Factors Affecting Fluctuations in Net Returns from the Processing of Oil Palm Fruit Bunches

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ABSTRACT

This paper attempts to elucidate factors which affect the efficiency of oil palm fruit processing in a selected palm oil mill. Three efficiency proxies are used, i.e. *revenue per tonne (RPT) of fresh fruits bunches (FFB), cost per tonne (CPT) and net revenue per tonne (NRPT), with the analysis being focused on a 30-month time series data. From the study, it was found that the RPT of the mill was positively correlated with the differentials in the oil extraction rate and kernel extraction rate (KER), differentials in crude palm oil (CPO) price as well as FFB intake. The differentials in OER and KER, in particular, were significant income generators, as they resulted in increases in RPT as high as 20% and 12% respectively. Nevertheless, both OER and KER had declined at the rate of 0.27% and 0.22% per month, respectively and the processing toll was negatively correlated with RPT by 1%, indicating the need to crosscheck the sources of RPT variability. The study also identified two causal factors, which affected CPT variability. These comprised maintenance, either major or routine, and depreciation. The study also revealed that the amount of FFB received was positively correlated with either RPT or NRPT and was found significant in reducing CPT. This implied economies of scale, as denoted by the significance of the utilization factor and workers' overtime.*

INTRODUCTION

From an investment viewpoint, a palm oil mill is often regarded as a profit centre since it generates profit margins from FFB processing. The *a priori expectation* is that a mill's productivity is correlated with the inflow of FFB because a higher FFB intake would translate into a greater profit margin. However, the profit margin can be undermined if the mill is inefficient. This occurs when the key factors of production, namely, labour, materials, energy, capital and other resources such as managerial skill are not utilized effectively. Processing slacks or inefficiencies occurring along the processing chain can, if left

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unchecked, later lead to the phenomenon of cost squeeze that can easily jeopardize the productivity and performance of the mill. These circumstances can be exacerbated by inflationary increases in costs, in a trend accentuated by the flow-on effects of an exchange rate decline (Mohd Arif,1998; PORIM, 1999; MPOB, 2000).

Theoretically, the profit margin of a palm oil mill is derived from processing charges (sometimes called processing toll), gains from oil and kernel extraction rates (OER and KER) as well as differentials in the CPO price[1]. In perfect competition where there are many sellers and buyers, to remain in business, mills have to be highly competitive and cost efficient whilst satisfying their objectives of maximizing their profit margin[2]. The presence of a cost squeeze is evident in *Figure 1* in which a particular mill shows variability ranging from RM 30 to (-) RM 35 in its NRPT[3] even at a time when the CPO market price was bullish in 1997-1999. Variability in the NRPT equates to business risk susceptibility and it is worse when the CPO price is low. The situation is even more difficult for this kind of mills in 2001 as well as in 2002, with a lower CPO price (compared to that of 1997-1999) to barely cover the production cost (Mohd Arif, 2000). According to MPOB (2002), there were eight mills that ceased operation in 2001 involving 1.8 million tonnes FFB capacity per annum. To remain competitive, therefore, it is necessary for the mills in operation to rectify the probable cost-squeeze factors to ensure optimal relocation of resources (Gopal, 1989; 1992a,b). This paper is an attempt to highlight mill competitiveness by elucidating the significant factors which lead to fluctuation in the net return for FFB milling.

METHODOLOGICAL FRAMEWORK

A particular mill was selected from the case study of three palm oil mills, which were earlier studied by Mohd Arif (2000). A 30-month time series data covering the period January 1997 to June 1999 was collected from that mill. The mill fitted the profit centre model as it was centrally run and managed by a subsidiary company.

Using the *a priori expectation* from a profit centre, the return from the processing of FFB is a function of the FFB intake; *i.e.*:

$$RPT = fn\ (FFBr) \qquad (1)$$

where RPT = return per tonne of FFB processed, and
FFBr = volume of FFB recieved

Hypothetically, FFB intake maximization must take place in order to fully utilize the capacity of the mill. This thereby optimizes RPT. Nonetheless, such a profit maximization objective is subject to the operational backlog and working hours. For the mill to remain efficient, RPT maximization objectives must be made through a combination of viable OER/KER and processing toll packages. It involves a skilled decision-making process at the mill-gate, which is central to the overall financial optimization of the mill. It must be complemented with efforts to achieve the economies of scale, such as optimal working hours and overtime, to fully utilize the milling capacity. Therefore, the RPT function of the particular mill is shown as:

