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The Production of Crude Palm Oil in Malaysia

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ABSTRACT

Palm oil production contributes significantly to the Malaysian economy. Malaysia currently holds the position as the world's second-largest palm oil producer after Indonesia. This study intends to empirically test the Cobb-Douglas (C-D) production function for the palm oil production sector in Malaysia with the validity of C-D's assumptions. The significance of factors such as capital, labour and utilisation rate in the production of Crude Palm Oil (CPO) is also tested in the study. The data on the productivity of the Palm Oil (PO) mills are collected from the Malaysian Palm Oil Board (MPOB). The methods of Least Square (LS) and robustness check are carried out in the estimation of the production function. The results show a positive and significant relationship between the production of CPO and labour, capital, and the utilisation rate. This study suggests that increases in capital, labour employment and the utilisation rate will boost the production of CPO in Malaysia.

Keywords: Crude Palm Oil; Cobb-Douglas Production Function; Wage, Capital, Utilisation Rate

JEL Classification: O13, Q10

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INTRODUCTION

The oil palm tree was brought into Malaya by the British in 1875 to improve the landscape of the Federation and it was only in the early 20th century that the oil palm tree was commercially planted in the state of Selangor by Henri Fauconnier (Worldbank, 2009). Under the First Malaysia Plan (1966 to 1970), palm oil was seen as a means to alleviate poverty, by making the oil palm tree a complementary crop to rubber. It was also meant to reduce dependence on rubber and tin. The existence of the Federal Land Development Authority (FELDA) played a major role in the expansion of oil palm cultivation in the country. In the early 1960s, FELDA introduced the oil palm tree to its settlers and this spurred the palm oil industry in the country. In less than a decade after FELDA introduced the oil palm tree, in 1966, Malaysia overtook Nigeria as the world's largest exporter of palm oil. However, Malaysia did not hold that status for long - in 2007, Indonesia overtook Malaysia and became the world's largest palm oil producer (World Bank, 2009).

Despite Malaysia being the world's second-largest palm oil exporter, the Malaysian palm oil industry has seen rapid development over the past few decades in line with the development of the palm oil plantation sector. In order to promote and develop the Malaysian palm oil industry, the Malaysian Palm Oil Board (MPOB) was established under the Ministry of Plantation Industries and Commodities. The growth of the industry has been evidenced by the expansion of the plantation areas. The planted area has more than doubled to 5.74 Million Hectares (Mn Ha) in 2016 from 2.03 Mn Ha in 1990. In addition, the same trend has also been seen in the palm oil mill sector due to the parallel development between the two sectors. In 1990, there were only 261 palm oil mills in operation with a total processing capacity of 42.9Million Tonnes (Mn T) of fresh fruit bunches (FFB) per year and this has increased to 453 mills with a total capacity of 110.3 Mn T (MPOB, 2017). The palm oil industry relies heavily on foreign demand, making it an export-oriented industry (Vijaya, Ma, & Choo, 2009). Of the total palm oil output, only 10% is consumed locally in Malaysia while the rest is exported worldwide. The industry is very aggressive and is one of the key contributors to the nation's income (Man & Baharum, 2011). In fact, in 2016, Malaysia's palm oil industry alone contributed 3.5% to the national economy amounting to RM42.8 billion (DOSM, 2017).

Currently, Malaysia's palm oil industry is facing three obstacles that pose a threat to the sustainability of the industry. First, the demand for CPO has decreased over the years. Comparing the data of two recent years, 2015 and 2016, the export of CPO decreased sharply from 5.28 Mn Tn to 3.82 Mn Tn, with a 27.5% drawdown driven by various factors, especially notable were the uncertain global economic conditions, and the global boycott of oil palm products by the European Union and other Western countries. Second, environmental concerns have discouraged the demand of palm oil products due to the deforestation issue as a direct result of oil palm plantation expansion. Over the years, the call to boycott oil-palm products has become stronger. The claims made by anti-palm oil campaigns give a negative impact on the palm oil industry (Lee, 2011). Third, Malaysia's oil palm industry is labour intensive, where foreign labourers are employed to harvest, upkeep, and maintain the plantations. Since the industry is labour intensive, production performance is highly influenced by labour performance (Lee, 2011). Malaysia's oil palm industry is facing acute labour shortage problems due to a lack of interest among locals to work in the industry (Azman & Choo, (2013), and to mitigate the problem, many estates hire foreign workers from other developing and least-developed countries (Abdullah, Azman, Khomeini & Rahman, 2011).

