Price Dynamics of Malaysian Palm Kernel Expeller

Ahmad Borhan A Nordin*; Mohd Arif Simeh* and Faizah Mohd Shariff*

ABSTRACT

The price of palm kernel expeller (PKE) moves at the lower range as compared to other oilmeals, particularly soyabean meal. The main use of PKE as ingredients in ruminant feedstuff does not fetch a good price for PKE due to the highly competitive world oilmeals market. Applications of PKE in the food sector with technology advancement provide some hope for PKE to obtain a better price in the future. The widening uses and the improved quality of PKE will improve the market of PKE either locally or internationally.

INTRODUCTION

The price level of palm kernel expeller (PKE) is influenced by a variety of market forces that can alter the current or expected balance between supply and demand. Global market conditions are more significant than domestic market since PKE is largely exported to foreign market rather than consumed locally. Many of these forces emanate mainly from feed and industrial-use markets, which include consumer preferences and the changing needs of end users, factors affecting the production processes (*e.g.* input costs, technology, *etc.*), relative prices of meals that can substitute in production of feedstuffs; government policies; and factors affecting storage and transportation.

The commercial value of PKE is derived from its importance as a source of protein and energy that can be utilized either as a single feed, with only minerals and vitamins supplementation, or combined with other feedstuffs. The world disappearance of PKE had doubled from 2.33 million tonnes (MnT) in 1995 to 4.78 MnT in 2005. The substantial growth proves that PKE is demanded worldwide due to its consistent availability and its competitive price, which is favoured by compound feed manufacturers that are looking for cheaper protein and energy sources. On top of that, PKE is produced through mechanical screw pressed method that excludes any chemicals and it is also acknowledged as genetically modified organism (GMO)-free product.

The supply of PKE has increased steadily over the years corresponding to the output of palm kernels, which is related to the rising production of oil palm fruits. The production of palm kernels has increased by 12.8% per annum in the eighties and slowed down to 4.5% per annum in the nineties, and 4.3% in recent years. Consequently, the production of PKE had increased from 0.28 MnT in 1980 to 1 MnT in 1990, 1.6 MnT in 2000 and had surpassed 2

* Malaysian Palm Oil Board,
P. O. Box 10620,
50720 Kuala Lumpur,
Malaysia.

MnT in 2005. The ending stock of PKE that fluctuated in the range of 100-150 thousand tonnes in early nineties had climbed up also to be hovering between 200-250 thousand tonnes in recent years.

On the demand side, Malaysian PKE has been exported to many countries worldwide. Previously, European countries such as Netherlands and Germany were major market with combined export share in between 75% - 90%, but in 2006, the market had broadened to countries like South Korea, Vietnam and New Zealand and others with export market share nearly 40%. The annual growth rate of export had decelerated from nearly 14% in the eighties to 3.7% in the nineties, but had bounced back to 6.8% per annum since year 2000. In terms of volume, the export of PKE had increased from 0.26 MnT in 1980 to 0.87 MnT in 1990 and had exceeded 2 MnT in 2005.

The domestic demand for PKE is rather small and mostly comes from the ruminant industry, which is not well developed in Malaysia and mainly operated by smallholder farmers (Loh, 2004). The system of production normally depends on native pasture and only supplemented with PKE. The domestic demand had reduced from more than 300 thousand tonnes in the nineties to less than 100 thousand tonnes in recent years.

The price of PKE moves according to other oilmeals prices, particularly soyabean meal's price, which is the dominant oilmeal in the world market. The decreasing prices of oilmeals in 1997 to 2002 period was mainly due to higher supply of oilmeals, particularly soyabean meal from Brazil and Argentina and also increasing supply of PKE from Indonesia that suppressed the price of oilmeal, including PKE. In addition, frequent incidence of mad cow disease and avian flu in several countries lowered the demand of oilmeals and had worsened the situation. Later, when those diseases were under control, the demand for oilmeals had also recovered, thus promoting oilmeals prices to a better position.