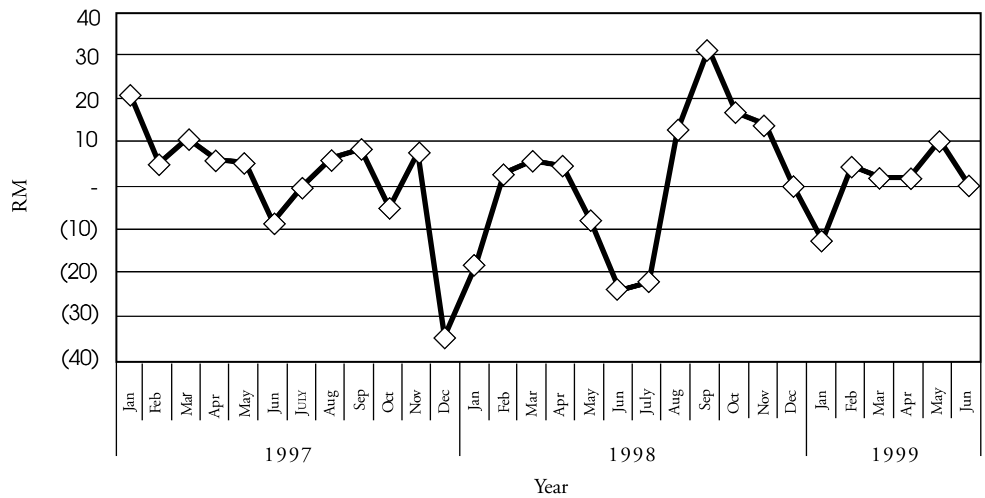

Figure 1. Net monthly return of a mill (RM).

[1] A contract is normally made between a palm oil mill and the respective FFB suppliers, which spells out the amount of FFB processing charge over the contract period. On the day of delivery, the OER and KER (from which FFB price is quotes) are awarded to the suppliers soon after quality examination is done at the receiving ramp.

[2] It occurs at a point when its RPT collectively offset its unit cost; *i.e.* cost per tonne (CPT).

[3] The trend was discovered from a case study of three palm oil mills, studied earlier by Mohd. Arif (2000).

RPT = *fn* (OER-D, KER-D, PT-D, FFBr, CPOP-D, KEP-D,
W-H, UF, OVER, OI, Q) (2)

where
OER-D = OER differentials
KER-D = KER differentials
PT-D = processing toll differentials
FFBr = FFB received
CPOP-D = CPO price differentials
KEP-D = kernel price differentials
W-H = working hours
UF = utilization factor
OVER = overtime
OI = other incomes
Q = FFB quality

On the cost side, milling efficiency is achieved through cost minimization strategies. The cost minimization objective is further affected by not only the fixed costs, but other varible costs as well. The variable costs, in particular, change according to changes in FFBr. They obviously include FFB intake related cost items such as cess, management fees[4], processing cost, sales commission[5], fuel, chemicals, overtime, effluent control, overtime, labour, utilization factor, *etc*. For this mill, therefore, the CPT function is written as:

CPT = *fn* (FFBr, WH, UF, PPC, MF, MM, RM, PPC, SC, PC, TC, D, VEM, OVER, F, C, S)(3)

where:
W-H = working hours
UF = utilization factor
PPC = cess
MF = management fees
MM = major maintenance
RM = routine maintenance
PC = purchase commission
SC = sales commission
TC = total cost
D = depreciation
VEM = vehicle maintenance cost
OVER = overtime
F = fuel
C = chemical
S = salary

Milling efficiency can be measured by the ratio of the value of CPO output generated to the value of inputs consumed, *i.e.*

Efficiency = output/ input (4)

To remain competitive, a mill has to be efficient by having an efficiency ratio greater than one. Therefore, the efficiency of the mill refers to the net return from the processing of a unit of FFB (net return per tonne, or NRPT). As mentioned above, there are other factors as well which affect both the revenue and cost components leading to combined effects on the profit margin. Thus, NRPT can be written as:

NRPT = *fn* (RPT, CPT) (5)

RPT = 15.543 + 19.671 OER-D - 0.914 PT-D + 12.343 KER-D
(3.625) (12.657) (8.374) (4.486)
+ 0.000086 CPOP-D + 0.0006699 FFBr-OWN
(2.477) (2.193)

