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AN ECONOMETRIC ANALYSIS OF THE SUPPLY AND DEMAND FOR PALM OIL IN SABAH

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INTRODUCTION

The palm oil industry has experienced rapid growth during the last three decades to become an important source of oil and fats in the world today. The rapid emergence of palm oil in the world's oil and fats market is attributable to Malaysia's and Sabah's success in the cultivation of oil palm on a massive scale. The aggressive pursuit of oil palm cultivation which began in the mid-sixties was basically to reduce the heavy economic dependence on timber, rubber and tin and at the same time to enhance the country's economic resilence in the face of wide price fluctuations in the world commodities market. In 1996, Malaysian palm oil accounted for 55% of the world production and 67% of world trade in palm oil. Palm oil is one of the important commodities that provides a more diversified stream of foreign exchange earnings to the country. In 1996, oil palm covered about one-third of the country's cultivated area amounting to 2.2 million ha and the cultivated area under oil palm in Sabah is about 345,435 ha. Sabah's share under oil palm cultivated area is 17.2%. In 1996, the export earnings from palm oil were RM 7.9 billion compared to RM 6.4 billion in

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1995. Production of palm oil grew from 7,000 tonnes in 1970 to 1.1 million tonnes by 1996, accounting for 15.4 percent of the country's production of palm oil. Such development has enabled the palm oil industry to be an important income earner for the state. Palm oil is the largest export earner of the state in the agricultural commodity sector. In view of its economic importance, the state government is continuously seeking ways to maintain its share of export earnings in the Sabah and Malaysian economy.

The objective of this paper is to formulate a supply and demand model of the Sabah palm oil industry. It is hoped that the model will provide a framework to analyse the effect of the important variables in the industry. The major variables of the industry, whose relationship is yet to be empirically established, are (i) production, (ii) domestic utilisation, (iii) exports, (iv) price of palm oil, (v) price of the substitutes, (vi) labour cost, (vii) world utilisation, (viii) exchange rate adjustments and (ix) interest rate.

MODEL

The model specification in this study is based on the dynamic econometric market model for storable commodities [(Labys, (1973), (1975); Adams and Behrman (1978)]. The structural model consisting of supply (Q_t), demand (C_t) and supply equals demand ($Q_t = C_t$) as market equilibrium conditions, is as follows:

$$Q_t = q(P_t, P_{t-j}, Z_t, Q_{t-1}, \varepsilon_t) \quad (1)$$

$$C_t = c(P_t, P_{t-j}, Y_t, Z_t, C_{t-1}, \varepsilon_t) \quad (2)$$

$$Q_t = C_t \quad (3)$$

Where;

Q_t = supply of commodity
C_t = demand for commodity
P_t = price of commodity
P_{t-j} = lagged j period
Y_t = income
Z_t = other exogenous variables

ε_t = stochastic error term (i = 1, 2)
j = 1 , 2 , 3 , ..., n .

The first two equations are supply (Q_t) and demand (C_t) respectively. They are postulated to be a function of price (P_t) and relevant predetermined variables (P_{t-j} , Y_{t-1} , Z_t , Q_{t-1} , C_{t-1}). The third is the market equilibrium condition.

The total quantity of palm oil demanded is not resolved within the domestic market as a large portion of this quantity is exported to foreign markets. In adapting the above model to include foreign trade, an export demand equation has been introduced into the model. Thus, the demand equation is made up of two equations explaining domestic and export demand.

DOMESTIC SUPPLY OF PALM OIL

The specification of the domestic supply response is based on the model developed by Mohammad Alias *et al*, (1987). This model is an improvement over earlier models developed by Nerlove, [(1958); Labys, (1973, 1975); Wickens and Greenfield (1973) and Adams and Behrman, (1978)] in that it treats the tree stock as capital explicitly and it constrains the harvesting decision by the existing productive capacity.

