

The Efficiency and Performance Evaluation of Government-Linked Companies (GLCs) in Malaysia using Data Envelopment Analysis

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Abstract— Efficiency is a vital criterion in global competitive business and sustainable growth. Efficiency has always been reflected in company's performance based on the existing input or resources available against the optimum output generated. A highly strong organizations capability will attract higher revenue and more investors to the company. The purpose of this study is to evaluate, compare and rank the overall efficiency based on the annual reports of companies in Malaysia stock market by using Data Envelopment Analysis (DEA). The analysis is carried out on 15 government-linked companies (GLCs) where cross-sectional data between periods of 2013 to 2017 were evaluated. Three efficiency input were considered including return on assets, return on equity and tobin's q where the outcome or outputs were profitability. The results indicate that Malayan Banking and Malaysian Resources Corporation Berhad are ranked as efficient companies in utilizing the resources, assets and capitals with profit. The implication of this research would benefit many organizations to perform better within their supply chain activity with the use of DEA as a tool of performance measures.

Keywords— Government-linked companies (GLCs), efficiency evaluation, performance, financial ratios, data envelopment analysis (DEA)

1. Introduction

The state-owned enterprises (SOEs) or known as government-linked companies (GLCs) plays a critical role in enhancing the economy of Malaysia. The objective is primarily connected to the commercial business where Malaysian government has a direct control. This is not just limited to percentage of ownership but also towards appointing the board members, senior management

and major decision units. There are debatable arguments with regards to these organizations towards the financial and efficiency issues in terms of operations, resources and business opportunities.

In gearing towards the vision 2020 as stated in GLC transformation (GLCT) programme, it is necessary for the GLCs to maintain their efficiency to become sustainable. Three principles under GLCT programme in July 2015 after their graduated from the programme which is expected to continue are performance focus, nation building and good governance which will benefit all stakeholders. In globalization of open market, GLCs were exposed to great competitions as it creates dynamic and complex environment as workforce becomes larger, diversified and agile.

DEA method is introduced to compare the efficiency and performance from the similar unit (e.g. [1], [2]). The individual units are known as decision making units (DMUs) and every DMU may consist of multiple or different sources of inputs and output. The frontier analysis is a powerful technique to evaluate performance of non-profit, public and private sector organization. Many studies has been conducted through DEA in various sectors and institutions including transportation [3] and supply chain [4], hospitals [5], [6], schools [7] and banking [8], [9]. Supply chain management is involved in all areas within every industries end to end process. This necessitates that DEA is one of the tools necessary for performance evaluation.

Efficiency can be defined as a ratio of output to input. The optimum efficiency may be achieved as the greatest output per unit from the input. Many

researchers have used various approaches to evaluate company efficiency in terms of financial, key performance index (KPI), productivity and resources. However, the most popular performance indicators for corporations are through financial ratio analysis (e.g. [10-16]).

There is a massive recognition of financial analysis as a critical construct in efficiency measurement of businesses in particular. As a result, substantial research interest has been generated as a significant link towards efficiency and performance. However, there is a dearth of research examining the benchmarks towards the different sectors under the same GLCs categories with regards to financial analysis through the use of DEA. In order to understand on how a financial analysis may differ in a variety of industry sectors, it is vital to provide the crucial need for implementing the efficiency of resources strategies.

This paper has two main objectives. Firstly, is to provide the evidence of efficiency based on financial report within GLCs. This is to portray how the financial reports may be used as a KPI in these organizations. Secondly, the aim is to examine the financial ratios which may affect the performance of the companies. To pursue the objective of this study, listed GLC companies in Malaysia were selected over the years of 2013-2017. The financial statement of the companies is then collected for data processing by using DEA analysis. The finding reveals that the financial ratios have been used in performance measurement of GLC companies.

The structure of the paper is organized as follows: Section 2 presents the techniques used both in GLCs financial ratios and non-parametric formulations whereas in Section 3, the empirical results are discussed. The final section concludes the paper discussion with findings and the methodological implications.

2. Materials and Methods

This section presents the materials and methods used in this study.

2.2.1 Materials

In this study, the list of top 20 government-linked

companies is obtained from GLC Transformation Program of Malaysia government between the years 2013 up to 2017 as indicated in **Table 1**. There are only 15 GLC companies data available for this study due to some of the companies are either merged, delisted or unavailable. 5 of the companies includes financial institutions, 2 telco's, 2 general industries, 2 transportation, 1 construction, 1 electricity, 1 food producer and 1 estate and investment service.

Table1. Government-Linked Companies in Malaysia.