R^2 = 0.947
Adj R^2 = 0.897
F = 41.778
DW = 1.67

RESULTS AND DISCUSSION

The regression results of the RPT function are satisfactory in terms of goodness of fit, with a high R^2 of 0.947. The variables having significant t-values are of *a priori expectations*. As postulated earlier, the RPT of the mill is positively determined by the differentials in the OER (OER-D) and KER (KER-D). A 1% increase in the OER and KER differentials increases the RPT by 20% and 12%, respectively. It shows that both variables are prime income earners of the mill. Apart from that, RPT, to a lesser extent, is also positively correlated with the differentials in CPO price (CPOP-D) and FFB received from the mill's own source (FFBr-OWN). Both the differentials in the CPO price and FFB received (own crop), respectively, lead to a 0.00009% and 0.0007% change in RPT. The result also shows that the mill-gate decision process on processing toll has significant effects on revenue. A 1% decline in processing toll (PT) leads to a 0.9% decrease in RPT.

The CPT function, which yields an equally high R^2 of 0.991, shows that four significant causal factors affect its variability. These comprise the processing cost (PC), major maintenance (MM), management fees (MF) and depreciation (D). A 1% increase in each of PC, MM, MF and D, respectively, leads to a 0.0004%, 0.00003%, 0.0000339% and 0.00005%

[4] The management fee is terminologically a monthly payment to headquarters and amounts to RM 21 per tonne CPO.
[5] The mill also incurs a monthly cost to headquarters (1.5% in value terms) for every tonne of FFB that it purchases.

increase in CPT. Although the percentages are small, they are nevertheless significant in explaining the variability in CPT. As postulated earlier, the total FFB received (FFBr-T) is negatively correlated with CPT, and this implies that an increase in FFBr can lead to economies of scale in FFB milling. This is further re-affirmed by the utilisation factor (UF), which gives a negative sign. A 1% increase in FFBr-T leads to a 1.9% reduction in CPT, and similarly, a one-percentage increase in UF reduces CPT by 0.08%.

$$\begin{aligned} CPT = \; & 44.681 + 0.99993685\ PC - 0.001884 FFBr\text{-}T - 0.07758\ UF \\ & (13.388) \quad (26.464) \quad (24.744) \quad (3.147) \\ & + 0.00003383\ MM + 0.00003392\ MF + 0.00004878\ D \\ & (4.733) \quad (3.176) \quad (2.965) \end{aligned}$$

R^2 = 0.991
Adj R^2 = 0.982
F = 214.954
DW = 1.818

$$\begin{aligned} NRPT = \; & -4.802 + 18.386\ OER\text{-}D + 11.043\ KER\text{-}D \\ & (0.579) \quad (12.95) \quad (4.181) \\ & - 0.0001269\ D + 0.168\ UF \\ & (2.674) \quad (2.563) \end{aligned}$$

R^2 = 0.956
Adj R^2 = 0.913
F = 65.808
DW = 1.803

Finally, in the NRPT function, it is shown that the differentials in both OER and KER (OER-D and KER-D) are significant contributors to profit margins. A 1% increase in both OER-D and KER-D leads to a 18% and 11% increase in NRPT, respectively. It was also demonstrated that a 1% increase in UF can result in a 0.17% increase in the NRPT of the mill, confirming the earlier *a priori expectation* on the importance of FFB intake optimization (FFBr). D is the only significant factor that outweighs the positive effects of OER-D and KER-D. A 1% increase in D results in a 0.00013% decline in NRPT. The R^2 of the regression was high at 0.956.

Despite being a significant profit generator, the variability in OER-D as illustrated in *Figure 2*, however, appears alarming although they are not yet at a critical stage that they endanger the NRPT. The OER has been declining at 0.25% per month and, assuming that the awarded OER remains constant, the OER-D will widen to a stage where the price offered by the mill can no longer be competitive *vis-à-vis* nearby mills. On the contrary, as shown in *Figure 3*, the KER-D are substantial profit margin generators. The KER-D thus forms the financial strength of the mill. But the mill's KER is also declining as its OER, at the rate of 0.22% per month. This may give rise to long-term financial implications for the mill.

Both OER and KER are awarded daily to the FFB private suppliers. However, substantial amounts of the FFB crop are sourced from sister companies in which the OER and KER are already stipulated on a long-term basis in the supply contracts. In view of the downward trends in both the extraction rates that form the major income source, a review of the award system is necessary in order to further enhance the mill's competitiveness.

