EVALUATION OF MARKET COMPETITIVENESS OF SMEs IN THE MALAYSIAN FOOD PROCESSING INDUSTRY

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ABSTRACT

This study aims to evaluate the market competitiveness of Small and Medium Enterprises (SMEs) in the Malaysian Food Processing Industry (FPI) in terms of technical efficiency and productivity growth. A non-parametric approach using Data Envelopment Analysis (DEA) was employed for the five-digit data of 35 sub-industries in the Malaysian FPI. The findings suggest that Technical Efficiency (TE) was 0.756 during the period of 2000-2006, indicating that SMEs in the Malaysian food industry were able to expand their output by 24.4 percent while using the same level of inputs. Total Factor Productivity (TFP) growth was negative 1.3 percent. Processing and preserving poultry and poultry products was the sub-industry with the highest productivity growth, while manufacturing of tea had the lowest. Research and development (R&D), training and public infrastructure were determinants that positively affected the TFP growth. For technical efficiency, public infrastructure, foreign direct investment and foreign ownership were the determinants.

Keywords: Competitiveness, food processing industry, technical efficiency, total factor productivity

INTRODUCTION

The important role of the Food Processing Industry (FPI) to an economy has been widely reported. Morrison (1997) noted that the FPI was a major force affecting the economic performance of industries in the USA. Adelaja, Nayga, Schilling and Tank (2000) calculated the industry's share to be as high as 8.9 percent of employment, 11 percent of the value-added and 13.5 percent of gross sales in the USA manufacturing sector. In Australia, Kidane (2006) concluded that the processed food industry accounted for about 68 percent of the real value of food exports and 20 percent of the merchandise real export value of the country. Nefusi (1990), Athukorala and Sen (1998), Menrad (2004), Dieu (2006), and Mikami and Tanaka (2008) presented similar findings that the food processing industry is an important contributor to a nation's economic growth.

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However, studies about the market competitiveness of the food processing industry, especially in small and medium-sized enterprises (SMEs), are still scarce. Most previous studies drew attention to the social aspects (Christy & Connor, 1989; Donk, 2000), to the macro economics (Wilkinson, 2004), to competition (Schiefer & Hartmann, 2008) and innovation (Menrad, 2004; Avermaete, Viaene, Morgan, & Crawford, 2003). In the long term, an improvement in an organization's performance and competitiveness should be based on productivity gains because high productivity means better technical performance at lower prices (Bleischwitz, 2001).

The two main indicators to describe the performance of industries or firms are efficiency and productivity growth. In an economic sense, efficiency is defined as the ratio between the actual output and the maximum (potential) output at a given level of inputs and technology, or the ratio between the minimum potential inputs and the actual inputs used in production at a given level of output (Coelli, Rao & Battese, 1998). Productivity, on the other hand, relates to the efficiency of resource allocation. Higher productivity means that the firm is able to produce more output from the same amount of input. Polopolus (1986), Spithoven (2003), Alpay, Buccola and Erkvliet (2002) argued that productivity determines the standard of living, while Morrison Paul (2000), Chuang and Hsu (2004) asserted that productivity and efficiency are important to characterize the production and market competitiveness. The present study aims to evaluate the competitiveness of the Malaysian FPI in terms of technical efficiency and productivity growth.

LITERATURE REVIEW

SMEs play a significant role in a nation's economy (Zuzak & Jirovskc, 2007; Avermaete et al., 2003). In Malaysia, 4,546 firms are classed as SMEs, with a share of 97 percent, 52 percent and 50 percent of the total FPI for numbers of establishment, output and value added respectively (Department of Statistics Malaysia, 2008). The biggest segment of this group is cereal and flour-based products, which produce grain-milled products, bakery products and noodles (Talib & Mohd Ali, 2009).

Performance of the Malaysian FPI has been investigated by Kalirajan and Tse (1989) and Radam (2007), who reported that the industry was operating below its production frontier. Mahadevan (2002) calculated Total Factor Productivity (TFP) growth in Malaysian manufacturing and concluded that TFP growth in the food sector had declined from 0.78 to 0.69 during 1987-1996.

Food industries in Malaysia, especially SMEs, are facing several problems such as practicing traditional technology, sub-standard grades of raw materials and low product innovation (Senik, 2010). The industry rarely has any budget to invest in research and development or to revitalize their production equipment. In addition, a poor understanding of product quality and business management concepts is a common problem. Some of the industries depend on imported raw materials such as chocolate, dairy products, meat and meat products. Therefore, it is important to understand the performance of SMEs in the food industry to understand their competitiveness in the market.

