

Profitability Performance of Selected Top Listed Malaysian GLCs and non-GLCs

Nordin Haji Mohamad and Fatimah Said

Abstract—The purpose of this study is to measure and compare the profitability performance of selected top-listed Malaysian companies, both government linked and non-government linked companies. A linear programming based methodology, known as data envelopment analysis, DEAs used to measure the relative performance of each company by utilizing a list of normalized performance indicators for the period 2009-2011. In addition to estimating technical and scale efficiency, DEA also provides a mean of measuring returns to scale – increasing, constant and decreasing – and identifying companies exhibiting the most productive scale size, *mpss*. The DEA scores indicate that only a small number of the companies were operating on the best-practice frontier under the assumptions of constant and variable returns to scale. Comparisons are made between government-linked and non-government linked companies. Most of the companies showed serious scale inefficiency and exhibited decreasing return to scale.

Index Terms—Data envelopment analysis, government linked companies, performance, relative technical efficiency.

I. INTRODUCTION

Profitability is the main financial goal of all business activities or ventures. It is usually defined as the ability of a given investment to earn a return on its use. Profitability also determines the survival of the business in the long run. Thus measuring and assessing profitability is very important. In financial study, profitability is normally measured in ratio forms as the return on assets (ROA), return on equity (ROE) and return on revenues or sales (ROS). For most of these ratios, a higher value is indicative that the business is flourishing.

Performance evaluation involves a number of attributes or criteria, both quantifiable and non-quantifiable. Several methods for effective evaluation of performance involving multiple variables have recently been conducted. This includes financial statement analysis [1], [2], balanced scorecard [3], [4], multivariate statistical analysis [5], analytic hierarchy process [6], [7], fuzzy set theory [8], grey relation analysis [9] and data envelopment analysis [10]. Among these approaches, DEA is perhaps the most commonly used methodology for measuring performance and efficiency estimation [11].

Manuscript received May 16, 2013; revised July 13, 2013.

This work was supported in part by the University of Malaya Research Grant UMRG: 246-12AFR, Profitability Performance of Selected Top-Listed Malaysian GLCs and non-GLCs. Nordin Haji Mohamad and Fatimah Said.

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DEA does not require specific functional relationship between production outputs and inputs nor any specific statistical distribution of the error terms. Its ability to handle production processes involving multiple inputs and multiple outputs makes it an appealing choice and outweighs its statistical shortcomings. It provides detailed information on the comparative performance of each decision making unit, DMU in the form of an efficiency score (one for efficient DMUs and less than one for inefficient DMUs) which is interpreted as a measure of business performance. For inefficient DMU, DEA identifies its peers from a set of efficient units that it is compared with, as well as improvements in output and/or input levels required by the unit to be on the efficient frontier. In other words, DEA provides the inefficient unit with guidance or path to the frontier. However, DEA provides no statistical information on the goodness and reliability of the results.

This paper investigates the performance of selected largest listed government-linked companies, GLCs and non-government linked companies, non-GLCs in Malaysia using super-efficiency DEA model. The paper unfolds as follows. Second section presents a literature review on selected performance evaluation conducted using DEA model. Section three defines the super-efficiency DEA model utilized in the study. This is followed by an empirical study on 114 largest listed companies (20 GLCs and 94 non-GLCs) by revenue as compiled by Malaysian Business. The final section presents our conclusions and directions for future research.

II. LITERATURE REVIEW

Al-Shammari [12] empirically assesses the relative efficiency of profit oriented DMUs, viz. fifty-five Jordanian manufacturing shareholding companies listed in the Amman Financial Market using input and output data for the year 1995. The number of employees, paid-in capital and fixed assets are three input measures utilized for the study, whereas the market value per share, net sales and net income after taxes are three output targets chosen. Out of the sample of 55 companies, 12 (21.82%) were found to be relatively efficient. The relative efficiency score of the 43 inefficient DMUs ranged from 0.127 to 0.911. The study also illustrates the necessary adjustments in the slack variables in order to achieve Pareto efficiency. Discussions with key executives in selected manufacturing organizations were also conducted. Despite agreeing that DEA provided new insights not available from other methods of assessment and can provide a motivation to the best practicing DMUs, they argued that DEA results cannot be considered as a substitute to the partial profitability ratio measures.