This study intends to empirically test the Cobb-Douglas (C-D) production function for the palm oil production sector in Malaysia with the validity of the C-D's assumptions. This is to verify the roles of labour, capital, and utilisation as the determinants of CPO production. This study adopts a comparative approach by comparing the data for the years 2010 and 2014 in order to see the fitness of the data into the C-D function. The fitness of the data into the model is determined by considering the absence of heteroscedasticity, multicollinearity, and autocorrelation (Husain & Islam, 2016). In addition, this study also intends to unravel the relationship between labour, capital and the utilisation rate in the palm oil production sector in Malaysia. The findings of this study might help authoritative bodies, economic researchers, and palm oil manufacturers to achieve the efficient utility of labour and capital; this will elevate the industry to the next frontier. According to Norhidayu, *et al*. (2016), palm oil millers should improve their productivity by introducing policies to induce technological innovation in order to shift up the production frontier. It was also highly recommended to that they apply known technology which includes improvements in learning-by-doing processes and improved managerial practices. It is also highly recommended that the mills inject more capital into upgrading their processing capacity and machinery.

LITERATURE REVIEW

A production function establishes a quantitative link between production inputs and outputs. The archetypal and most famous production function is the Cobb-Douglas (C-D) production function which was developed by Charles W. Cobb and Paul H. Douglas (Hossain, Majumder, & Basak, 2012). The C-D production function was developed in the functional form, $Y = f(K,L) = AK^{\alpha} L^{\beta}$. Most researchers within the economic field employ this functional form to quantitatively describe the relationship between inputs and outputs (Husain & Islam, 2016). In the C-D production function, Y denotes output, while K and L indicate capital and labour. The sum of the addition of α and β is equal to one. Meanwhile, the values of α and β should be equal or more than zero because the function depicts the real-world economy and it is also self-explanatory in nature. Economic researchers favour the C-D production function due to its simplicity and its easy manipulation. According to Husain and Islam (2016), the C-D function obeys the rules imposed on the production function that includes; (1) the production should involve the utilisation of both inputs (K and L); (2) the marginal product of both inputs should be positive; (3) the marginal product diminishes as the inputs increase; (4) as other inputs increases, the marginal product also increases.

A significant amount of theoretical and empirical research on the C-D production function has been carried out throughout the world. A study conducted by Hoque (1991) was intended to inspect the nexus between the size of farm and production efficiency in Bangladesh. Two C-D production functions were estimated by using the least-squares method with fixed and random coefficients. Bhatti (1993) identified the presence of an industry-wise and/or a high block-wise heteroscedasticity in industry data for developing and least-developed countries. To find out the solutions to the heteroscedasticity problem, several algebraic forms have been tested by Wu and Bhatti (1994), including the variable elasticity of substitution (VES), and the constant elasticity of substitution (CES). Bhatti and Owen (1996) conducted a study to comprehend the production pattern of agricultural-based industries in China. The findings of the study were side-by-side with the findings by Wu and Bhatti (1994), and Hogue (1991). To extend the work of Bhatti and Owen (1996), Bhatti *et al*. (1998) conducted a study to measure the productivity of agricultural-based industries in China by using advanced econometric modelling, but Bhatti and Khan (2000) omitted the complexities of econometric analysis in their study in order to reduce time and cost. A study by Mok (2002) was intended to unravel industrial productivity in China. The study highlighted the potency of employee bonus schemes to elevate industrial productivity. In addition to that, the proportion of temporary workers also had a significant effect on industrial productivity, supporting the assertion of the need for flexibility in employment.

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The suitability of the C-D production model in measuring the production process was confirmed in the study conducted by Hossain *et al*. (2004). The study reviewed several production models but the best model that fitted the production process of manufacturing industries was the C-D model. Aiyar and Dalgaard (2009) conducted a study to test the validity of C-D assumptions by using international data of relative factor shares and capital-output ratios. The study found that the C-D model fitted the data well.