The Malaysian government continues to enhance the performance of SMEs by promoting and encouraging SMEs through many programmes, including financial support, management training and market access. In order to provide a more conducive business environment, the government has relocated many of them within an industrial estate (Table 1).

Table 1: Industrial Estate of SMEs, Malaysia, 2007

State	Industrial Estate	Area (Ha)	Unit
Kedah	Sungai Petani	40.83	91
Perak	Kuala Kangsar	46.86	44
Kuala Lumpur	Mukim Batu	25.84	390
Selangor	Bdr Sultan Sulaiman	18.98	59
Melaka	Mesjid Tanah	26.45	89
Johor	Bdr Sri Alam	47.79	184
Terengganu	Teluk Kalong	23.20	41
Sarawak	Samajaya Free Industrial	3.62	16
Total		233.58	914

Source: SMIDEC Corp (2007)

METHODOLOGY

The concept of modern efficiency measurement was initially proposed by Farrell (1957). Charnes, Cooper and Rhodes (1978) extended the model to develop a non-parametric approach to measure efficiency using Data Envelopment Analysis (DEA). In the existing literature, DEA is widely used and is one of the most popular methods for investigating the efficiency and productivity of economic units.

DEA Model

The output-oriented DEA model was employed in this study because, for an industry or firms in the industry, it is logical to maximize output at a given level of input, rather than minimize input at a given level of output. Suppose there are N sub-industries, each producing M outputs using K inputs. For all the N sub-industries, we have a $K \times N$ input matrix X, and $M \times N$ output matrix Y. If u represents the $M \times 1$ vector output weight and v represents the $K \times 1$ vector of input weight, for each sub-industry we have the ratio of all outputs over all inputs as $u'y_i/v'x_i$. Following Coelli et al. (1998), the optimal weights of this ratio (i.e. u and v) can be obtained by using linear mathematical programming:

$$\max_{u,v} (u'y_i/v'x_i),$$
$$\text{subject to } u'y_j/v'x_j \leq 1, \quad j=1,2,...,N \quad \text{and } u, v \geq 0 \quad \ldots\ldots\ldots\ldots (1)$$

where y_i and x_i are output and input of i^{th} sub industry respectively. For the maximum efficiency of the i^{th} sub-industry, it should have a value of u and v, subject to the constraint that all efficiency measures must be in the range of 1 to 0. For a finite solution problem, an additional constraint should be imposed to the equation (1):

$$\max_{\mu,v} (\mu' y_i), \lambda$$
$$\text{s.t.} \quad v' x_i = 1$$
$$\mu' y_j - v' x_j \leq 0, \quad j=1,2,\ldots,N$$
$$\mu, v \geq 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Correspondingly, equation (2) can be obtained from an equivalent envelopment set on duality in linear programming for the DEA model:

$$\min_{\theta,\lambda} \theta,$$
$$\text{s.t.} \quad -y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$\lambda \geq 0, \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

where θ is a scalar indicating the efficiency level of a firm with a maximum value of 1 and a minimum of 0, and λ is a $N \times 1$ vector of constant. If θ is equal to unity, the sub-industry experiences full efficiency, and if θ is less than unity, the sub-industry is operating below maximum efficiency, or inefficiency exists in the sub-industry. Equation (3) engages less constraint than the multiplier form ($K+M < N+1$), hence this form is preferred to be solved. The Malmquist productivity index is based on the geometric means of two distance functions from the period t to the period $t+1$, which is applicable to panel data. Assume a sub-industry produces a single output y by using a single input x, at the point A in period t with the production possibility frontier $F(t)$. This will move forward to point B in period of $t+1$ with $F(t+1)$, as shown in Figure 1.

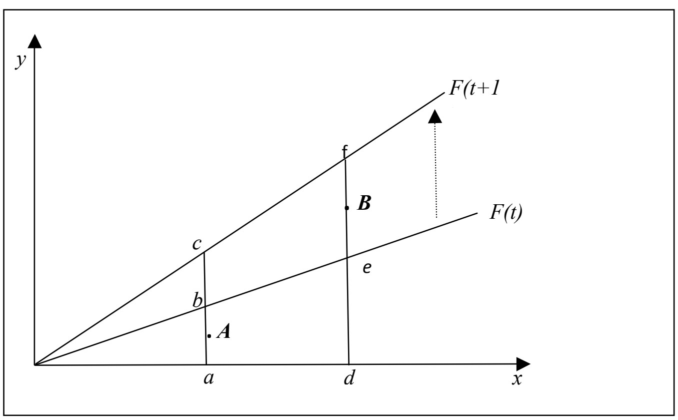

Figure 1: Concept of Input Distance Function in the Malmquist Index with Constant Return to Scale Technology