DM U	Company Name	Abbreviation	Industry	Code
1	Affin Holdings	AFFIN	Financial Institution	5185
2	Axiata Group	AXIATA	Mobile Telecomms	6888
3	BIMB Holdings	BIMB	Financial Institution	5258
4	Boustead Holdings	BSTEAD	General Retailers	2771
5	CIMB Group Holdings	CIMB	Financial Institution	1023
6	Malayan Banking	MAYBA NK	Financial Institution	1155
7	Malaysia Airports Holdings	AIRPOR T	Industrial Transportation	5014
8	Malaysia Building Society	MBSB	Financial Services	1171
9	Malaysia Resources Corporation	MRCB	Construction and Materials	1651
10	Sime Darby	SIME	General Industrials	4197
11	Telekom Malaysia	TM	Fixed Line Telecomms	4863
12	Tenaga Nasional	TENAG A	Electricity	5347
13	TH Plantations	THPLAN T	Food Producers	5112
14	UEM Sunrise	UEMS	Real Estate Investment and Services	5148
15	UMW Holdings	UMW	Automobiles and Parts	4588

Source: Bursa Malaysia [17]

There are three financial ratios considered in this study. They are return on assets (ROA), return on equity (ROE) and tobin's q ratio (TQR). The data over the years 2013 to 2017 as in **Table 2** were collected from company's financial report in Bursa Malaysia. Below is the description of the financial ratios used in this study:

[1] Return on assets (ROA), measured by net profit divided by total assets.

[2] Return on equity (ROE), measured by net profit divided by shareholders equity.

[3] Tobin's q ratio (TQR), measured by total market value of the firm divided by total assets.

Table 2. The descriptive of financial data between years 2013-2017.

Unit No.	GLCC companies	Inputs			Output
		ROA	ROE	TQR	Profit (000000)
1	AFFIN	0.024786	0.219910	0.816459	1606.588
2	AXIA TA	0.036816	0.079305	3.471812	1912.561
3	BIMB	0.038573	0.592952	0.913450	2223.983
4	BSTE AD	0.32381	0.071335	1.499566	548.984
5	CIMB	0.008588	0.093705	0.857146	3784.049
6	MAYBAN K	0.010477	0.116119	1.044849	7085.906
7	AIRP ORT	0.016312	0.042075	1.819277	278.254
8	MBSB	0.033842	0.337332	1.323678	1424.367
9	MRCB	0.020729	0.056819	0.001228	161.821
10	SIME	0.052000	0.092641	0.736266	2.92547
11	TM	0.035298	0.100838	1.501667	0.77278
12	TENA GA	0.053657	0.136258	0.800840	6.44264
13	THPL ANT	0.020634	0.042849	0.914293	72.2464
14	UEMS	0.030870	0.050847	0.560393	349.164
15	UMW	7.72863	0.154129	0.634907	1.10612

2.2.2 Methods

Data envelopment analysis (DEA) is a mathematical linear programming model that computes by determining the relative efficiency of operating entities of the decision making units (DMUs). DEA model is used to describe how efficiently the decision making units are able to benchmark the performance by transforming the inputs into outcomes or outputs. In DEA model, the efficiency of the units is expressed as the ratio of the sum-weighted output divided to sum-weighted inputs. DEA frontier is empirically observed the values of DMUs that are efficient by score as one or 100% whilst the inefficient will be denoted as a lower score.

There are some advantages of the non-parametric DEA analysis according to [18]: DEA is suitable for measuring efficiency with multiple input and output. It is a useful method when analyzing small data set. However, the main advantage of DEA, instead of requiring a prior assumption about the analytical form of the production function, DEA constructs the best practice production function on

the basis of observed data [19].

In this study, the input-output oriented is used because finance is a direct effect towards the GLCs revenue. By following the indicators from previous literature: return on asset, return on equity and tobin's q (e.g. [20-23]) is formulized in order to measure the corporation performance. According to Piot-Lepetit and Nzongang [24], the main reasons for using ratios analysis are to allow comparison among institution of different sizes and to control for sector characteristics permitting the comparison of individual ratios to be benchmarks. Financial ratios also are easy to be calculated and interpreted [25]. Following is the computation method used to evaluate the efficiency of 15 GLCs:

$$\text{Maximize } h_k = \frac{\sum_{r=1}^s t_r Y_{rk}}{\sum_{i=1}^m w_i x_{ik}} \tag{1}$$