A study conducted by Hossain and Islam (2013) employed the C-D production function to assess returns to scale and to estimate the level of productivity and allocative efficiency in manufacturing firms in the South-West region of Bangladesh. The study found that textile, jute, and cement manufacturing firms have decreasing returns to scale, whilst fertilizer and seafood manufacturing firms have increasing returns to scale. It was also found that the capital productivity of all firms in the study was higher than the average capital productivity. Another study that tested the C-D production function was conducted by Chowdhury and Islam (2015).

The study aimed to estimate the C-D production function in the ready-made garment industry in Bangladesh. The time series data used in the study consisted of data on production (Y), labour wage (L), and capital (K) of the Tex-Town Group Limited from 2002 to 2013. In the study, the authors gave serious attention on the fitness of data into the model by considering the three econometric issues i.e. heteroscedasticity, multicollinearity, and autocorrelation. In order to obtain reliable parameter estimates, several adjustments and procedures were made. The model of the study is estimated by using the Ordinary Least Squares (OLS) method. The results of the study showed that there were positive associations between the two inputs, labour wage and capital on ready-made garment production.

The C-D production function has been widely used to measure production-performance and a nation's productivity. A study by Hajkova and Hurnik (2007) aimed to test the assumption that labour did not significantly influence production, thus making the C-D production function unreliable for the Czech economy. The researchers employed a more general production function, but the results showed that labour input was the constant and significant predictor of production, thus proving the predetermined assumption as invalid. The results also showed that there was no significant difference between the C-D production function and the general production function, for the period 1995 to 2005. In addition to that, Hossain and Al-Amri (2010) conducted a study to determine the production model that best described the production process of some major manufacturing industries in Oman. The data used in this study were time series data from 1994 to 2007, published by the Ministry of Commerce and Industry, Oman. The study reviewed the justification to use the C-D production function instead of using other production functions. The results of the study found that, out of several production functions, the C-D production function fitted the data precisely in terms of labour, capital elasticity, returns to scale, and standard errors. The results also projected a high value of the coefficient of determination or R-square and good Durbin-Watson statistics. From the results, manufacturing industries in Oman indicated an increasing return to scale. From the nine industries reviewed, seven industries indicated an increasing return to scale, whilst the other two industries indicated a decreasing return to scale.

Despite the numerous studies that have been conducted to test the validity of the C-D assumptions, only one study by Azman (2014) tested the C-D production function within Malaysia's oil palm industry. The study aimed to examine the technical efficiency among palm oil millers in Malaysia by using the C-D production function. The cross-sectional data of palm oil mill activities used in this study consisted of data on fresh fruit bunches, labour and cost. The study found that palm oil mills in Malaysia were technically efficient which meant that PO mills in Malaysia produced maximum CPO from a given or minimised input used in CPO production. It was also found that labour and the age of PO mills were significant in determining CPO production at the 1% probability level, while capital was significant at the 5% level. FFB, labour and capital had a positive correlation with CPO production. Meanwhile, the age of PO mills had a negative correlation with CPO production.

From the above review of previous literature, it is evidenced that sufficient studies have been conducted to test the validity of the C-D production function. However, based on the review of previous literature, no studies have been conducted to empirically test the C-D production function with the validity of C-D's assumptions for the palm oil production sector in Malaysia. Hence, this study is expected to contribute to the body of knowledge. Moreover, moving forward, we intend to look at the issues related to the sustainability of the palm oil industry. Other than the production of CPO, the stability in the price of CPO over years is also one of the factors that affect the sustainability of the palm oil industry. Studies such as Brennan (1998), Timmermann (2001), Pesaran *et al*. (2006) and Nur-Syazwani and Bulkley (2015) discussed the importance at looking at the presence of structural breaks in the time series data and incorporated this into the analysis. Future research will investigate the stability of the price data series of the CPO in Malaysia.