The shift in production from *A* to *B* in two periods of time will provide four input distance functions: ($D^t(A) = aA/ab$, $D^{t+1}(A) = aA/ac$, $D^t(B) = dB/de$) and ($D^{t+1}(B) = dB/df$). Then we obtain the Malmquist input-based productivity index (M):

$$M\ (A,B) = \frac{dB/df}{aA/ab}\left[\frac{dB/de}{dB/df}\,\frac{aA/ab}{aA/ac}\right]^{1/2} = \frac{dB/df}{aA/ab}\left[\frac{df}{de}\,\frac{ac}{ab}\right]^{1/2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

From this equation, *M* is composed of: (1) the efficiency term which captures the change of distance from the frontier function in *t* and *t+1* as is shown outside the parentheses; and (2) the technological growth which captures the geometric mean of the vertical movement of the frontier function from *F(t)* to *F(t+1)* as shown inside the parentheses. Fare, Grosskopf and Lovell (1994) hypothesized that $D^{t+1}(Y^{t+1}, X^{t+1})$ and $D^t(Y^t, X^t)$ must be equal to unity to be efficient. Therefore, we can express the relative efficiency change as:

$$M\ \left(y^{t+1}, x^{t+1}, y^t, x^t\right) = \quad \ldots\ldots\ldots \quad (5)$$

TE TP

Subscript *c* indicates constant return to scale technology. The Malmquist productivity index can be greater than one (progress), equal to one (no growth) or less than one (retreat). Working with panel data on the Malmquist productivity index, the assumption of Constant Return to Scale (CRS) will give the same result with the assumption of Variable Return to Scale (VRS) (Coelli et al., 1998). The models decompose total factor productivity into four components namely: technical efficiency change (EFCH); technological change (TECH); pure efficiency change (PECH); and scale efficiency change (SECH).

Tobit Regression

To find the determinants of efficiency and productivity, most studies are conducted in two stages of analysis. A DEA estimate (from the first stage) is regressed in the second stage using a censored model (Simar & Wilson, 2007). Tobit regression is an appropriate method to investigate the determinants of productivity growth for a censored or truncated condition for a dependent variable. Following Amemiya (1973), and McDonald and Moffitt (1980), the general model can be defined as:

$$\begin{aligned} y_t &= x_t\beta + u_t, \quad && \text{if } X_t\beta + u_t > 0 \\ &= 0 && \text{if } X_t\beta + u_t \leq 0 \\ & && t = 1, 2, \ldots N \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6) \end{aligned}$$

where N is the number of observations, y_t is the dependent variable, X_t is a vector of explanatory variables, β is an unidentified coefficient, and u_t is an independently distributed error term assumed to be normal with zero mean and constant variant σ^2. We consider growth as a positive value (censored with lower value zero). Therefore, a tobit model is suitable to identify the factors affecting the dependent variables. As noted by McDonald and Moffitt (1980), Greene (2003) and Dubin and Rivers (1989), the use of a conventional regression method like OLS produces a biased and inconsistent estimation.

From the existing literature (Wood, 1990; Bougheasa, 1999; Adelaja et al., 2000; Cahill, 2004; Jefferson & Rawski, 2000; Harris & Robinson, 2002; Alcala & Ciccone, 2004; Ang, 2008; Ascari & Cosmo, 2004; Girma & Wakelin, 2007; Bronzini & Piselli, 2009; Coe, Helpman, Hoffmaister, 2009; Dhawan, Jeske & Silos, 2010), ten explanatory variables were included consisting of six endogenous variables; firm research and development (R&D), the staff training cost (TRAIN), information and technology expenditure (ITEXP), university graduate workers (UNIV), non-university graduate workers (NU) and foreign ownership (FOWE). Foreign ownership was treated as a dummy variable with 0 for no foreign ownership and 1 for foreign ownership in each sub-industry. Four exogenous variables are Public Infrastructure (GINF), Foreign Direct Investment in the Malaysian FPI (FDI), Trade Openness Index (OPEN) and World Oil Price (WOILP) as energy price.