The margin achieved from the processing toll (PT) over the 30-month period was continuously negative. It significantly affected the RPT to the extent that a one percent decline in PT led to a 0.9% fall in revenue. The monetary loss from toll charges, which averaged at RM 6.42 per tonne of FFB, is alarming (*Figure 4*). The negative margin is critical in that it is pointless to fully utilize the milling capacity although the utilization factor has been shown in the CPT and NRPT functions above to lead to economies of scale. This is because the mill will incur more toll losses at the mill-gate if the incoming FFB consignments are increased.

To be in business, the mill maintains the PT rate to ensure a continuous inflow of FFBs. This occurs at the expense of it having a detrimental effect on its margin[6]. The financial weakness of the mill, eroded through toll charging is fur-

TABLE 2. OER AND KER TRENDS IN THE MILL

	Jan 1997	Jan 1998	June 1999	Monthly growth rate (%
OER	19.14	17.06	17.75	-0.20
KER	6.00	6.27	5.62	-0.22

[6] The PT rate is stipulated in the supplier contract and it is for a two-year period. A review is often ignored as nearby mills are also offering competitive rates.

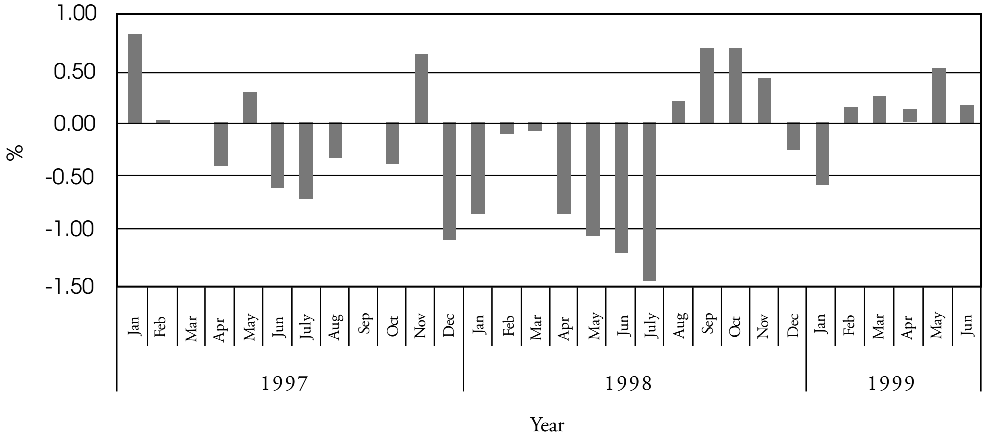

Figure 2. OER differentials in the mill.

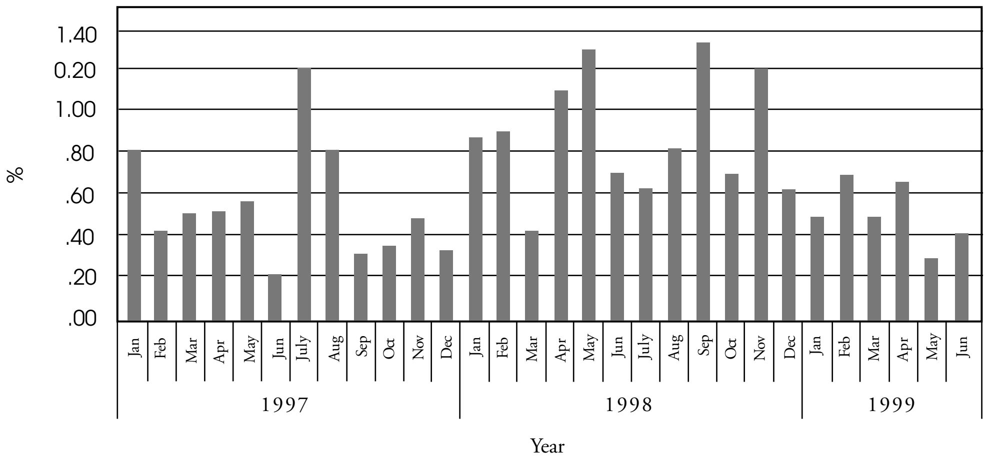

Figure 3. KER differentials in the mill.