METHODOLOGY

Data

The data used in this study was sourced from the surveys on Palm Oil Productivity Growth which were conducted by the Economics & Industry Development Division, MPOB. The cross-sectional data involving 115 palm oil mills operating in the years 2010 and 2014 were analysed separately according to the year mentioned. The required data for the study were CPO production (V), value of assets (K), total number of workers (L) and utilisation rate (U).

Variables

Production of Crude Palm Oil (CPO)

The dependent variable in this study was the production of (CPO) among the (PO) mills in Malaysia. Production of CPO in Malaysia is denoted in metric tonnes every year for domestic and international consumption.

Figure 1 shows the trend of CPO production in the 115 selected mills in Malaysia for the years 2010 and 2014. The general trend showed that the mills that produced high output in the year 2010 also produced high output in 2014. But there were some mills that produced higher output in 2010 but produced lower output in the year 2014 as compared to other mills. For example, mill 018 produced2.98 of output while mill 019 produced 3.34 of output in 2010. However, in 2014, mill 018 produced a higher output which was 2.98 compared to mill 019 that produced 2.59 output. This inconsistent output occurs in the production of crude palm oil.

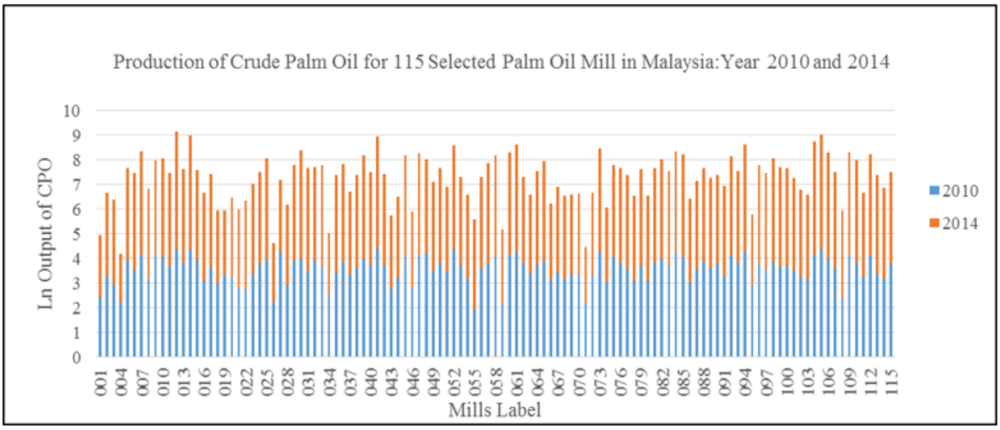

Figure 1: Production of Malaysia CPO for 115 selected PO mills in 2010 and 2014.

Value of Capital (K)

The value of capital is an important factor that affects the productivity of production. In this study, the value of assets is treated as the proxy of technology that mills possess. According to Berzkalnea and Zelgalvea (2014), intellectual capital, for example, advanced technology; is an asset for companies besides knowledge and skilful workers. The value of companies increases as the intellectual capital becomes higher. It is an intangible fixed asset that organisations possess and becomes part of the uniqueness of the organisation. As applied in this study, the higher the values of the fixed assets of the PO mills, the savvier the technology that they employ. The higher the value of the capital/machinery that the mills own, the higher the production of CPO. Figure 2 shows the fluctuated level of capital. Within the years 2010 and 2014, there was an uncertain amount of capital used in the mills. Some of the mills had increasing capital and some showed a decreasing trend.