The model is:

$$\ln TFPCH_{it} = \alpha + \beta_1 \ln R\&D_{it} + \beta_2 \ln TRAIN_{it} + \beta_3 \ln ITEXP_{it} + \beta_4 \ln GINF_{it} + \beta_5 \ln FDI_{it} + \beta_6 \ln OPEN_{it} + \beta_7 \ln WOILP_{it} + \beta_8 \ln UNIV_{it} + \beta_9 \ln NU_{it} + \beta_{10} \ln FOWE_{it} + U_{it} \quad \ldots\ldots (7)$$

Analysis of Data

Panel data of SMEs in the Malaysian FPI were obtained from the Department of Statistics Malaysia(DOS). SMEs were defined according to the SME Corporation(SME Corp) for manufacturing, manufacturing-related services and agro-based industries as a firm with sales turnover between RM250,000 to RM25 million, or a firm employing between 5 and 150 full-time employees.

The data is five-digit, referring to the new Malaysian Standard Industrial Classification (MSIC), which has been improved since 2000. Therefore, for consistency, the data used in the study starts from 2000 to 2006. We obtained data for 35 sub-industries (Appendix 1). From each sub-industry, one output and nine inputs were extracted as variables for measuring efficiency and productivity growth (equations 3 and 5). Output is in the form of value-added and inputs consist of number of workers, wages and total working hours, overtime working hours, capital (total asset), materials, water, electricity, fuel and gas. The unit of the variables is total cost in Ringgit Malaysia, except for labour in terms of man hours.

FINDINGS AND DISCUSSION

Technical Efficiency

By using equation (5), the result shows that SMEs in the Malaysian FPI have an average TE score of 0.756, which suggests that the industry has the potential to expand output by as much as 24.4 percent. Alternatively, the industry is operating at 75.6 percent efficiency. This result is similar to the TE score found by Zahid and Mokhtar (2007) of 72.9 percent, which reveals that the performance of the Malaysian food industry has not improved significantly over the last two decades.

Figure 2 shows the trend of TE during the period of observation. The TE trend declined from 2001 and reached its lowest score in 2003 at 69 percent, then improved from 2003 to 2004 to reach 79.4 percent and again declined in the following period to record a TE score of 73.4 percent in 2006. This fluctuation reveals that the ability of the industry to catch-up with the production frontier varies with time.

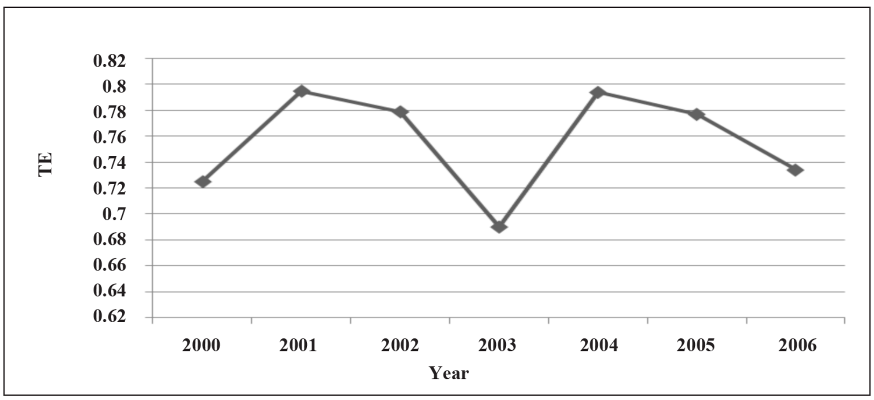

Figure 2: Trend of technical efficiency of SMEs in the Malaysian food processing industry, 2000-2006

Table 2 contains three scales of TE scores for each sub-industry: low, medium and high TE. Five sub-industries have achieved the maximum TE score (refined palm oil, kernel palm oil, feed, alcohol and soft drinks). These industries are fully efficient due to their ability to allocate inputs optimally. In contrast, the industries of crude palm oil, pineapple, sugar, glucose and flour have low TE scores ranging from 16.6 percent to 46.1 percent. Particular attention was given to the crude palm oil industry because the industry is the primary agro-based industry in Malaysia. Data from the Malaysian Pineapple Industry Board (LPNM, 2010), shows that the production of canned pineapple decreased from 22,989 tonnes in 2000 to 17,721 tonnes in 2008. Meanwhile, the domestic sugar industry produced only 17,000 tonnes, which accounted for just 1.4 percent of the total national demand (1.241 million tonnes) in 2008.