In the past, particularly before 1997, the price of PKE was more than USD 100/t, but it kept falling and even plummeted to USD 61/t in 2001. The price remained between USD 60 – USD 80/t for about five years, which downgraded the value of PKE. However, the price went up slightly to USD 82/t in 2005 due to tight supply of soyabean meal and grains, and then exceeded USD 100 level to USD 150/t in early 2007. Global market forces triggered the price of PKE to reach favourable level, but these factors were unmanageable as well as unpredictable.

Alternatively, a better price of PKE can only be ascertained by increasing its local demand in other sectors such as food or energy sectors in order to withstand the vagaries of the world market. The possibility of diversifying the uses of PKE will provide better demand for PKE, thus promoting its price to a better level. However, the new demand for PKE must be sufficiently large in order to give a positive and significant impact to the price of PKE.

OBJECTIVE

The main objective of the study is to analyse the price of PKE and its underlying factors, which include supply and demand factors. Secondly, the study looks also at the possibility of promoting the price level of PKE by increasing its demand from other sector, particularly food sector.

METHODOLOGY

The study relates prices to ending stocks, which is derived from an equilibrium model for competitive markets with inventories. The model had been applied in determining corn and wheat price (Westcott, 1999).

For annually produced commodities, supply is a function of the previous year's price, but commodities from perennial crops such as oil palm's products, supply is rather inelastic towards previous price. However, demand for commodities is a function of prices in the current period and previous year, particularly export demand, which is a function of lagged prices to reflect supply response. Normally, supply is positively related to expected price while demand and stocks are negatively related to price

The market clearing, equilibrium condition determines the price at which supply equals demand plus stocks. In equilibrium, prices can be determined from the inverse of the stocks function. This provides a price determination equation, with prices negatively related to stocks, as follows:

(Price equation; inverse stocks function) $p = h^{-1}(I, z)$ ---------- (1)

where p = price

I = ending stocks

z = a set of exogenous variable

The basic pricing model (Equation 1) provides a starting point for introducing adjustments that shift the pricing relationship. Additional adjustments are included in Equation 1 in order to account for global market factors as well as domestic factors that can prompt the movement of PKE's price.

The substituting effect among oilmeals is also influencing the movements of PKE price substantially. The price of soyabean meal is used to represent the world price level of oilmeal because of its dominance in the world oilmeal

consumption, which comprises nearly 70%. On top of that, it is a meal-driven seed as compared to PKE, which is oil-driven seed. The up-and-down of the soyabean meal's price will drag along prices of other oilmeals, including PKE.

Production of PKE is the major component of supply and is determined by the amount of palm kernels produced and recovery rates for both palm kernel and PKE. The recovery rate of palm kernel decreased from 5.62% in 1996 to 5.25% in 2004, which associated in part, with the nature of the planting material that was selected for higher oil content, thus reducing the kernel ratio (Nasir *et al.*, 2005). In addition, the meal recovery rate that ranges between 52% and 54% is also another factor, and it depends on type of crushing method used.

The export demand plays crucial role for PKE market since its domestic demand is rather small. Usually, higher export demand relates to lower price and *vice-versa*. Although Malaysia is currently the largest exporter of PKE, but it has a smaller share in the world oilmeal market, thus making it less dominant in determining PKE price.

In general, stocks are inversely related to the price. If total use rises relative to supply, ending stocks decrease and price tend to rise. On the other hand, if supply rises relative to total use, ending stocks accumulate and prices tend to decline.

The price of PKE is derived explicitly from feed use for animal consumption. Therefore, different use of PKE, particularly in the food sector would create structural change of PKE use, thus reduce the stock level and raise the price to a certain extent. Equation 2 includes variable PS for production, DE for export demand, and SBMP for soyabean meal's price to the general pricing model.

$$p = h^{-1} (I, PS, DE, SBMP) \text{ ---------- } (2)$$

The functional form used to estimate Equation 2 is logarithmic (double-log). PKE price model:

$$Ln(p) = a + b\ Ln\ (I) + c\ Ln\ (PS) + d\ Ln\ (DE) + e\ Ln\ (SBMP) \text{ ---------- } (3)$$

Equation 3 was estimated using annual time series data of prices of oilmeals from 1992 to 2006 from *Oil World*, while production, ending stock and export of Malaysian PKE during the same period was published by MPOB. The FOB price of PKE from 1996 to 2006 was obtained also from MPOB.