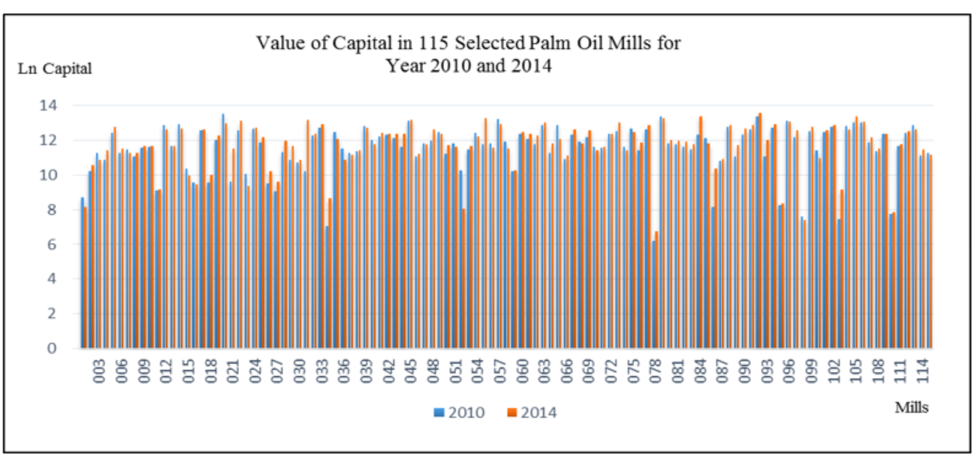

Figure 2: Value of Capital for 115 selected PO mills in 2010 and 2014

Total Number of Workers (L)

The number of workers plays an important role in producing the output of the PO mills. The skilled and experienced workers contribute more output to the PO mills compared to non-skilled and inexperienced workers. Thus, the number of workers significantly affects the performance of the PO mills in line with the usage of the technology/installed machinery. The figure above shows the trend of the number of workers in the palm oil mills. The trend shows only a little change in the number of workers between the two years and the pattern is almost the same between the mills. Refer to Figure 3.

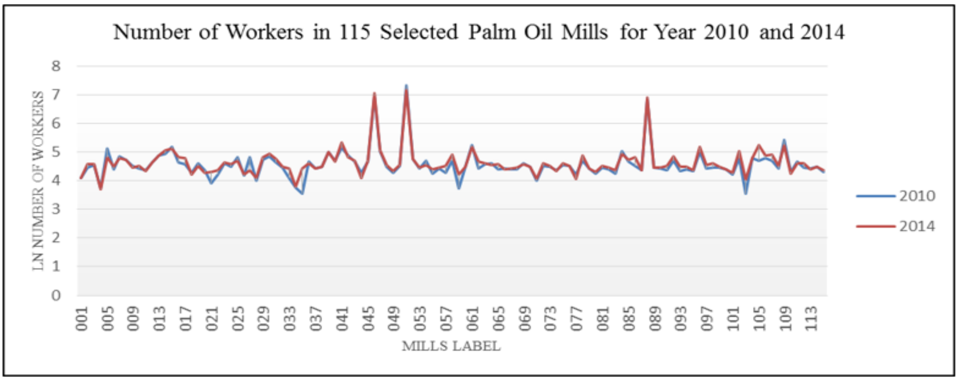

Figure 3: Number of workers for 115 selected PO mills in 2010 and 2014

Utilisation Rate (U)

The utilisation rate of the PO mills is calculated by dividing the capacity of the PO mill with the number of fresh fruit bunches (FFB) processed. The higher the utilisation rate means the PO mill utilises its capacity at the maximum rate. The figure above shows the stronger pattern of changes of utilisation rate between the two years compared to the capital and number of workers trends. This is the reason why this variable seems important to include into the model as there is a significant trend in Figure 4.