Table 2: Average Technical Efficiency of SMEs in the Malaysian Food Processing Industry, 2000-2006

Low TE (0.00 - 0.69)		**Medium TE (0.70 - 0.90)**		**High TE (0.91 - 1.00)**	
Palm oil	0.166	Poultry	0.700	Rice	0.910
Pineapple	0.359	Chocolate	0.709	Coffee	0.911
Sugar	0.404	Cocoa	0.732	Ice	0.940
Glucose	0.416	Peanuts	0.758	Other food	0.955
Other Flour	0.461	Milk	0.762	Bread	0.956
Coconut	0.481	Mineral Water	0.764	Ice Cream	0.956
Tea	0.544	Snack	0.816	Fish	0.978
Spice	0.561	Flour	0.822	Soft drink	1.000
Sauce	0.611	Meat	0.832	Alcohol	1.000
Biscuit	0.671	Noodle	0.857	Feed	1.000
Starch	0.677	Fruit &Vegetable	0.859	Kernel Oil	1.000
		Oil From Other Vegetable	0.896	Ref. Palm oil	1.000

The rice sub-industry was grouped under the high technical efficiency growth bracket. Malaysia has been a net importer of rice for many years. As a result, several rice development programmes were implemented by the government, mainly in the northern part of Peninsular Malaysia, such as Kedah, Perlis, Perak and Kelantan. Farmers have been supported with financial schemes and by research institutions as well. The Malaysian Agricultural Research Development Institution(MARDI), along with research centres in several universities, actively carry out research to enhance the yield of rice production in the country.

Productivity Growth

Productivity growth is important for SMEs in the Malaysian FPI to sustain them in a competitive market, both domestically and globally. This is the focus of the present study because productivity growth means the SMEs are on the right path. In this study, we employed the Malmquist Productivity Index which decomposed the total factor productivity change (TFPCH) to technical efficiency change (EFCH) and technological change (TECH), and the EFCH decomposed to scale efficiency change (SECH) and pure efficiency change (PECH). Table 3 shows that the average TFPCH was 0.987, which infers that SMEs in the Malaysian FPI have experienced a negative productivity growth rate of 1.3 percent during the period of observation. This negative growth was a primary result of the declining growth in technological change (-2.7 percent).

The EFCH and SECH experienced positive growth while the TFPCH, TECH and PECH experienced negative growth. This implies that the industry performs better in terms of catching up to the production frontier, but worse in terms of shifting the frontier itself.

Table 3: Productivity Growth of SMEs in the Malaysian Food Processing Industry, 2001-2006

Year	EFCH	TECH	PECH	SECH	TFPCH
2001	1.212	0.895	0.968	1.252	1.085
2002	0.999	0.833	1.031	0.969	0.832
2003	0.766	1.549	0.933	0.821	1.186
2004	1.189	0.784	1.025	1.160	0.931
2005	1.097	1.169	1.057	1.038	1.282
2006	0.896	0.805	0.959	0.935	0.722
Mean	1.013	0.973	0.994	1.019	0.987

Positive technological change can be achieved by improving technology management in the production process, for instance, using machinery, skilled labour, automation systems and new product development and innovation. Trends in the efficiency and TFPCH for the period of 2000-2006 can be seen in Figure 3.

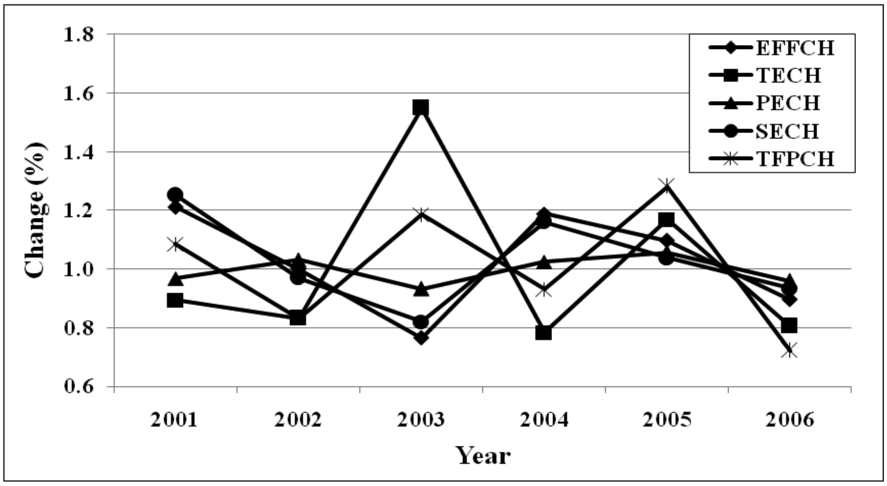

Figure 3: Trend of TFPG and its components of SMEs in the Malaysian FPI, 2001-2006

Overall, productivity growth shows a declining trend from 2001 to 2002. This condition is presumably a result of the impact of the economic contraction following the financial crisis that swept across South East Asian countries in 1997/1998. After the crisis, the economy was hit by soaring energy prices in 2005, when world oil prices increased by as much as 40 percent. The employment market in the manufacturing sector suffered the most significant impact, indicated by the number of workers engaged in the industry dropping by 50.3 percent in 2001 before showing an increase of 8 percent in 2002. Another challenge faced was the supply of raw materials. About 70 percent of the raw materials used by SMEs in the Malaysian food processing industry are imported.

