14 November 1997.

MOHAMMAD HAJI ALIAS; MOHD FAUZI MOHD JANI and RAMLI ABDULLAH (1997). An econometric model of the Malaysian palm oil industry. *Technical Report: PORIM- UKM Joint Project, Viva No. 31/97 (12).*

MAD NASIR SHAMSUDIN; FATIMAH MOHD ARSHAD and FAUZIAH ABU HASSAN (1997). The effect of export duty liberalization on the Malaysian palm oil industry. Paper presented at the 22nd World Congress and Exhibition of the International Society for Fat Research (ISF), 8-12 September, Kuala Lumpur.

MOHAMMED YUSOFF (1988). Production and trade model for the Malaysian palm oil industry. *ASEAN Economic Bulletin, 4:*169-177.

MOLL, HA J (1987). ***The Economics of Oil Palm.*** Wageningen. Pudoc.

OIL WORLD (1997). ***Annual 1997.*** ISTA Milke GmbH.

OIL WORLD. OIL WORLD: 1963-2012. ISTA Milke GmbH.

PLETCHER, J (1991). Regulation with growth: the political economy of palm oil in Malaysia. ***World Development, 19(6): 623-636.***

PYNDYCK, R S and RUBINFELD, D L (1998). ***Economic Models and Economic Forecasts.*** Fourth Edition. Boston. Irwin/Mc Graw-Hill.