Briefly, the Mohammad Alias *et al* model consists of two equations:

$$Y1_t = f(P_{ti} , P_{tj} , R_{ti} , \varepsilon_{1t}) \quad (4)$$

$$Y2_t = f(Y1_t , X_t , \varepsilon_{2t}) \quad (5)$$

Where;

$Y1_t$ = matured hectarage
$Y2_t$ = production
P_{ti} = price of input i
P_{tj} = price of the other input
X_t and R_{ti} = other exogenous variables

F_t = quantity of fertilizer ('000 kilogram per hectare)
TIME = time trend proxy for technology

$b_1 > 0$, $b_2 > 0$, $b_3 > 0$, $b_4 > 0$

DEMAND FOR PALM OIL

Demand for palm oil is a derived demand as it is used as an input in the production of intermediate and final products. Thus, the demand equation is derived based on the theory of the firm. It is specified as follows:

$$Q_i = f(P_i , P_{yi}) \; i = 1 , 2 , 3 , ..., n \qquad (8)$$

Where:

Q_i = quantity of input i demanded
P_i = prices of input i and related input
P_{yi} = price of output

Thus, the domestic demand for palm oil can be specified as:

$$\log PDPO_t = c_0 + c_1 \log PO_t + c_2 \log PKP_t + c_3 \log HSB_t + c_4 \log KNK_t + c_5 \log JP_t + c_6 \log PDPO_{t-1} + \varepsilon_{3t}) \qquad (9)$$

Where;

$PDPO_t$ = domestic demand for palm oil (million tonnes)
PO_t = domestic price of palm oil (RM/Kg)
PKP_t = domestic price of copra (RM/Kg)
HSB_t = price of final goods proxied by average price of soap (RM per unit)
KNK_t = gross domestic product of Sabah (RM per year)
JP_t = total population of the Sabah (million persons)
$PDPO_{t-1}$ = domestic demand for palm oil lagged 1 year (million tonnes)

$$c_1 < 0\ ,\ c_2 > 0\ ,\ c_3 > 0\ ,\ c_4 > 0\ ,\ c_5 > 0\ ,\ c_6 > 0$$

The price of final products is proxied by the average price of soap. Since palm oil as a raw material is used by industries, the demand for palm oil is expected to increase with increased demand for soap. The price of palm oil is expected to be negatively related to the quantity demanded for palm oil. As in other studies such as Mad Nasir Shamsudin *et al* (1993) and Zulkifli Senteri *et al* (1987), palm oil is assumed to be a substitute input for copra oil in some uses, thus its cross price elasticity coefficient is anticipated to be positive.

In the case of export demand for palm oil, its specification is similar to that of the domestic demand:

$$\log PLPO_t = d_0 + d_1 \log EPX_t + d_2 \log PXSB_t + d_3 \log WPOC_t + d_4 \log KPP_t + d_5 \log PLPO_{t-1} + \varepsilon_{4t} \qquad (10)$$

Where;

$PLPO_t$ = export demand for palm oil ('000 tonnes)
EPX_t = export price of palm oil (RM per tonnes)
$PXSB_t$ = price of soya bean oil (RM per tonnes)
$WPOC_t$ = world palm oil consumption (million tonnes)
KPP_t = exchange rate (RM/US$)
$PLPO_{t-1}$ = export demand of palm oil lagged 1 year ('000 tonnes)

$$d_1 < 0\ ,\ d_2 > 0\ ,\ d_3 > 0\ ,\ d_4 > 0\ ,\ d_5 > 0$$

Since palm oil is a raw material used by industries, the demand for it is expected to increase with increased industrial activity. Soya bean oil is assumed to be a substitute input for palm oil in some uses. Thus, its cross price elasticity coefficient is anticipated to be positive. The coefficient of exchange rate variable is expected to be positive. An increase in the exchange rate would mean that palm oil is relatively cheaper, leading to an increase in the demand for it. The economic activity of the

processing sector for palm oil is represented by the world palm oil consumption.

CLOSING IDENTITY

The model is closed by an identity which defines the market clearing condition:

$$Q_t = PDPO_t + PLPO_t + \Delta S_t \qquad (11)$$

Where;

ΔS_t = change in the domestic stock of palm oil in metric tonne

DATA SOURCES

The data used in this research are time series data for 1970 to 1996. The data are obtained from different publications and formal sources which include Products Statistics, Ministry of Primary Production, Malaysian Foreign Commerce Statistics, *Profile* Malaysia's Primary Commodities, Oil Palm, Cocoa and Coconut Statistics Information Book, The Malaysia, The Prices of Selected Products by FAMA Products Directory, Economics Reports from the Ministry of Finance Malaysia, Yearly Reports from "Bank Pertanian Malaysia", Department of Statistics, Malaysia (Sabah Branch), Palm Oil Registration and Licencing Authority Malaysia (PORLA), Department of Agriculture, Malaysia (Sabah Branch), International Financial Statistics by International Monetary Fund (IMF) and the Seventh Malaysia Plan (1996 - 2000).

