Company Operation Performance Analysis Using Data Envelopment Analysis Approach: A Study on Public Listed Companies in Malaysia

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ABSTRACT

The purpose of this paper is to measure and evaluate the relative efficiency of 14 publicly listed companies in Malaysia using Data Envelopment Analysis (a non-parametric approach). Data from financial statements for the period 2004 to 2008 was used in the analysis and the relative efficiency of each company, across the five-year period was examined. The Data Employment Analysis (DEA) results show that under the CRS technology assumption, only one company is considered technically efficient while the average overall technical efficiency varies from 0.13 to 0.50. When the aggregate efficiency is decomposed into pure technical efficiency and scale efficiency using the VRS production function, it is found that the source of inefficiency is scale rather than technical inefficiency. Most of the companies are found operating under increasing returns to scale. It indicates that managers' capabilities to utilize companies' given resources still need to be enhanced. They must reduce non essential expenses so as to produce efficiently.

Keywords: Efficiency, Data Envelopment Analysis, Malaysia, Expenses, Performance, Stochastic Production Approach

INTRODUCTION

Research on the performance and efficiency of companies has been given enormous attention over the past decades (Thore *et. al*., 1994; Hsu and Liu, 2008; Joshi and Singh, 2009). Previous research basically uses conventional ratios such as return on assets. Later studies used various measures of performance which included the financial index, a non-parametric approach -Data Envelopment Analysis (DEA) and parametric approach-Stochastic Production Approach (SPA). DEA is frequently used to measure the efficiency of a company. DEA is a non-parametric multiple input-output efficiency technique that measures the relative efficiency of Decision Making Units (DMUs) using a linear programming model. It is non-parametric because it requires no assumption on the shape or parameters of the underlying production function. This technique has been applied for measuring the relative efficiency of DMUs in various sectors such as hospitals, financial institutions, textile industry, IT companies and transportation companies.

Despite its drawbacks, DEA is popularly used because of its advantages. The main advantage is that it can readily incorporate multiple inputs and outputs to calculate technical efficiency. The purpose of this study is to examine the relative efficiency of 14 Malaysian companies from 2004 to 2008, using the DEA approach. The paper is organized as follow. Section 2 includes a brief literature review. In Section 3, data and methodology will be discussed and findings will be presented in Section 4. Finally, the conclusion is provided in Section 5.

LITERATURE REVIEW

Efficiency measurement is one aspect of a company's performance. Efficiency can be measured with respect to maximization of output, minimization of cost or maximization of profits. A

company is regarded as technically efficient if it is able to obtain maximum outputs from given inputs or minimise inputs used in the production of given outputs. The objective of producers is to avoid waste. Various studies have been carried out to examine the performance of companies. Majority of these studies used financial ratios such as return on assets (Lin and Liu, 2004; sales (Wang, 2003) return on equity (Ponnu and Ramthandin, 2008) and return on invested capital (Hsu and Liu, 2008) to examine the performance of companies.

Some studies have used more advanced methods to measure the performance of companies. Batra and Tan (2003) examined technical efficiency using data from six countries –Malaysia, Indonesia, Mexico, Colombia, Taiwan (China) and Guatemala. Their study shows that technical efficiency rises with company size and that there is a substantial overlap in the distribution of efficiency across company sizes, with some small companies operating at the same or higher levels of efficiency than some large companies. Education and training of workers, investments in new technology, automation, and quality control were factors that distinguish more efficient companies from less efficient companies in all 6 countries under investigation.

Wu *et. al*. (2006) examined the performance of retailing industry in Taiwan using DEA and found that on average almost half of retailing companies were inefficient. Using DEA-Based approach, Hong and Park (2007) report that through the application of SVM model (Support Vector Machine) enable to evaluate an individual company and provide the efficiency of an IT venture business without comparing it with other companies. Variables such as total capital turnover, sales/employee and the productivity of employees were important financial information in evaluating the efficiency of the IT business venture. Radam *et. al*. (2008) examined the

technical efficiency of 7,360 small and medium enterprises in Malaysia using a stochastic frontier production model. The results indicate that the number of firms considered technically efficient is only 3.06 percent of the total firms and that efficiency varies from as low as 0.30 to as high as 97.10 percent.

Eslami *et. al*., (2009) in a study on 18 Iranian companies producing automobiles and automobile parts, reported that in 2005, 8 companies were efficient, out of which 4 companies remained efficient in 2006. In a readymade garment firms, Joshi and Singh (2009) report that firms efficiency score was 0.75 and that most of the firms are found operating under decreasing returns to scale.

DATA AND METHODOLOGY

Data were obtained from the from OSIRIS database, 2009. Publicly listed companies were randomly chosen from the database and finally 14 companies were selected based on the criteria that data is available from 2004 to 2008. The analysis was conducted using DEAP.

In this study non-parametric measure DEA was employed. It is non-parametric because it requires no assumption on the shape or parameters of the underlying production function. DEA is a linear programming technique based on the pioneering work of Farrell's efficiency measure (1957), to measure the different efficiency of decision-making units (DMUs). Based on the past studies, input was measured by both total expenses (operating and financial expenses) and total assets. Output was measured in terms of sales.