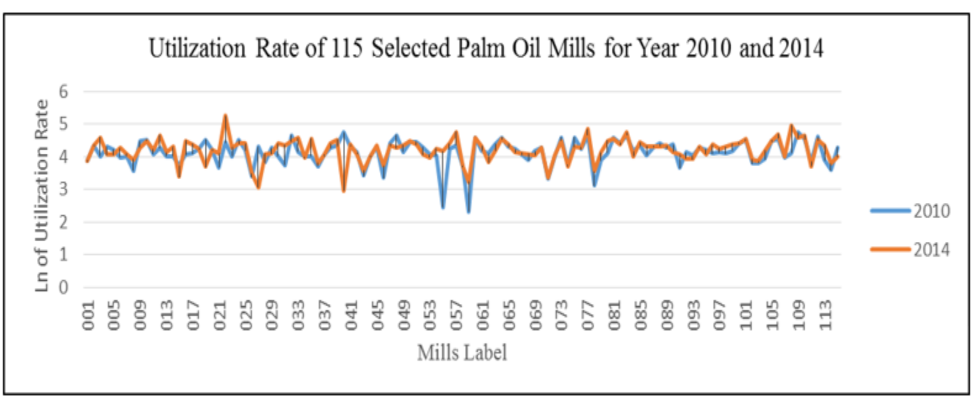

Figure 4: Utilisation rate for 115 selected PO mills in 2010 and 2014

Hypotheses

H_0: There is no significant relationship between crude palm oil (CPO) with capital, labour and the utilisation rates of the PO mills in Malaysia for the year 2010.
H_1: There is a significant relationship between crude palm oil (CPO) with capital, labour and the utilisation rates of the PO mills in Malaysia for the year 2010.

THEORETICAL FRAMEWORK

We estimated the Cobb- Douglas Production Function which in its stochastic form, may be expressed as:

$$Y = f(K,L) = AK^{\alpha} L^{\beta} e^{U} \quad (1)$$

where
Y = output; the weight of Crude Palm Oil production (tonnes metric)
K = capital; the value of fixed assets (technology of machinery) that mills own (Ringgit Malaysia)
L = labour: the number of workers in the mills (people)
U = the utilisation rate (stochastic disturbance term),
E = base of natural logarithm
α = the ratio of the marginal product to the average product defines the elasticity of output with respect to labour input
β = the ratio of the marginal product to the average product defines the elasticity of output with respect to the capital input

In the Cobb-Douglas production function, there is a nonlinear relationship between the inputs L and K and the output Y, and the two inputs are interacting. To estimate the parameters of α_1, α_2 and α_3 in equation (3), the nonlinear Cobb Douglas model must be linearized. According to the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), both of the models are based on -2LogLikelihood. Since the models have the same base, the natural log of both sides of the variable is appropriate for this model. When taking the natural log of both sides, the general natural log of the Cobb Douglas model will be as follows:

$$ln\ Y = lnA + \alpha lnK + \ \beta lnL + \mu L = \beta + \alpha LnK + \beta LnL + \mu\ ,\ where\ \beta = LnA \quad (2)$$

In this study, there is an additional explanatory variable included which is the utilisation rate (U). We believe that U is one of the major factors that contribute to the production of CPO. Therefore, the model estimation for this model can be written as follows:

$$LnY = \beta + \alpha_1\ lnK + \alpha_2\ lnL + \alpha_3\ lnU + \mu_i \quad (3)$$

Where,
lnY = log of Crude Palm Oil production in the mills
lnK = log of the fixed asset value in the mills
lnL = log of the number of workers in the mills
lnU = log of the utilisation rate of the mills
μ_i = error term

A robustness check was carried out for any possibility of the violation of CLRM assumptions, namely multicollinearity (MC), autocorrelation, and heteroscedasticity.

Multicollinearity is a situation when two or more variables are related to each other. We detect the presence of multicollinearity by using Variance Inflation Factors (VIF). To calculate the VIF, the formula is as follows:

$$VIF = \quad 1/(1\text{-}r2)(4)$$

The rules of VIF are as follows:

- If the VIF is less than 5, there is no multicollinearity existing
- If the VIF is more than 5, there is possibility of multicollinearity existing
- If the VIF is more than 10, the problem of multicollinearity is severe

It was expected that the results were not affected by multicollinearity. Though it was suspected that as the study was about the Cobb-Douglas production function, there might be a linear relationship between the three explanatory variables. For example, PO mills which have a small number of workers and capital were categorised as a small PO mill. However, as the study has a large sample size, the degree of collinearity was expected to be small.

On the other hand, autocorrelation which is the interrelationship between a number of series of observations ordered in time or space was tested by using the Durbin-Watson Test (d).

When d is greater than dU, this implies that there is no autocorrelation in the model. When d is lower than dL, this implies the presence of autocorrelation in the model.

We also expected that the results would not be affected by autocorrelation.

The problem of heteroskedasticity generally occurs when the variance of the error term is different from the observations. We assume the variance based on the following model:

$$Yi = \beta_\theta + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_i \tag{5}$$

Heteroskedasticity implies a non-constant variance of the error term (μt) in the above model. It was thought that heteroscedasticity might exist in the present case as there was a large heterogeneity in samples. Since the data contained information about 115 samples, the variance of the error term was likely to be non-constant.