EMPIRICAL RESULTS

The selection of the variables in the equation specification is based on the theory, statistical, econometrical characteristics which are right cohesion marks, the significant informative

variables R^2, the F value and Durbin - Watson (DW) and Durbin h statistics.

The Matured Area Size: The results for the equation of the matured area size are as below:

$$\log MA_t = 2.1771 + 0.2896^{**} \log PO_{t-4} - 0.1449 \log CCO_{t-4} - 1.1142^{*} \log W_{t-4}$$

(0.374) (2.453) (-1.345) (-1.895)

$$- 0.4163^{**} \log BLR_{t-4}$$

(-2.283)

$R^2 = 0.9359$ F Value = 126.4 D.W = 1.826

The numbers in bracket are t-values.

* Significant at the 10 percent level

** Significant at the 5 percent level

The results show that the matured area size of oil palm can be explained by the price of palm oil, the price of dried cocoa beans, labour cost and loan interest rate for the agricultural sector. All these informative variables are in the form of four-year delayed data.

From the results, the price of palm oil is significant at the 5 percent level to explain the matured area size of palm oil. The estimated elasticity of the matured area size with respect to the price of palm oil lagged 4 years is 0.2896. It means, *ceteris paribus*, for every one percent increase in the price of palm oil lagged four years, the matured area size will increase by 0.2896 percent.

This result also shows that the price of cocoa is not significant in explaining the matured area size of oil palm. The elasticity of the matured area size of oil palm with respect to the price of cocoa lagged 4 years is 0.1449. It means, *ceteris paribus*, for

every one percent decrease in the price of cocoa lagged 4 years, the size of matured area of palm oil will increase by 0.1149 percent. This result shows that cocoa is not a close subtitute crop to oil palm in Sabah. The decision of investors and cultivators in Sabah whether to plant oil palm or cocoa depends on the suitability of soil and the relative income obtained from palm oil and cocoa. The estimated equation also indicates that labour cost is very important in explaining the size of oil palm plantation. The labour cost variable is significant at the 10 percent level. This result has been expected because more than 55 percent of the production cost of palm oil goes to labour cost. The elasticity of the matured area size of oil palm to labour cost lagged 4 years is -1.1142. It means that, *ceteris paribus*, for every one percent increase in the labour cost lagged 4 years, the matured area size of oil palm would decrease by 1.1142 percent. Finally, the coefficient for the borrowing interest rate is significant at 5 percent level to explain of the matured oil palm. The estimated elasticity of the matured area size of palm oil with respect to the interest rate for loan is -2.283. It means, ceteris paribus for every one percent increase in the interest rates for loan for the past four years, the size of matured palm oil area will decrease by 2.283 percent.

Production: The results for the estimation of the production equation are as below:

$$\begin{aligned}\Lambda \qquad\qquad & \qquad\qquad ** \qquad\qquad\qquad\qquad *** \\ \log Q_t = -2.8183 &+ 1.8962 \log MA_t + 0.4113 \log L_t + 1.3812 \log F_t \\ (-1.988) &\quad (2.741) \qquad\quad (1.506) \qquad\quad (3.112) \\ & \qquad\quad ** \\ &+ 0.1523\ TIME \\ & \quad (2.834)\end{aligned}$$

$R^2 = 0.9777$ F Value = 196.9 D.W = 1.909

Notes:

The numbers in bracket are t-values

** Significant at the 5 percent level

*** Significant at the 1 percent level

The above estimated result shows that the production can be explained by the size of the matured area, labour cost, quantity of fertilizers and technology. The estimation result shows that the matured area size is an important factor for the production of oil palm. The matured area size coefficient is significant at the 5 percent level. The estimation elasticity of production with respect to the matured area size is 1.8962. It means, ceteris paribus for every one percent increase in the matured area size, the production will go up by 1.8962 percent. The elasticity of production to matured area size may be caused by the capability of the investors or cultivators to react to changes. In the process of palm oil production, especially in the estate sector, it depends on the paid labourers who have strong labour union support.

The result also shows that the coefficient for quantity of fertilizer is significant at the 1 percent level to explain the palm oil production. The estimated elasticity of palm oil production to fertilizer quantity is 1.3812. It means that the production of palm oil is elastic to fertilizer quantity.