Another study on measuring the relative market efficiency of sixty-two top listed companies in Egypt was conducted by Mostafa [13] using production frontier approach, PFA (an alternative name for DEA). Two inputs comprising of assets and employees, and three outputs signifying by net profit, market capitalization and share price are chosen as input-output indicators. The efficiency scores under constant return to scale, CRS ranged from 0.2 to 1.0 with an average of 0.39. Under variable return to scale the scores varied from 0.4 to 1.0 with an average of 0.46. This indicates that if the average company in the sample is on the most efficient frontier then the average company could realize a 54 percent cost saving. Overall, the results indicate that the performance of several companies is sub-optimal, suggesting the potential for improvements in profitability and marketability. Slack variables are used to identify sources of inefficiency. Among future directions suggested include the utilization of a larger sample size, to test the robustness of the results and cross analysis with traditional efficiency measures such as financial ratio.

Other studies on listed companies include [14], [15]. Ebadi *et al.* [16] utilize five super-efficiency models in ranking 74 high schools from the north of Iran. It was found that the difference between the results obtained by various alternatives is not significant. In this paper we utilize an equivalent Andersen-Petersen [17] super-efficiency model to investigate the relative technical efficiency of selected top listed companies by revenue in Malaysia.

III. METHODOLOGY

Following Mohamad and Said [10] the strictly output-oriented DEA model under constant return to scale, CRS utilized to evaluate listed companies activities that allows the inclusion of multiple inputs and outputs in the production frontier is stated as follows

$$\text{Maximize } \Omega_0 \quad (1)$$

subject to

$$-X_{0i} + \sum_{k=1}^S X_{ki} \lambda_k = 0, i = 1, 2 \dots n, \quad (2)$$

$$-Y_{0j} \Omega_0 + \sum_{k=1}^S Y_{kj} \lambda_k \geq 0, j = 1, 2 \dots m, \quad (3)$$

$$\lambda_k \geq 0, k = 1, 2, \dots, S, \Omega_0 \text{ unconstrained}$$

where there are S DMUs to be investigated, each utilizes m inputs denoted by $X_k = \{X_{k1}, X_{k2}, \dots, X_{km}\}$ to produce n outputs denoted by $Y_k = \{Y_{k1}, Y_{k2}, \dots, Y_{kn}\}$. The relative technical efficiency, θ_0 for DMU₀ is defined as $\theta_0 = 1/\Omega_0$.

For evaluation under the assumption of variable return to scale, VRS an additional convexity constraint is imposed on λ_k such that

$$\sum_{k=1}^S \lambda_k = 1. \quad (4)$$

This results in the formation of a convex hull of intersecting planes which envelope the data points more

tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained under the assumption of CRS. The difference in the technical efficiency scores under the two assumptions of returns to scale is mainly attributable to scale inefficiency. Thus, scale efficiency, SE , can be viewed as the extent to which a DMU can take advantage of returns to scale by altering its size towards the optimal size (defined as the regions in which there are CRS in the relationship between outputs and inputs) and is computed as $SE_0 = \theta_0^{CRS} / \theta_0^{VRS} \leq 1$.

Under normal DEA model, inefficient DMUs having unique scores of less than one can be ranked according to their scores. But all efficient DMUs are assigned efficiency score of unity (or 100 percent), making it impossible to differentiate their performance. To overcome this problem one alternative procedure known as super-efficient DEA model was proposed by Andersen and Petersen [17] on the traditional DEA model by eliminating the constraint associated with a particular efficient DMU. This relaxation produces efficiency score of greater than or equals to one, thereby making it possible to rank all efficient DMUs. Here, in the output oriented DEA model we proposed an Andersen-Petersen equivalent super-efficient DEA model by eliminating all the terms associated with a particular efficient DMU in all constraints when evaluating that particular DMU such that (1)-(3) become

$$\text{Maximize } \Omega_E \quad (5)$$

subject to

$$-X_{0i} + \sum_{k \neq E}^S X_{ki} \lambda_k = 0, i = 1, 2 \dots n, \quad (6)$$

$$-Y_{0j} \Omega_E + \sum_{k \neq E}^S Y_{kj} \lambda_k \geq 0, j = 1, 2 \dots m, \quad (7)$$

$$\lambda_k \geq 0, k = 1, 2, \dots, S,$$

Ω_E unconstrained,

DMU_E is an efficient DMU. This will produce a score of $0 < \Omega_E \leq 1$, giving super-efficiency score of $\theta_E \geq 1$, making it possible to rank efficient DMUs. The scores for inefficient DMUs remain unchanged.