RESULTS AND DISCUSSION

This study utilised two different data sets based on the surveys on the production of CPO by the MPOB in 2010 and 2014 and tested for the significance of the input factors; utilisation rate, labour and capital towards the production of CPO in Malaysia. The C-D model was adopted and this study looked into whether the input factors and production output fitted well or not. A comparison was made with the results obtained for these two different years i.e. 2010 and 2014.The results based on the data set of the production of CPO in Malaysia in 2010 are tabulated in Table 1.

Table 1: Least Squares Estimation of the Production of CPO in Malaysia (2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.257933	0.518501	-2.426095	0.0169
LN_U	0.734006	0.100175	7.327225	0.0000
LN_L	0.229624	0.075260	3.051059	0.0029
LN_K	0.063867	0.028347	2.253055	0.0262

R-squared	Adjusted R-squared	Durbin-Watson stat	Mean dependent var	VIF ($1/1-R^2$)
0.454582	0.439841	1.750834	3.559884	1.83346

On the basis of the above information, the coefficients were all significant at the 5% significance level as the P-values were all lower than 0.05. The coefficients also did not suffer from multicollinearity, which is evident from the values of the VIF. They were free from the problem of autocorrelation as the value of the Durbin Watson statistic was more than 1.736 (near to 2), and the study was also dealing with cross-sectional data. There was no heteroscedasticity at 1% significance based on the White's heteroscedasticity test as the probability was more than 0.01, this study did not reject the null hypothesis of homoscedasticity (refer to Table 2). These results were better than the results found by Chowdhury and Islam (2015), whereas no adjustments or procedures were needed to tackle the statistical problems since none of them existed in this study. However, in Chowdhury and Islam (2015), some of the statistical problems existed, thus several statistical remedies needed to be performed on the data. Since no statistical problems existed in this study, the data was said to be a good fit with the model similar to the study conducted by Hossain and Al-Amri (2010).

Table 2: White's Heteroscedasticity Test of the Production of CPO in Malaysia (2010)

F-statistic	2.931386	Probability	0.010910
Obs*R-squared	16.10545	Probability	0.013199

$$Ln\ Y = -1.2579+0.06387LnK+0.22962LnL+0.73401LnU \quad (6)$$

The above equation (6) explained that Malaysian crude palm oil (CPO) production was significantly and positively related to capital, labour and the utilisation rate. The coefficient of -1.2579 meant that if all independent variables were held constant, the CPO production for 2010 declined by 1.2579. Labour, capital and production were statistically significant at the 5% level. The results were consistent with Chowdhury and Islam (2015); and Hajkova and Hurnik (2007). Meanwhile, the coefficients for capital, labour and the utilisation rate were 0.06387, 0.22962 and 0.73401 respectively. This meant that in the Malaysian palm oil milling sector, if the amount of capital increased by 1 unit, the CPO production increased by 0.06387 unit, holding other variables constant; and if the amount of labour increased by 1 unit, CPO production increased by 0.22962 unit, holding other variables constant; if the amount of the utilisation rate increased by 1 unit, CPO production increased by 0.73401 unit, holding other variables constant. This explains that the utilisation rate affected production the most when compared to capital and labour in the Malaysian PO milling sector (CPO production).

The circumstances were slightly different in the year 2014. The data did not fit into the C-D production function, unlike in 2010, which is likely due to the changing production factors. The coefficient for the variable, capital was not significant at the 5% significance level. Besides, there were also autocorrelation and heteroscedasticity problems in the model estimation (refer to Table 3-4).