Advancement in technology also affects production. The above mentioned results also indicate that in the period of the research, the development in technology had increased the production at the level of 0.1523 times per year. This explains that the oil palm cultivation sector had adjusted its production by 0.1523 times from the planned production every year. This adjustment is quite high and may be caused by usage of high yielding oil palm clone trees that produce more palm oil. Moreover, the estate sector normally practises the latest management style and adopts new technology compared to small orchard cultivators. Technology is significant at the 5 percent level.

Domestic Demand for Palm Oil

The results of the estimated domestic demand for palm oil are as below:

$$\underset{\Lambda}{\log PDPO_t} = \underset{(-2.381)}{-6.3946} \underset{(-2.066)}{- 0.1134 \log PO_t^{*}} + \underset{(0.474)}{0.0333 \log PKP_t} + \underset{(1.720)}{1.1062 \log HSB_t^{**}}$$

$$+ \underset{(2.570)}{1.2433 \log KNK_t^{**}} + \underset{(1.877)}{0.2493 \log JP_t^{*}} + \underset{(2.430)}{0.5254 \log PDPO_{t-1}^{**}}$$

$R^2 = 0.9979$ F Value = 165.4 Durbin h = 0.527

Notes:

The numbers in bracket are t-values

* Significant at 10 percent level

** Significant at 5 percent level

The results of the estimation show that the domestic demand of palm oil can be explained by palm oil price, price of copra, average price of soap, gross domestic production, population and domestic demand of palm oil lagged 4 years.

From the result, the estimated elasticity of the domestic demand for palm oil to oil palm price is -0.1134. The elasticity of domestic demand for oil palm to price of copra is 0.0333. It explains that domestic demand for palm oil is not elastic to palm oil price and price of copra. It means that for every one percent increase in the price of palm oil, *ceteris paribus*, the domestic demand for palm oil will decrease by 0.1134 percent while domestic demand for palm oil will increase by 0.333 percent for every one percent increase in price of copra. The estimated

coefficient for palm oil price is significant at the 10 percent level.

The above mentioned results show that the local average price of soap is important in deciding the domestic demand of palm oil. The estimated coefficient for the local average price of soap is significant at the 10 percent level. The estimated elasticity of demand for palm oil to local average price of Soap is 1.1062. It means, *ceteris paribus* the domestic demand for palm oil will increase by 1.1062 percent for every one percent increase in the local average price of soap. The above results also show that gross domestic production is significant at the 5 percent level. The estimated elasticity of domestic demand for palm oil to gross domestic production is 1.2433. It explains that domestic demand for palm oil is elastic with respect to gross domestic production. It means that for every one percent increase in the gross domestic production, domestic demand for palm oil will increase by 1.2433 percent.

The estimated coefficient for the population variable is significant at the 10 percent level. The estimated elasticity of domestic demand for palm oil to population is 0.2493. It implies that the domestic demand for palm oil is not elastic to the size of the population. It means that for every one percent increase in the population size, the domestic demand for palm oil will increase by 0.2493 percent. The results also show that the adjustment level is quite moderate. The domestic demand for palm oil has adjusted to about 52.5 percent from the original planned demand for each year. The estimated coefficient for the domestic demand for palm oil lagged one year is significant at the 5 percent level.

Foreign Demand for Palm Oil (Export)

The results of the estimation of the foreign demand for palm oil are as below:

$$\log PLPO_t = \underset{(-0.460)}{-0.5689} - \underset{(-2.490)}{0.1858}^{**} \log EPX_t + \underset{(0.943)}{0.1048} \log PXSB_t + \underset{(1.795)}{0.1366}^{*} \log WPOC_t + \underset{(2.580)}{1.2938}^{**} \log KPP_t + \underset{(7.519)}{0.9709}^{***} \log PLPO_t$$

$R^2 = 0.9705$ F Value = 112.1 Durbin h = 0.843

Notes:

The number in brackets are t-values.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

The estimated results mentioned above indicate that the changes in foreign demand for palm oil can be explained by the export price of palm oil, soya bean price, total global consumption or demand for palm oil, exchange rates between the Malaysian Ringgit and the US dollar and lagged foreign demand for palm oil.

The results also show that the export price of palm oil is significant at the 5 percent level. The estimated elasticity of foreign demand for palm oil to export price of palm oil is -0.1858. It is inelastic, showing that for every one percent increase in export price of palm oil, foreign demand for palm oil will decrease by 0.1858 percent.