Figure 4 shows the TFPCH, EFCH and TECHCH for each sub-industry. Industries such as poultry, refined palm oil, snacks and noodles have experienced productivity growth above 20 percent and contributed significantly to the TFPCH of SMEs as a whole. In contrast, the tea, starch, palm kernel oil, milk, glucose and pineapple industries indicated a negative TFPCH score (-18 percent up to -34.7 percent). These industries were also facing problems in the supply of raw materials. For example, in the case of tea and pineapple, few new plantations for the supply of raw materials were established due to competing land use with other economic sectors. Most of the industries had no significant EFCH during the period of observation, which was demonstrated by 13 industries having an EFCH equal to or close to zero. Meanwhile, the industry of crude palm oil, poultry, mineral water, coconut and spice recorded an EFCH ranging from 14.6 percent to 60.3 percent, while the glucose, starch, tea, milk and coffee industries had the lowest EFCH, ranging from -23.2 percent to -8.9 percent.

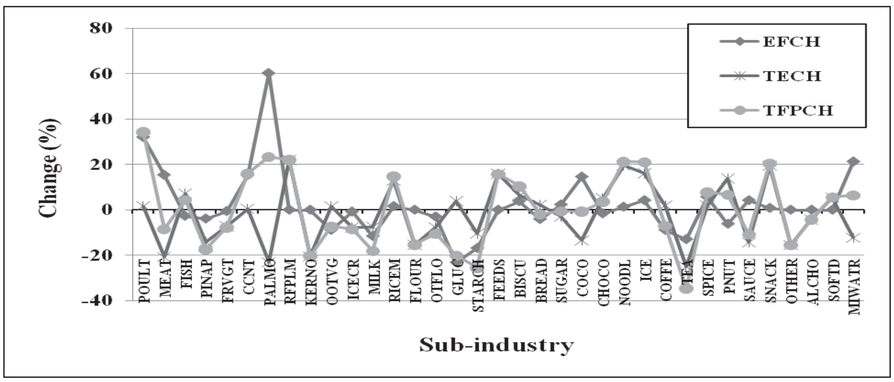

Figure 4: TFPCH, EFCH and TECH by sub-industry in the Malaysian FPI, 2001-2006

Seventeen sub-industries had a negative TECH, 12 sub-industries had a positive value, while six other industries had a TECH close to zero. The negative TECH scores range from -25.0 percent (manufacturing of tea) to -2.8 percent (sugar refinery) and positive TECH scores ranged from 0.5 percent (coconuts) to 22.0 percent (refined palm oil).

These findings map the performance of SMEs in the food industry in Malaysia in terms of TFP growth, technical efficiency and technological change. Some of the industries stand as primary export commodities and others may stand as import substitutions of food stuffs.

Determinants of Productivity Growth and Its Components

Identifying the determinants of productivity growth is important for decision makers. TFP growth and its components (technical efficiency change, technological change, scale efficiency change and pure efficiency change) were obtained from the DEA analysis and modeled as dependent variables. Since we want to identify the determinants of growth, the dependent variable is left censored at low limit zero and there is no limit on the right side. This means that we censored the positive effect of the determinants, for which the tobit regression method is appropriate (Bjurek, Kjulin & Gustafsson, 1992; Chay & Powell, 2001; McDonald, 2009). Table 4 shows a summary of the significant determinants of technical efficiency change on the Malaysian SMEs in the food processing industry.

Table 4: Determinants of Productivity Growth in the SMEs

	Determinants	Coef.	Std. Err.	z	P>|z|	
EFCH	GINF	0.79	0.15	5.17	0.00	***
	FDI	0.44	0.12	3.55	0.00	***
	FOWE	0.57	0.12	4.57	0.00	***
	OPEN	1.98	0.56	3.55	0.00	***
TECH	R&D	0.10	0.03	3.49	0.00	***
	GINF	5.64	2.92	1.93	0.05	*
	FDI	1.57	0.95	1.65	0.10	*
	OPEN	-5.43	1.25	-4.36	0.00	***
	FOWE	0.40	0.08	5.10	0.00	***
SECH	FDI	0.34	0.16	2.13	0.03	**
	FOWE	1.29	0.15	8.64	0.00	***
PECH	FOWE	0.64	0.31	2.04	0.04	**
		Coef.	Std. Err.	t	P>|t|	
TFPCH	R&D	0.10	0.03	3.28	0.00	***
	TRAIN	0.07	0.03	2.24	0.03	**
	GINF	0.59	0.17	3.51	0.00	***
	OPEN	-1.86	0.98	-1.91	0.06	*