Subject to

$$\frac{\sum_{r=1}^s t_r Y_{rj}}{\sum_{i=1}^m w_i x_{ij}} \leq 1, i, j = 1, 2, 3, \dots, n \tag{2}$$

$$t_r \geq \varepsilon, r = 1, 2, 3, \dots, s \tag{3}$$

$$w_i \geq \varepsilon, i = 1, 2, 3, \dots, m \tag{4}$$

Where,

h_k is the efficiency of DMU_k

s is the output

t_r is a weights of output r

m is the number of input

w_i is the weights to determine input i

ε is a positive value

n is the number of entities

$$\text{Maximize } h_k = \sum_{r=1}^s t_r Y_{rk} \tag{5}$$

Subject to,

$$\sum_{i=1}^m w_i x_{ij} - \sum_{r=1}^s t_r Y_{rj} \geq 0, j = 1, 2, 3, \dots, n \tag{6}$$

$$\sum_{i=1}^m w_i x_{ik} = 1 \tag{7}$$

$$t_r \geq \varepsilon, r = 1, 2, 3, \dots, s \tag{8}$$

$$w_i \geq \varepsilon, i = 1, 2, 3, \dots, m \tag{9}$$

3. Results

The empirical results for all 15 GLCs are presented in **Table 3** where the particular efficiency were formulated and solved using the software LINGO.

Table 3. GLC Companies efficiency score.

GLC Companies	Θ	Efficiency Score
AFFIN	0.2839	28%
AXIATA	0.3952	40%
BIMB	0.3468	35%
BSTEAD	0.1261	13%
CIMB	0.6618	66%
MAYBANK	1.0000	100.00%
AIRPORT	0.1084	11%
MBSB	0.1560	16%
MRCB	1.0000	100.00%
SIME	0.0006	0.06%
TM	0.0001	0.01%
TENAGA	0.0012	0.12%
THPLANT	0.0276	3%
UEMS	0.1125	11%
UMW	0.0212	2%

Table 3 indicates that the most efficient companies are those that has achieved 1.0000 (100%) in this study. From the 15 GLC companies listed, only two of them are most efficient in using their input of maximizing the profitability. The 2 companies are Malayan Banking and Malaysian Resources Corporation Berhad. The computation shows that the higher efficiency contributors are by tobin's q ratio. On the other hand, 13 companies have been considered as inefficient due to scoring less than 100%. Hence, AFFIN, AXIATA, BIMB, BSTEAD, CIMB, AIRPORT, MBSB, SIME, TM, TENAGA, THPLANT, UEMS and UMW are amongst other less efficient performances which need improvements.

Table 4. GLC Companies ranking of different sectors.

GLC Companies	Efficiency	Ranking
AFFIN	0.2839	6
AXIATA	0.3952	4
BIMB	0.3468	5
BSTEAD	0.1261	8
CIMB	0.6618	3
MAYBANK	1.0000	1
AIRPORT	0.1084	10
MBSB	0.1560	7
MRCB	1.0000	1
SIME	0.0006	14
TM	0.0001	15
TENAGA	0.0012	13
THPLANT	0.0276	11
UEMS	0.1125	9
UMW	0.0212	12

The DEA is a quantitative approach for measuring efficiency. Therefore, the qualitative factors are not being considered in this analysis. As shown in **Table 4**, only two corporations are at ranking number 1 where the efficiency score is 100%. The GLC companies that is ranked in the first list is MAYBANK and MRCB. MAYBANK is a financial institution while MRCB is from the construction industry.

4. Conclusion

The DEA model is a mathematical model which measures the government-linked companies by decision making units that provides useful information on the performance evaluation. There were 15 GLC companies from different industry sector listed in Malaysia stock market analyzed from proxy statements published in 2013 until 2017. According to the result, Malayan Banking and Malaysian Resources Corporation Berhad were substantially efficient with higher ranking compared to the rest of GLC companies. This implies that the companies are in optimal of inputs or resources to generate maximum output. On the other hand for the non-performing companies it suggests to utilize the resources, assets and capital. These studies also reveal that the profitability is not necessarily reflecting the overall efficiency of the company as factors such as market value or business prospect will impact the investor perception. This study is significant because overall company's efficiency is evaluated and ranked by considering three financial ratios with DEA model.