The estimated elasticity of foreign demand to the price of soya bean is 0.1048. It means that foreign demand is not elastic to soya bean price. For every one percent increase in the price of soya bean, foreign demand for palm oil will increase by 0.1048 percent. From the results, the estimated elasticity of the foreign demand of palm oil to world palm oil consumption is 0.1366. The world palm oil consumption variable is significant at the 10 percent level, but it is not elastic. It means that for every one percent increase in the world palm oil consumption, the foreign demand for palm oil will increase by 0.1366 percent.

The results also show that the exchange rates between the Malaysian Ringgit and the US dollar is significant, at the 5 percent level in explaining the changes in foreign demand. The estimated elasticity of foreign demand to exchange rate is 1.2938. It is elastic, showing that for every one percent increase in exchange rate, *ceteris paribus*, foreign palm oil demand will increase by 1.2938 percent. The above result also indicates that the adjustment rate is moderate at 0.9709. This means export demand for palm oil has been adjusted by 97.1 percent from lagged foreign palm oil demand. This variable is significant at the 1 percent level.

EVALUATION OF THE MODEL

A major criteria which is used to evaluate a model is the fit of individual variables in a simulation exercise. The measures which are often used in this context are the Root Mean Square Error (RMSE), Root Mean Square Percent Error (RMSPE) and Theil's Inequality Coefficient or U statistics which are as below:

a) $$\text{RMSE} = \sqrt{\frac{1}{N}\sum_{t=1}^{N}(Y_t^s - Y_t^a)^2}$$

b) $$\text{RMSPE} = \sqrt{\frac{1}{N}\sum_{t=1}^{N}(Y_t^s - Y_t^a)^2 / Y_t^a \times 100}$$

Where;

Y_t^s = simulated value of Y_t
Y_t^a = actual value
N = number of periods in the simulation

Both the above mentioned statistical methods measure the deviation in relation to the true value. If the value is small, it means that the estimated value is more accurate. The results of the our simulation exercise with respect to RMSE and RMSPE are shown in Table 1 below:

TABLE 1
SIMULATION STATISTICAL RESULTS

Equation	RMSE	RMSPE
The matured Area Size (MA)	0.1377	1.0146
Production (Q)	0.1345	1.0304
Domestic Demand of Palm Oil (PDPO)	0.0455	0.4163
Foreign Demand of Palm Oil (PLPO)	0.0630	0.9404

Theil's Inequality Coefficient method can also be used to measure the accuracy of the model besides RMSE and RMSPE. It is given by:-

$$U = \frac{\sqrt{\frac{1}{N}\sum_{t=1}^{N}(Y_t^s - Y_t^a)^2}}{\sqrt{\frac{1}{N}\sum_{t=1}^{N}(Y_t^s)^2} + \sqrt{\frac{1}{N}\sum_{t=1}^{N}(Y_t^a)^2}}$$

Theil's Inequality Coefficient measures the accuracy of the model and estimated by comparing the simulation value (Y_t^s) and true value (Y_t^a) of the endogenous variable. The value of U falls between 0 and 1. If U = 0, the capability of the model to estimate is perfect.

Theil's Inequality Coefficient can be divided into three main evaluations called proportions of inequality which are U^m, U^s and U^c. U^m and U^s are used to measure the differences in estimated values and true values. If U^m and U^s are small (closer or equal to 0), it means the model which has been used is considered good. As for the U^c value, if the value is closer to 1 or equal to 1, the model is considered good and the estimated value is also accurate (*Pindyck & Rubinfeld; 1992*). The results regarding the Theil's Inequality Coefficient or U statistics are shown in Table 2.

TABLE 2
SIMULATION STATISTICAL RESULTS

Equation	U	U^m	U^s	U^c
MA	0.005	0.000	0.004	0.966
Q	0.005	0.000	0.007	0.993
PDPO	0.001	0.000	0.000	1.000
PLPO	0.004	0.000	0.003	0.997

With;

U = Theil's Inequality Coefficient
U^m = Fraction of error due to bias
U^s = Fraction of error due to different variation
U^c = Fraction of error due to different covariance

However, there are also other methods that can be used to measure the accuracy of the simulation such as measuring the

capability of the model to reach the turning points of the actual data. For the time being, data for the period 1970 - 1996 were used; one simulation had been carried out to see the capability of the model to reach the historical data. The results from **Figures 1** and **4** show that base line simulation results can track the true value. Based on the above mentioned three criteria, this model can be considered as a valid model and can be used for the other simulations.