(*) P<0.1; (**) P<0.05; (***) P<0.001

Technical Efficiency Change

The significant determinants of technical efficiency change (EFCH) in the SMEs are public infrastructure, foreign direct investment and foreign ownership. These three determinants were positively affecting the change in technical efficiency at the one percent confidence level. GINF had a coefficient of 0.797, which reveals that a one percent increase in the public infrastructure budget is expected to contribute as much as a 0.797 percent change in the SMEs' EFCH. The same interpretation can be drawn from the measure of foreign direct investment, openness and foreign ownership, which had coefficients of 0.440, 0.568 and 1.984 respectively. This finding is in line with previous studies, for instance, Haughwout (2002), Chuang and Hsu (2004) and Benfratello and Sembenelli (2006). Other positive determinants are R&D, training cost and non-university graduate labour, but these factors were only statistically significant at 10 percent level.

Technological Change

Technological change was found to be a deteriorating factor in facilitating productivity growth. Such means that most industries experienced little improvement in production technology during the period of observation. Technological change is depicted by a shift in the production frontier as a result of employing new technology in production: for example, using automation and new machinery in the production line, using computerized quality control and adopting modern management systems. The positive determinants to TECH, as shown in Table 3, are R&D, public infrastructure, FDI and foreign ownership. Each is significant at the one percent level. Meanwhile, the negative factor affecting TECH was openness. Openness is measured as the sum of export and import value divided by the GDP (Sun, Hone & Doucouliagos, 1999; Anderson, 2001; Ang, 2008). The finding indicates that openness has a positive effect on productivity growth. In our case, the food market in Malaysia is dominated by imported products. More liberalized trade regimes provide fewer barriers for international trade, making it easier for foreign products to enter the domestic market. The impact is not encouraging for improving the marketing competitiveness of domestic food producers, especially for SMEs, due to high competition in the local market.

Scale Efficiency Change

The significant determinants of SECH are FDI and foreign ownership. Theoretically, the SECH measures the effect of input growth on output growth by calculating the ratio between CRS and VRS in the production frontier. Larger producers tend to be more efficient than smaller producers. FDI and foreign ownership affect productivity growth because foreign investors control their investment through sharing the ownership of the business. Scale efficiency is related to the size of the company or industry (Kim & Shafi'i, 2009). Our results support the argument that a higher SECH index was found in the larger sub-industries and the lowest SECH index was found in the smaller sub-industries.

Pure Efficiency Change

About 75 percent of the PECH score was distributed at the value of unity or close to unity. This means that there was no significant change in the PECH during the period of observation. Thus, only foreign ownership was found to be a significant determinant of PECH.

Total Factor Productivity Growth

The determinant analysis using the fixed effect model identifies that the significant factors affecting the TFP growth are research and development, training cost and public infrastructure (positive factors), whereas openness had a negative impact. This finding is consistent with Moreno, Lo'Pez-Bazo and Artis (2002) and Delorme, Thompson & Warren (1999), confirming that public infrastructure had a positive impact on productivity. On-the-job training also increased the performance and productivity of workers. In the present study, we found that the relationship between training cost and the TFP growth was 0.073. However, trade openness had a coefficient of -1.86.

CONCLUSION

This study attempts to evaluate the market competitiveness of SMEs in the Malaysian FPI in terms of efficiency and productivity growth. This evaluation is crucial due to the dynamic challenges faced by SMEs in both the domestic and global markets. Since the country is a net importer of food products, the development of domestic food producers, particularly SMEs, is a critical issue. This investigation discloses a strategy to encourage domestic food production and marketing. The findings of this study map the performance of SMEs in the food industry in Malaysia in terms of TFP growth, technical efficiency and technological change. Some of the industries produce primary export commodities while others may potentially be substitutes for imported food stuffs.

Empirically, we found the average technical efficiency of SMEs in the Malaysian FPI to be 0.756, indicating that the industry can augment its output by as much as 24.4 percent at the same level of inputs. The manufacture of palm oil, pineapple, sugar, glucose and the manufacture of flour from beans are sub-industries with low technical efficiency. On the other hand, soft drink, alcohol, animal feed, kernel oil and refined palm oil are industries with high technical efficiency. During the period of 2000 until 2006, the food processing industry experienced a negative total factor productivity growth of -1.3 percent, which was mainly caused by the lack of technological change.