RESULTS AND DISCUSSIONS

Figure 1 shows prices of PKE in CIF and FOB basis that has been declining in the long-term as depicted by the linear trend line. Before 1997, the CIF price of PKE was hovering above USD 100/t, and dropped slowly to USD 60/t in 2001. The price rebounded back to USD 80 – USD 90/t but still did not exceed USD 100/t in 2006, but it displayed a momentum to surpass that level in the future. However, the FOB price of PKE, particularly in the period from 1997 to 2005 was moving at the lower range between USD 40 – USD 60/t, but rallied also to a higher level recently.

The difference between both prices reflects the insurance and freight charges, which was averaging about USD 30/t. In the past, the charges was approximately 40% of FOB price, but at certain occasions, the insurance and freight charges was nearly 92% of the price, which reflected low value for PKE.

Based on the regression analysis, the following results was obtained, whereby the estimated logarithmic regression for PKE price is:

$$Ln(p) = -1.176 - \underset{(0.005)}{0.554\ Ln\ (I)} + \underset{(0.082)}{1.250\ Ln\ (SP)} - \underset{(0.082)}{0.738\ Ln\ (ED)} + \underset{(0.001)}{0.927\ Ln\ (SBMP)}$$

$R^2 = 0.855$
F-value = 14.793 (0.000)
Standard error of the estimate = 0.11266
Durbin-Watson statistic = 2.042
Estimation period = 1992 – 2006

The F-value for the overall significance of the equation greatly exceeds the 1% critical value. Each coefficient has the expected sign, with negative signs for ending

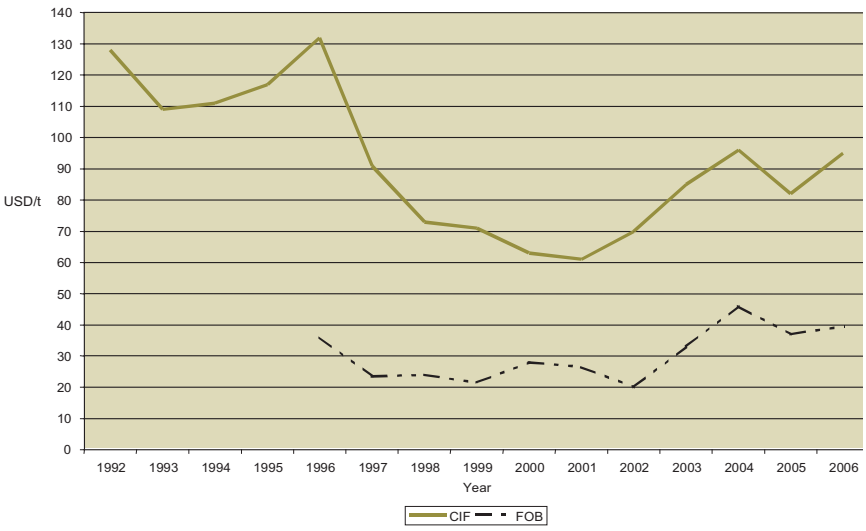

Figure 1. Palm kernel expeller prices, 1992-2006.

Sources: CIF prices (Oil World); FOB Prices, (MPOB) unpublished.

stock and export demand, while positive signs for production and soyabean meal's price. In addition, soyabean meal's price is significant at the 1% level, ending stock is significant at the 5% level, while both production and export are significant at the 10% level. The model explains about 86% of the variation in the logarithm of the prices, while the Durbin-Watson statistic indicates that first-order autocorrelation is not a problem with the equation.

Figure 2 shows a graph of historical CIF prices for PKE over the model-estimated period of 1992-2006, along with the predicted values generated by the model. In general, the price model track actual prices rather well. Most differences between the model estimates and actual prices are less than USD 16/t. For the full sample, the mean absolute error is about USD 6.50/t, with a mean absolute percentage error of about 7.3% for PKE. Hence, the predicted value from the model is considered as the baseline level for comparing purposes.