IV. EMPIRICAL IMPLEMENTATION

DEA Input and Outputs: The sample addressed in the study relates to selected listed companies in Malaysia. The basic data are obtained from *Malaysian Business* magazine [18] for financial year end that falls on or before July 31. Only companies which have been listed at Bursa Malaysia for at least two years are surveyed. Their financial performance are broken down into six sub-listings including turnover (or revenue), net profit, equity and assets. However, no information is furnished on input factors relating to labour, capital and expenditure. A total of 114 companies comprising of 20 GLCs and 94 non-GLCs were selected based on their revenues.

Table I summarizes the descriptive statistics. All indicators show an increasing trend. The average revenue, profit, equity

and assets grow at a rate of approximately 6.60, 30.10, 19.30 and 16.50 percent per annum respectively. A GLC conglomerate Sime Darby dominates the top revenue generator for all years but the top earner in terms of profit earned is another GLC financial institution, Malayan Banking which also accumulates the largest asset for all the years. At RM25657.2 million, a GLC power supplier TNB tops the equity list in 2009, but loses to Malayan Banking for the next two years. On the less fortunate side, a non-GLC Lion Corporation is the biggest loser at RM-1215.50 million in 2009 and RM-281.1 million in 2011. Another non-GLC loser is Zelan at RM-275.0 million in 2010 and generating the lowest revenue in 2011 at RM41.4 million.

TABLE I: DESCRIPTIVE STATISTICS FOR 2009-2011 (RM MILLION)

Year	Variables	Mean	Std. Dev	Maximum	Minimum
2009	Revenue	4571.2	5164.4	32028.0	559.1
	Profit	372.9	651.2	3002.3	-1215.5
	Equity	3277.8	4701.8	25657.2	121.0
	Asset	15758.4	38384.0	268910.9	425.3
2010	Revenue	4672.9	5366.1	33819.5	755.1
	Profit	466.7	649.4	3968.5	-275.0
	Equity	3788.2	5469.9	27877.2	156.8
	Asset	18013.5	45459.5	332219.1	518.8
2011	Revenue	5190.4	6294.8	42872.0	41.4
	Profit	631.7	916.9	4619.8	-281.1
	Equity	4666.8	6609.6	32470.3	0.6
	Asset	21338.7	54791.6	405449.6	532.6

One input and six output indicators are chosen to characterize and reflect the diverge performance of the companies. These indicators are defined as follows,

- Input (X): Total operating expenditure (or cost), approximated as revenue less net profit.
- Output 1 (Y1): The rate of change of revenue, expressed in percentage.
- Output 2 (Y2): The rate of change of net profit, expressed in percentage.
- Output 3 (Y3): The rate of change of assets, expressed in percentage.
- Output 4 (Y4): The return on revenue, expressed in percentage.
- Output 5 (Y5): The return on equity, expressed in percentage.
- Output 6 (Y6): The return on assets, expressed in percentage.

The single input, total operating expenditure denotes the business operational costs of materials and labour to generate products or to provide the services. This may include salary and wages for the employees, office rentals, maintenance costs and others. However, no information is furnished on these items and we approximate it as revenue less net profit. The first three output measures capture the dynamicity of the performance while the next three measures capture the profitability ratios, normally equated with the company's ability to generate a return on its resources.

All the six output measures take on negative values for some observations and DEA is not capable of handling negative data. Thus for consistency, all indicators (including input) are normalized on a scale of [1, 100] such that

$$X_{nor} = \frac{99(X_{act} - X_{min})}{X_{max} - X_{min}} + 1 \quad (8)$$

where X_{nor} is the value of the normalized indicator, X_{act} is the actual value of the indicator; X_{max} is the maximum value of the indicator; X_{min} is the minimum value of the indicator.

This transformation ensures that $X_{nor} \in [1, 100]$, and is synonymous with *United Nation Human Development Index*.

DEA Results and Interpretations: We used linear programming software LINDO to solve the *strictly* output-oriented super-efficient DEA model under the assumptions of CRS and VRS. This amounts to solving 228 linear programming problems. The efficiency scores are interpreted as a measure of comparative performance of the units under investigation. It provides information on how each individual company performed in comparison with other companies for the year under consideration.