Considering that efficiency level and productivity growth are different across the industry, the government should establish policies that encourage improvements, especially for industries that have low efficiency and productivity growth to increase their ability to compete with imported products. The policies should be directed at moving forward technological change by promoting new investments in machinery and automation, using information technology and product development and assisting the marketing skills of management. To achieve economies of scale, the government could introduce a merger scheme among small firms in the same sub-industry. This strategy has been successful in many developed countries to increase the performance and marketing competitiveness of the food processing industry. R&D and training cost can improve firm performance, but public infrastructure and foreign direct investment need government attention to develop SMEs in the Malaysian food industry.

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Appendix 1

Sub-industries of the Malaysian Food Processing Industry

No.	Code	Sub Industry	Abbreviation
1	15111	Processing and preserving poultry and poultry products	POULT
2	15119	Processing and preserving meat and other meat products	MEAT
3	15120	Processing and preserving fish and fish products	FISH
4	15131	Canning of pineapples	PINAP
5	15139	Canning and preserving fruits and other vegetables	FRVGT
6	15141	Manufacture of coconut oil	CCNT
7	15142	Manufacture of crude palms oil	PALMO
8	15143	Manufacture of refined palm oil	RFPLM
9	15144	Manufacture of palm kernel oil	KERNO
10	15149	Manufacture of oil and fat from other vegetables	OOTVG
11	15201	Manufacture of ice cream	ICECR
12	15202	Manufacture of condensed, flour and other milk products	MILK
13	15311	Rice milling	RICEM
14	15312	Flour milling (excluding sago and tapioca)	FLOUR
15	15319	Manufacture of flour products of other beans	OTFLO
16	15322	Manufacture of glucose, syrup and maltose	GLUCO
17	15323	Manufacture of starch, sago products and tapioca	STARCH
18	15330	Manufacture of animal feed	FEEDS
19	15411	Manufacture of biscuit and cakes	BISCU
20	15412	Manufacture of bread, cake and other bakery products	BREAD
21	15420	Sugar refinery	SUGAR
22	15431	Manufacture of coco products	COCO
23	15432	Manufacture of chocolate and sugar confectionary	CHOCO
24	15440	Manufacture of macaroni, noodle and similar products	NOODL
25	15491	Manufacture of Ice (excluding dry ice)	ICE
26	15492	Manufacture of coffee	COFFE
27	15493	Manufacture of tea	TEA
28	15494	Manufacture of spice and curry powder	SPICE
29	15495	Manufacture of peanut and peanut products	PNUT
30	15496	Manufacture of sauce and flavor include MSG	SAUCE
31	15497	Manufacture of Snack	SNACK
32	15499	Manufacture of food other category	OTHER
33	15510	Alcohol from fermentation, drugs and wine	ALCHO
34	15541	Manufacture of soft drink	SOFTD
35	15542	Processing of mineral water	MIWATR

Appendix 2

Variables and Definition for Measuring Efficiency and Productivity

Variables	Definition
Output	Total value-added of each sub-industry (RM)
Labor	Total number of worker (person)
Wage	Total amount paid to worker
Man hour working	Total working hour
Over time working	Over time working hour
Capital	Total asset (RM)
Material	Value of raw material purchased in particular year (RM)
Water	Total amount spent for water (RM)
Electricity	Total amount for electricity (RM)
Fuel and gas	Total amount for fuel and gas (RM)

Appendix 3

Descriptive Statistics of Output and Input Data

	N	Minimum	Maximum	Mean	Std. Deviation
Output	35	3403.6	2125026	129159.634	3.54E+05
Labor	35	158.3	27100.8	2542.8657	4880.54337
Wage	35	1803.2	392971.1	35682.2486	67546.09104
Capital	35	4705.2	3128628	204187.843	5.20E+05
Material	35	6745.9	13919488	732385.783	2.37E+06
MHW	35	253141.6	44560231	3.79E+06	7.87E+06
OT	35	2941.7	10381571	441669.351	1.73E+06
Water	35	30.1	10056.1	1081.6857	1768.74917
Electricity	35	86.9	38950	7799.5229	10136.05344
Fuel	35	219.7	108512.6	9086.8	19439.37627
Valid N (listwise)	35				

Notes: All units in RM (‘000) unless for Labor, Man Hour Working (MHW) and Over Time (OT)