FIGURE 1
SIMULATION OF MATURED HECTARAGE, 1970-1996 ('000 HECTARE)

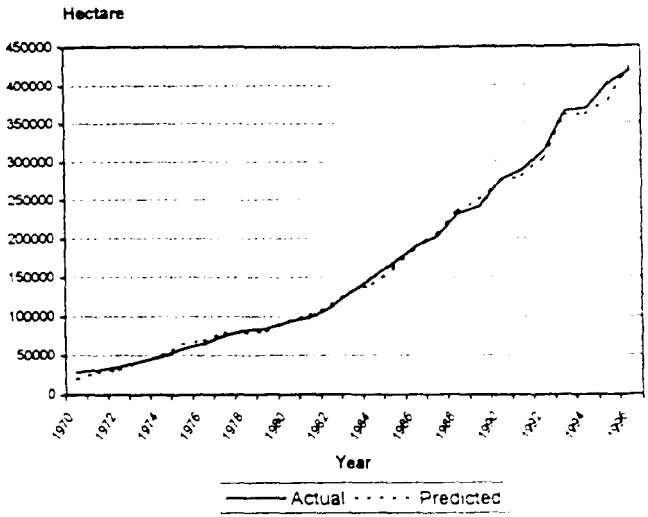


FIGURE 2
SIMULATION OF PALM OIL PRODUCTION, 1970-1996 ('000 METRIC TON)

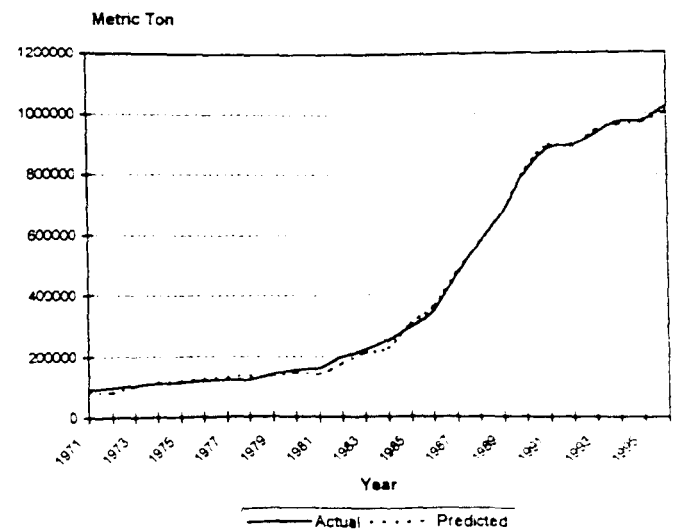


FIGURE 3
SIMULATION OF DOMESTIC DEMAND FOR PALM OIL, 1970-1996
('000 METRIC TON)

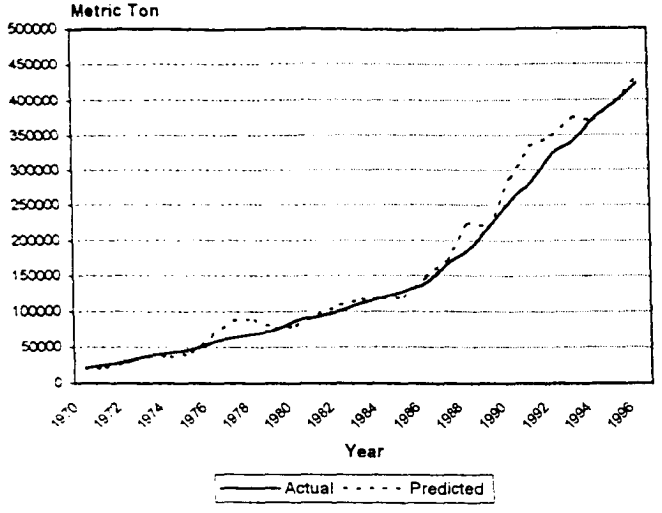
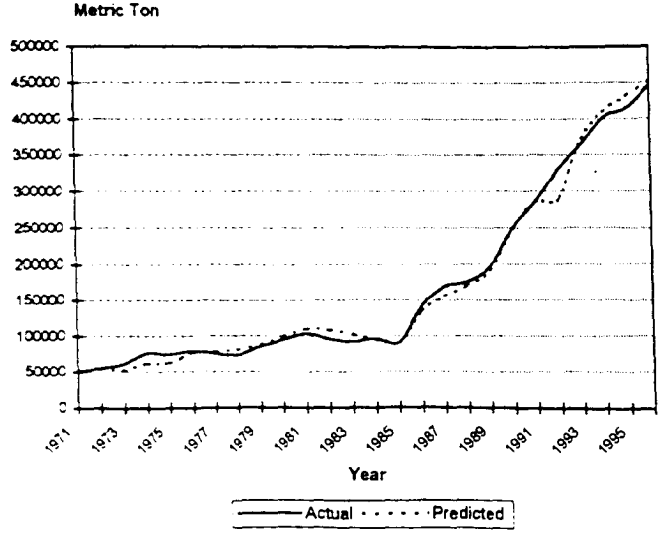