Table 3: Least Square Estimation of the Production of CPO in Malaysia (2014)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.798328	0.596343	-1.338707	0.1834
LN_U	0.611228	0.111080	5.502609	0.0000
LN_L	0.266320	0.079943	3.331369	0.0012
LN_K	0.058777	0.030124	1.951167	0.0536

R-squared	Adjusted R-squared	Durbin-Watson stat	Mean dependent var	VIF ($1/1-R^2$)
0.344165	0.326440	1.577659	3.692560	1.52478

Table 4: White's Heteroscedasticity Test of the Production of CPO in Malaysia (2010)

F-statistic	8.208268	Probability	0.000000
Obs*R-squared	36.01729	Probability	0.0000003

According to Bank Negara (2010), the Malaysian economy experienced a strong resumption of growth, recording an expansion of 7.2% following the downturn in 2009 and after a sharp contraction, private investment rebounded strongly to register double-digit growth in 2010, reflecting the expansion of capital spending across all sectors, including the agricultural sector. This positive change might be the reason why in 2010, labour and capital for Malaysian palm oil mills perfectly fitted the model estimation of the C-D production function. In addition, the agriculture sector benefited from higher prices in 2010 where the price of crude palm oil increased considerably during the year to reach RM3770 per tonne by the end of 2010. Instead, the estimated value of the share of real private investment for the agricultural sector in 2014 decreased from 5.6% in 2010 to 4.6% (Department of Statistics and Bank Negara Malaysia, 2014).

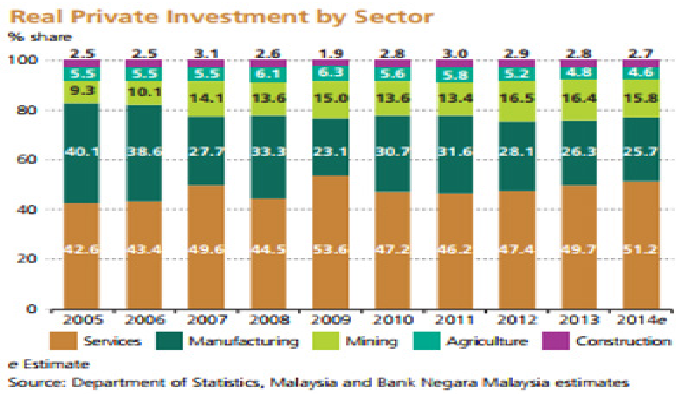

Figure 5: Real Private Investment by Sector (Bank Negara Malaysia, 2014)

Real private investment is the part of capital investment that is conducted by the private sector. Since the palm oil mills in Malaysia are owned by private companies, it is not possible that decrease of real private investment in the agricultural sector would affect the whole capital investment in agriculture. As reported by Bank Negara Malaysia (2014), public investments in agriculture are not highlighted as priority is given to other sectors such as services and the manufacturing sector. The reduction of the share percentage showed the decrease of capital in the agriculture sector that is mainly dominated by the palm oil industry in Malaysia. This might be a factor as to why capital showed an insignificant result in the C-D production function model estimation.

The findings indicated that the utilisation rate should be given a priority if palm oil mills intend to produce CPO at the maximum yield. Therefore, our earlier assumption on the utilisation rate as one of the important contributors to CPO production was proven true in the year 2010 and more recently in 2014. In reality, if the mills fully utilised their capacity, the CPO can be obtained at its maximum yield. It is also highly recommended for the PO millers to inject more capital in upgrading their processing capacity and installed machinery. By doing so, the PO mills can boost their production since an improvement in the production process is one of the factors that contribute to the high yield of CPO.

CONCLUSION

This study was based on the data sets from the one-time surveys conducted by the MPOB in 2010 and 2014 to evaluate the performance of the palm oil milling sector's productivity and to identify factors that contributed to the productivity growth. It was found that the C-D function fitted the data in 2010 but not in 2014 due to the changes in production factors. The Malaysian crude palm oil (CPO) production was significantly and positively related to capital, labour and the utilisation rate based on the data set in 2010. On the other hand, capital was found to be insignificantly related to Malaysian crude palm oil (CPO) based on the data set in 2014. This was in line with the fact that there was a reduction in the investment allocated to the agriculture sector in Malaysia. If it had not been for this reason, capital would have been one of the significant factors in the production of CPO as well. In addition, the utilisation rate should be given a priority in the effort to maximise the production of CPO in Malaysia. It is also highly recommended to use a more recent dataset for future research on the performance of the oil palm sector. The findings of this study were limited to the data sets of 2010 and 2014 (which is the most recent) available from the surveys of the MPOB.

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