EMPIRICAL RESULTS

Table 1 presents the DEA efficiency scores for the 14 companies for the five year period. Note that a company that has a score less than 1 was regarded as inefficient. It was found that only company was efficient in 5 years. This implied that majority of the sample of Malaysian companies did not show good efficiency during this 5 years. The scores of inefficient companies show a discrepancy on the year-by-year basis and the trend seemed to be downward. For example, the efficiency score of company 7 was 0.88 in 2004, and then decreased to 0.22, 0.17, 0.21, 0.13, and 0.32 in year 2005, 2006, 2007, 2008, respectively. This implies that in the year 2004, the company had wasted 12 percent of the level of inputs of efficient companies with the same level of outputs. The original data for this company indicate that the company has increased its expenses from 2004 to 2006 but reduced its expenses in 2007 and 2008 and this has affected its efficiency. Looking at the overall average performance, the Malaysian companies' efficiency has decreased in 2005 and 2006, but increased slightly in 2007 and then decreased again in 2008. When the aggregate production efficiency is decomposed into pure technical efficiency and scale efficiency using the VRS production function, it was found that the source of inefficiency is due to scale inefficiency rather than pure technical inefficiency for all years except for 2005.

Table 1: Efficiency Scores from DEA Model, 2004-2008

Co	2004			2005			2006			2007			2008		
No	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
1	0.55	0.55	1.00	0.29	0.30	0.99	0.16	0.20	0.81	0.24	0.31	0.79	0.15	0.20	0.74
2	1.00	1.00	1.00	0.92	1.00	0.92	0.88	1.00	0.88	0.88	1.00	0.88	0.76	1.00	0.76
3	1.00	1.00	1.00	0.58	1.00	0.58	0.32	0.43	0.75	0.53	0.66	0.80	0.42	0.54	0.78
4	0.47	0.48	0.97	0.49	0.59	0.83	0.47	0.56	0.84	0.47	0.58	0.82	0.38	0.49	0.78
5	0.32	0.34	0.95	0.23	0.42	0.56	0.23	0.41	0.57	0.26	0.50	0.52	0.27	0.62	0.44
6	0.20	0.28	0.71	0.18	0.24	0.74	0.19	0.30	0.65	0.31	0.38	0.83	0.16	0.26	0.59
7	0.88	1.00	0.88	0.22	1.00	0.22	0.17	0.62	0.27	0.21	0.78	0.26	0.13	0.69	0.19
8	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	0.65	0.69	0.94	0.48	0.70	0.68	0.32	0.68	0.47	0.29	0.79	0.37	0.28	0.61	0.45
10	0.60	0.66	0.91	0.53	0.65	0.82	0.48	0.74	0.65	0.73	0.92	0.80	0.42	0.78	0.53
11	0.33	0.61	0.55	0.30	0.60	0.49	0.24	0.64	0.38	0.32	0.52	0.62	0.21	0.44	0.48
12	0.73	0.82	0.89	0.59	0.76	0.78	0.48	0.79	0.61	0.59	0.77	0.77	0.35	0.69	0.51
13	0.50	0.80	0.62	0.47	1.00	0.47	0.49	1.00	0.49	0.45	1.00	0.45	0.35	1.00	0.35
14	0.97	1.00	0.97	0.77	1.00	0.77	0.64	1.00	0.64	0.76	1.00	0.76	0.51	1.00	0.51
Av	0.60	0.73	0.89	0.50	0.73	0.70	0.43	0.67	0.64	0.50	0.73	0.69	0.38	0.67	0.58
Mx	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mn	0.20	0.28	0.55	0.18	0.30	0.22	0.16	0.20	0.38	0.40	0.31	0.26	0.13	0.20	0.19

The returns to scale analysis are shown in Table 2. The constant returns to scale indicate that the company has reached the best scale. The increasing returns to scale indicates that an increase in inputs leads to a more than proportionate increase in output while decreasing returns to scale indicate that an increase in inputs leads to a less proportionate increase in outputs. In 2008, all companies except company numbered 2 and 8 show increasing returns to scale. It indicates that managers' capabilities to utilize companies' given resources still need to be enhanced. They must reduce non essential expenses so as to produce efficiently.

Table 2: Returns to Scale Analysis for each Company, 2004-2008

Year	No. of companies/Percentage share	RTS			Total
		IRS	CRS	DRS	
2004	No. of companies	11	3	-	14
	% share	78.6	21.4	0	100
2005	No. of companies	12	1	1	14
	% share	85.7	7.1	7.1	100
2006	No. of companies	12	1	1	14
	% share	85.7	7.1	7.1	100
2007	No. of companies	12	1	1	14
	% share	85.7	7.1	7.1	100
2008	No. of companies	12	1	1	14
	% share	85.7	7.1	7.1	100

Note: RTS = returns to scale, IRS = increasing returns to scale, CRS = constant returns to scale, DRS = decreasing returns to scale

Source of data? (please mention)

CONCLUSION

This paper examined the relative efficiency of selected Malaysian public listed companies using the non-parametric approach of data envelopment analysis (DEA) from 2004 to 2008. The DEA methodology is employed using both the constant returns to scale (CRS) and variable returns to scale (VRS) assumption to provide measures of technical and scale efficiency. The results reveal a substantial level of dispersion of technical efficiency between companies within the sample for

the year to year basis. The estimated results show that only 1 company is relatively efficient throughout the period under investigation while the average overall technical efficiency varies from 0.13 to 0.50. It was found that the source of inefficiency is mainly due to its scale rather than pure technical inefficiency. The inefficient companies can effectively promote resource utilization efficiency by better handling their inputs.

This study is not without its limitations. More companies should be included in the study and other input and output variables could be used. However, the findings could help the management of the company to review its resources to increase performance and efficiency.

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