A. Technical Efficiency

The results for the top and bottom ten under the assumption of CRS is presented in Table II. Seven non-GLCs are considered super-efficient in at least one year under the assumption of CRS. These are PBB Group, Kwantas Corporation, QSR Brands, Press Metal, Media Prima, General Corporation and Keck Seng (M). None is super-efficient in all years. Only four averaged as super-efficient. None of the GLCs are considered relatively efficient under CRS. As depicted in Table II, with the exception of PBB Group the top companies ranked by DEA comprises of lower ranked companies by revenue. These top performers obtain an average relative technical efficiency of greater than seventy-eight percent. Only two are GLCs, namely Syarikat Takaful Malaysia, an Islamic insurance company and Malaysia Airport Holdings. An interesting observation is that the bottom performers are from top companies by revenue except Maxis. In fact the bottom-five are the top-five by revenue and are GLCs main income generators. The technical efficiency score for inefficient units under CRS range from 0.13941 to 0.88819. The overall average is 0.58561 with GLCs and non-GLCs averaging 0.54104 and 0.59509 respectively.

TABLE II: TECHNICAL EFFICIENCY SCORES, 2009-2011

Company	2009	2010	2011	Average
PBB Group	0.19586	2.71779	1.44226	1.45197
QSR Brands	1.66583	1.50592	0.52814	1.23330
Press Metal	2.01644	0.83419	0.69049	1.19037
Kwantas Corporation	0.49005	0.57083	1.97151	1.01080
Keck Seng (M)	0.55902	0.75323	1.35231	0.88819
Media Prima	0.67898	1.31626	0.66600	0.88708
General Corporation	1.17225	0.74839	0.57516	0.83194
Syarikat Takaful (M)*	0.85543	0.71554	0.83460	0.80185
Malaysia Airport *	0.69316	0.79541	0.89743	0.79533
Carlsberg Brewery	0.83655	0.75263	0.76319	0.78412
:				
:				
Shell Refining Co.	0.21674	0.39806	0.60046	0.40509
IOI Corporation	0.35747	0.35384	0.50079	0.40403
Lion Corporation	0.31750	0.43923	0.44667	0.40113
UMW Holdings *	0.27859	0.35038	0.56237	0.39711
Maxis	0.36918	0.38931	0.42618	0.39489
Malayan Banking *	0.25098	0.36821	0.41976	0.34632
MISC *	0.22734	0.27245	0.53812	0.34597
Petronas Dagangan *	0.12475	0.17946	0.28578	0.19666
Tenaga Nasional *	0.12285	0.17876	0.22554	0.17572
Sime Darby *	0.09901	0.13830	0.18093	0.13941

* Government Linked Companies, GLCs.

B. Pure Technical Efficiency

The VRS efficiency scores measure pure technical efficiency (*PTE*) excluding the effects of scale operations and are more encouraging. They are greater than the corresponding CRS efficiency scores. Only two companies, Press Metal and British American Tobacco (M), both non-GLCs exhibit super-efficiency in all years. Sixteen more companies (one GLC, Sime Darby, and fifteen non-GLCs) achieve super-efficient score in at least one year. Seven companies are also efficient under CRS, thereby implying that they are also 100% scale efficient in at least one of the years under evaluation. Six of the financial institutions (three from each group) namely Malayan Banking, BMB Holdings, CIMB Holdings, Hong Leong Financial Group, Hong Leong Bank and Public Bank join the top thirty percent DEA ranking. The average for the three years is 0.78636, 0.90731 and 0.98232 respectively, indicating a significant increasing trend. The overall group average is 0.89200 with GLCs and non-GLCs averaging 0.84983 and 0.90097 respectively. However, the minimum average *PTE* score by GLCs is 0.79028, higher than the minimum average score by non-GLCs of 0.69683.