Overall, the statistical measures indicate good performance of the price model and it provide analytical framework that can be useful in price forecasting applications. Technically, 10% decrease in stock level would cause the PKE price to increase by 5.5%, which reflect that the price responses rather softly towards changes of the stock level and also to export level with flexibility less than 10%. On the other hand, the price responses more to variations in production with flexibility about 12% and also to the movements of soyabean meal price with flexibility nearly 10%.

Presently, there are more than 1000 flour-based companies, with the majority are small medium enterprises (SMEs) and few large companies producing biscuits, premium bread and premium noodles. The production of wheat flour increased from 692 300 t in 1995 to 833 100 t in 2005 with sales value increased from RM 863 million to RM 1 billion, respectively (MITI, 2006).

The bread industry in Malaysia has seen many changes, from a small-scale processing industry to a medium scale industry. The industry is flourishing at a fast pace and bread products are gaining much popularity. In addition, bread has been labelled as the most popular substitute of rice, the staple diet of Malaysians. The bakery products industry in Malaysia where baked good dominates a large share of 62%, registered a value of almost RM 2 billion in 2003 with an annual growth of RM 65 million over the previous year, and expected to grow by 4% per annum to reach RM 2.9 billion by 2006 (Ling, undated).

According to *Euromonitor* report, the Malaysia's bread market is worth RM 470 million – RM 500 million, which is smaller as compared to the bread markets in Singapore, Thailand, the Philippines and Indonesia that are worth RM 9.1 billion in total and forecast to grow at an average annual rate of more than 9%. In addition, demand for premium bread in these countries is projected to grow at 20% per annum due to demographic lifestyle changes.

The main ingredient for making bread is wheat flour, which is processed locally. However, the raw material, *i.e.* wheat is imported from Australia, US, China and India. In 2003, about 1.05 million tonnes of cereal grains were imported (wheat is the main import) and valued at RM 662.3 million. In fact, the food processing industry is dependent on imports for nearly 70% of the raw food materials used, and imports grew from RM 3.99 billion in 1999 to RM 5.85 billion in 2003.

Malaysia is a net exporter of wheat flour. The output in 2003 was 701 000 t and about 76 723 t was exported. The domestic demand of wheat flour was estimated in the range of 500 000 – 600 000 t. Wheat flour is a controlled item and its ceiling price had increased from RM 0.85/kg in 1991 to RM 1.20/kg in 2003 and RM 1.35/kg in 2007. Meanwhile, the current price of PKE is RM 506/t or simply RM 0.51/kg. Therefore, if PKE can substitute 5% of wheat flour in bread, it can reduce the cost of making bread, and simultaneously create opportunity for its price to elevate further. Furthermore, the market for PKE flour can be extended to ASEAN region,

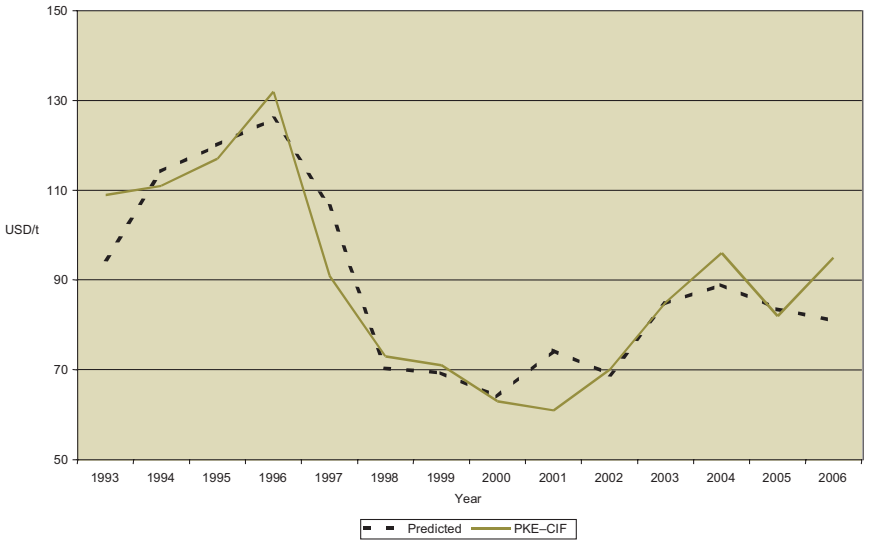

Figure 2. Actual and predicted palm kernel expeller prices, 1993-2006.

instead of concentrating in the local market only.