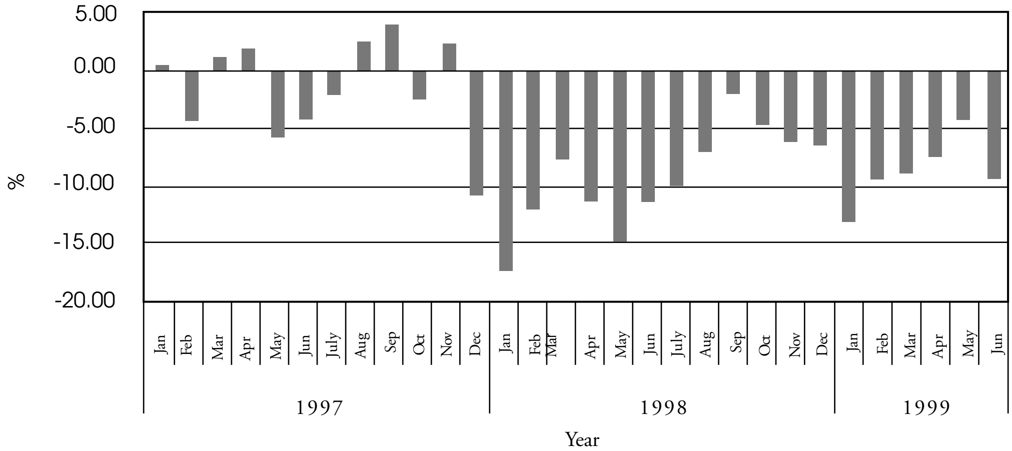

Figure 4. Processing tool differentials.

ther exacerbated through monthly payments to headquarters for MF. MF, which amounts to RM 21 per tonne of CPO produced and sold, increases CPT variability significantly. To enhance the mill's efficiency, it is quite reasonable at this point in time to review the MF monthly rate so that the constant losses from PT charges are minimized. Such a financial balancing exercise, aimed at strengthening the financial structure of the mill, will not deteriorate the financial position of the headquarters since the latter is merely an administrative centre.

As in the earlier *a priori expectation*, FFBr has been noted as one of the significant contributive factors of RPT variability. While FFBr can continue to positively contribute to NRPT, several related issues related to the FFB intake need to be examined. Inevitably, the sales commission (SC), which amounts to 1.5% of the value of the FFB purchased, is more of a disincentive to the mill. With a higher intake of FFB, the mill will incur more payment (SC) to headquarters. The rate should be reviewed considerably as in the case of the MF. The headquarters, which receives, payment, does not bear the transaction risks such as low quality FFBs and losses from OER-D or KER-D, PT, *etc*. To boost production, a production-related incentive scheme should be developed to enhance the morale of the mill workers and staff. This is more obvious as the utilization factor (UF) and overtime (OVER) were found significant in either reducing CPT or enhancing NRPT. At the same time, the mill has to undertake *forced purchases* from a sister company. Close rapport between the mill and the feeding plantation as well as with the other outside suppliers is inevitably important in ensuring a good supply of FFBs. Apart from that, good rapport is essential also for POME and EFB disposal opportunities.

Major maintenance (MM), routine maintenance (RM) and depreciation (D) were significant slacking factors which affected CPT of the mill. Being highly capital intensive, the mill is subject to repairs and upgrading. But in terms of NRPT, only depreciation appeared significant. Expenditure on parts replacement and upgrading of building structures and machineries is inevitable, particularly for the mills longer in operation. But there should be no short cuts. More effective managerial time is required to oversee the overall efficiency of the processing chain as well as the tasks concerning purchase of FFBs, CPO sales and quality checks.

CONCLUSION

The model specified and estimated in this paper attempted to explain the possible sources of cost inefficiencies in FFB processing. Regression analysis was employed in this study to basically establish a relationship between the variables affecting RPT, CPT and NRPT of a particular palm oil mill based on a 30-month time series data.

From the study, it was shown that the profit margin of a palm oil mill depends mainly on differential gains from OER and KER to offset its operating cost. The contributive effects of these two factors are outweighed by the losses from the processing toll. Continuous losses from toll charges and the declining OER and KER adversely affected the financial strength of the mill. Furthermore, all these three factors are key components in the FFB price formation and attempts to strategize in this area are crucial in order to sustain the mill's competitiveness vis-a-vis other nearby mills.

Equally important is for the mill to reduce its CPT variability by reviewing the relevance of MF and SC and to undertake comprehensive cost control measures affecting maintenance, upgrading and repairs. The study implies that such overall measures are needed to supersede inefficiencies resulting from the toll losses in view of the high cost of production. This would further complement the effects of greater FFB inflow, which has a positive correlation with profit margin as well as the generation of economies of scale.

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