FIGURE 4
SIMULATION OF EXPORT DEMAND FOR PALM OIL, 1970-1996
('000 METRIC TON)



SUMMARY AND POLICY IMPLICATION

As a whole, the equations of the model reflect the palm oil industry satisfactorily. As for the supply of palm oil, the research results show that palm oil price, the price of dried cocoa beans, labour cost and the loan interest rate are important in explaining the changes in the hectarage of matured oil palm. Meanwhile, the hectarage of matured oil palm areas, number of labourers, the quantity of fertilizers used and technology are all important factors that contribute to the output of oil palm seeds and eventually, palm oil. This research also explains that the production of oil palm seeds is influenced rather substantially by the hectarage of matured area. This can be seen through the value of elasticity for production against the matured hectarage which was 1.8962. It means that, for one percent increase in the hectarage of matured area production will increase by 1.8962 percent. Therefore, practical steps to increase production should be taken either in the estate sector or smallholdings, through optimum usage of labour power to produce quality seeds which can produce palm oil at an optimal level. Besides that, the quantity of fertilizer used must also be done effectively with optimum usage and followed by technological advancement. The palm oil industry is important to Sabah's economy. This is clearly seen in the increasing hectarage of matured area, increased production and consumption. Thus, the stability of the palm oil industry in Sabah depends much on how far this industry can be modernised and the capacity to increase production and consumption.

Development activities must be up-graded to ensure modern technological and management practices can be carried out, not only in the estate sector but also in the smallholdings. Through this, the production adjustment rate could be increased. In its effort to achieve the target, the government needs to provide suitable incentives for the growth of the palm oil based industry and to formulate and implement a complete and suitable policy. This is because there are small and medium-sized firms which produce product from palm oil for both local and foreign

markets, for instance, the production of palm oil-based household products.

The results of this research put foward a number of policy implications. The palm oil industry contributes significantly to Sabah's income, workforce and the socio-economic development. In order to ensure the survival and continued growth of the palm oil industry in Sabah, several measures should be taken. This research provides empirical evidence that labour problems pose a serious threat to the palm oil industry in Sabah. The problems pertaining to increasingly high labour costs, of local labour and the reliance on foreign labour. Therefore, research and development (R&D) should look into technology improvement in the palm oil production that can decrease the number of labourers needed. The loan interest rate of the agriculture sector needs to be fixed at a level where palm oil manufacturers can maintain their competitiveness. The solution to the labour cost and technology that can reduce the number of labourers and affordable loan interest rate will help to define the investment environment in the palm oil industry in Sabah more efficiently.

The research also shows that the output of palm oil is influenced by the increase in the matured hectarage area. This can be seen through the elasticity value of production with respect to the matured hectarage which was 1.8962. Therefore, the practical measures to increase total production of palm oil, whether in the estate sector or small plantation holdings are to optimize the use of labor and the amount of fertilizers, as well as to improve technology. Size of cultivated areas, production capacity and consumption of the commodity influence the output of palm oil industry. The strength of the palm oil industry in Sabah will depend on how the industry modernize its management skills, increase consumption and improve production methods.

Efforts should also be made to increase the rate of consumption of domestic palm oil. Based on the elasticity value of the domestic average price of soap at 1.1062, for example, it can be

seen that the growth of firms in the local palm oil industry largely depends on the domestic demand for palm oil products. Therefore, in the long term, any undesirable changes in the demand for these products and the country's economic growth, will have an income impact on the consumption of palm oil.

The research also shows that foreign demand for palm oil is effected by the exchange rate between the Malaysian Ringgit and the US dollar and world palm oil demand. Therefore, increasing activities in the production and processing of palm oil-based products by foreign firms can also encourage the increase in the export demand for palm oil.

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