Based on personal communication with major bread manufacturers, an estimate total amount of 51 000 t wheat flour is utilized in bread manufacturing annually. The utilization has increased by 5% to 10% per annum in the past years. The estimated amount provides about 2550 t of PKE to replace 5% of wheat flour in the bread formulation and it constitutes approximately 1.1% of stock level in 2006.

In addition, if the premium PKE can replace 5% of wheat flour in bread, therefore it is also possible for it to be included in other wheat flour-based products. Considering on the amount of wheat flour produced in 2005, *i.e.* 833 100 t, then about 41 655 t can be replaced by PKE, or about 17.3% of the PKE stock level.

Although, the responsiveness of PKE price towards the stock level is rather moderate, nonetheless it will be significant if the amount of stock involved is quite substantial. Therefore, if the utilization of PKE in other sectors, particularly as wheat flour replacement in food sector can be realized, then it will cause the stock level to reduce, and automatically prompt the price of PKE to increase further.

Table 1 shows the impact of replacing 5% of wheat flour with PKE in bread production and also for various wheat flour products with assumptions that other factors remain constant, and the price of PKE is subjected only to the stock level.

The results shows that if the premium PKE can only replace 5% of wheat flour in bread, then approximately 2550 t of the ending stock will be utilized, resulting an increase in price. The amount is rather small, *i.e.* less than USD 1/t or only RM 1.64/t as compared to the baseline level. However, if it can replace 5% of wheat flour in any wheat flour-based products, then the increase is quite substantial, *i.e.* USD 9.17/t, or RM 30.80/t.

Table 2 shows price forecasts over a range of different reduction in stock levels as the stock equals 255 thousand tonnes. The PKE price will be above USD 90/t if the stock reduction is more than 15%, and the price will be more than USD 100/t if 30% of the stock can be reduced without interference from other variables.

The use of PKE in other sectors will benefit PKE in the long-term and make it more versatile and possibly change its trademark as ingredients for ruminants' feedstuffs to a more commercial one. Furthermore, it can upgrade the image of PKE to a higher level, thus can fetch a better price.

CONCLUSION

The price of PKE moves along the lower range but follows prices of major oilmeals, particularly soyabean meal price that moves at the upper range. PKE is considered as less preferred product, whereby it is demanded when the purchasing power among the buyers was low. This is true when the price level of oilmeals is on a higher note, thus causing the buyers to switch to PKE. However, when the purchasing power increasing due to lower oilmeals price, buyers would prefer other oilmeals to PKE. Therefore, the application of PKE must be widened and diversified locally and not just depending on the world market.

The application of PKE in the food sector, particularly wheat flour-based products can enhance the price of PKE to a certain extent. Although the benefits may be marginal based on current scenario nevertheless it will trigger more benefits in the future as its application widens.

TABLE 1. IMPACTS OF STOCK REDUCTION ON PALM KERNEL EXPELLER (PKE) PRICE

Application	Reduction of PKE stock level (t)	Increment of CIF price @ USD/t *	Increment in RM/t**
Bread	2 550	0.49	1.64
Wheat flour-based products	41 665	9.17	30.80

Notes: * Baseline level equals USD 82.43/t.
** USD: RM = 1: 3.36 (November 2007).

TABLE 2. PALM KERNEL EXPELLER (PKE) PRICE MODEL ESTIMATES FOR DIFFERENT STOCK REDUCTION LEVELS

Reduction of PKE stock level (%)	PKE price model forecast *	Difference with baseline level @ USD 82.43/t
10	87.39	4.95
15	90.20	7.77
20	93.28	10.85
25	96.68	14.24
30	100.44	18.01
40	109.40	26.96
50	121.03	38.59

Note: *Assumes level of other independent variables at year 2006.

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