TABLE III: MEAN EFFICIENCY GLCS AND NON-GLCS, 2009-2011

	TE	PTE	SE
All companies	0.58561	0.89200	0.66386
Maximum	1.45197	1.82110	0.91828
Minimum	0.13941	0.69683	0.17101
GLCs_ average	0.54104	0.84983	0.62685
Maximum	0.80185	0.93995	0.91828
Minimum	0.13941	0.79028	0.17101
Non-GLCs_ average	0.59509	0.90097	0.67046
Maximum	1.45197	1.82110	0.86454
Minimum	0.39489	0.69683	0.42410

C. Scale Efficiency

The ratio of CRS and VRS efficiency is the scale efficiency ($SE = TE/PTE$). This is reported in Table III. The fourteen VRS-efficient units are not able to register best business performance scores because of limitations of their scale and operation. Seven companies are 100 percent scale efficient in at least one of the years under evaluation, thereby putting them on the frontier of the most productive scale size, mpss. No company (GLCs or non-GLCs) is 100 percent scale efficient in all the years. It is interesting to note that eight of the GLCs (40.0%) achieve scale efficiency of less than 50.0 percent as compared to four of the non-GLCs (4.26%). The bottom-five are all GLCs namely, Sime Darby, Tenaga Nasional, Petronas Dagangan, Malayan Banking and MISC.

Table III also provides a summary of the average efficiency scores and the relative efficiency ranges for GLCs and non-GLCs. Results under VRS are more encouraging. The inefficient scores range from 0.69683 to 0.97597. Almost all of the companies investigated achieve a pure technical efficiency score of more than 70.0 percent. None of the company's *PTE* scores falls below 69.0 percent. The distribution of *SE* score is slightly better than that of *TE* with higher average score of 0.66386 and shorter range. The scores for inefficient units vary in a range of 0.17101–0.91828 for the GLCS and 0.42410 – 0.86454 for the non-GLCs. Fifty-five percent of the GLCs and 37.23

percent of the non-GLCs are more than 70.0% scale efficient. Thus, it seems that most companies appeared to be facing serious scale inefficiency.

D. Returns to Scale

Apart from the inefficiencies that could arise in the conversion process, another reason for the inefficiencies of the inefficient units could be attributed to the scale of operations. DMUs that do not operate at the most efficient (or productive) scale size cannot be fully efficient. The inefficiency may arise because it is operating under DRS or IRS. A DMU is said to be operating under DRS if changing all inputs by the same proportion results in a smaller proportional change in outputs. IRS may also be defined similarly. Whether a DMU is operating under IRS or DRS can be determined by observing its *TE* and *PTE* efficiency scores, such that

- if $TE = PTE$, CRS prevails
- if $TE \neq PTE$, then

$$\left\{ \begin{array}{l} \sum_{k=1}^S \lambda_k < 1 \rightarrow \text{IRS.} \\ \sum_{k=1}^S \lambda_k > 1 \rightarrow \text{DRS.} \end{array} \right.$$

In our analysis only seven performers, operating under CRS are 100% scale efficient, in at least one year, thereby implying the existence of multiple most productive scale size. The remainder DMUs all exhibit DRS. This suggests that most companies not only show serious scale inefficiency, but also operate in a region of DRS. None of the company is operating in an IRS region. Hence it may be concluded that one reason for the inefficiency of these companies (GLCs and non-GLCs) comes from its scale size. It is operating under DRS leading to the fact that any increase in input results in less than proportionate increase in outputs or improvement in performance.

V. CONCLUSION

The study utilizes a strictly output oriented super-efficiency DEA methodology to assess the performance of selected largest listed companies in Malaysia based on multi-dimensional performance indicators under the assumptions of CRS and VRS. One input and six output indicators reflecting the business dynamicity and profitability achievements are used for the evaluation. A linear transformation is adopted to handle the negative data such that all indicators lie between 1.0 and 100.

Results obtain suggest that only 3.5% and 12.3% are found to be relatively efficient under CRS and VRS respectively. None of the GLCs is efficient under CRS. However, only 6% are 100% scale efficient with multiple most productive scale size in at least one of the years under evaluation. None is 100% scale efficient in all years. These top performers are from revenue-bottom-ranked companies, mainly non-GLCs. Thus, revenue-top-ranked companies (mainly GLCs) are not necessarily top-ranked performers. The VRS test suggests that the nonperformers are operating in the region of DRS.

These findings are in agreement with findings by Zhu [19]. However, the study found no company is operating in the region of IRS.

Like any other performance or efficiency evaluation technique, DEA has several limitations. DEA efficiency scores are sensitive to sample size and input-output mix. Future studies should focus on larger sample size and experiment with different input-output mix to test the robustness of the results. Efficiency or performance gives more meaning when it is assessed over time. Given a set of panel data the Malmquist total factor productivity, *TFP* change index technique can be utilized to explore the dynamicity of companies. This provides avenue for future research.

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