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References

- [1] Fernandes, F.D.S., Stasinakis, C. and Bardarova, V., 2018. Two-stage DEA-Truncated Regression: Application in banking efficiency and financial development. *Expert Systems with Applications*, 96, pp.284-301.
- [2] Wang, W.K., Lu, W.M. and Liu, P.Y., 2014. A fuzzy multi-objective two-stage DEA model for evaluating the performance of US bank holding companies. *Expert Systems with Applications*, 41(9), pp.4290-4297.
- [3] Wu, J., Zhu, Q., Chu, J., Liu, H. and Liang, L., 2016. Measuring energy and environmental efficiency of transportation systems in China based on a parallel DEA

- approach. *Transportation Research Part D: Transport and Environment*, 48, pp.460-472.
- [4] Arabzad, S. M., Ghorbani, M., & Bahrami, M., 2012. Distribution Evaluation Based on Data Envelopment Analysis. *Int. J. Sup. Chain. Mgt*, 1(1), p.27.
- [5] Jacobs, R., 2001. Alternative methods to examine hospital efficiency: data envelopment analysis and stochastic frontier analysis. *Health care management science*, 4(2), pp.103-115.
- [6] Du, J., Wang, J., Chen, Y., Chou, S.Y. and Zhu, J., 2014. Incorporating health outcomes in Pennsylvania hospital efficiency: an additive super-efficiency DEA approach. *Annals of Operations Research*, 221(1), pp.161-172.
- [7] López-Torres, L. and Prior, D., 2016. Centralized allocation of human resources. An application to public schools. *Computers & Operations Research*, 73, pp.104-114.
- [8] Ebrahimnejad, A., Tavana, M., Lotfi, F.H., Shahverdi, R. and Yousefpour, M., 2014. A three-stage data envelopment analysis model with application to banking industry. *Measurement*, 49, pp.308-319.
- [9] Wang, K., Huang, W., Wu, J. and Liu, Y.N., 2014. Efficiency measures of the Chinese commercial banking system using an additive two-stage DEA. *Omega*, 44, pp.5-20.
- [10] Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance*, 23(4), pp.589-609.
- [11] Hartarska, V., 2005. Governance and performance of microfinance institutions in Central and Eastern Europe and the newly independent states. *World development*, 33(10), pp.1627-1643.
- [12] Avkiran, N.K. and Morita, H., 2010. Predicting Japanese bank stock performance with a composite relative efficiency metric: A new investment tool. *Pacific-Basin Finance Journal*, 18(3), pp.254-271.
- [13] Avkiran, N.K., 2011. Association of DEA super-efficiency estimates with financial ratios: Investigating the case for Chinese banks. *Omega*, 39(3), pp.323-334.
- [14] Strøm, R.Ø., D'Espallier, B. and Mersland, R., 2014. Female leadership, performance, and governance in microfinance institutions. *Journal of Banking & Finance*, 42, pp.60-75.
- [15] Da Silva, T.P., Leite, M., Guse, J.C. and Gollo, V., 2017. Financial and economic performance of major Brazilian credit cooperatives. *Contaduría y administración*, 62(5), pp.1442-1459.
- [16] Alexakis, C., Izzeldin, M., Johnes, J. and Pappas, V., 2018. Performance and productivity in Islamic and conventional banks: Evidence from the global financial crisis. *Economic Modelling*.
- [17] Bursa Malaysia, Company Announcements | Bursa Malaysia Market, (online) Available at: <http://www.bursamalaysia.com/market/listed-companies/company-announcements/#/?category=all>, Accessed (15 November 2018)
- [18] PHAM, T.Q.M., Choi, K.H. and Park, G.K., 2018. Efficiency Analysis for Major Ports in Korea and China using Boston Consulting Group and Data Envelopment Analysis Model. *Journal of Korean Navigation and Port Reserch*, 42(2), pp.107-116.
- [19] Wijesiri, M., Yaron, J. and Meoli, M., 2017. Assessing the financial and outreach efficiency of microfinance institutions: Do age and size matter?. *Journal of Multinational Financial Management*, 40, pp.63-76.
- [20] Agle, B.R., Mitchell, R.K. and Sonnenfeld, J.A., 1999. Who matters to Ceos? An investigation of stakeholder attributes and salience, corporate performance, and Ceo values. *Academy of management journal*, 42(5), pp.507-525.
- [21] Berman, S.L., Wicks, A.C., Kotha, S. and Jones, T.M., 1999. Does stakeholder orientation matter? The relationship between stakeholder management models and firm financial performance. *Academy of Management journal*, 42(5), pp.488-506.
- [22] Song, H., Zhao, C. and Zeng, J., 2017. Can environmental management improve financial performance: An empirical study of A-shares listed companies in China. *Journal of cleaner production*, 141, pp.1051-1056.
- [23] Muravyev, A., 2017. Boards of directors in Russian publicly traded companies in 1998–2014: Structure, dynamics and performance effects. *Economic Systems*, 41(1), pp.5-25.
- [24] Piot-Lepetit, I. and Nzongang, J., 2014. Financial sustainability and poverty outreach within a network of village banks in Cameroon: A multi-DEA approach. *European Journal of Operational Research*, 234(1), pp.319-330.
- [25] Hassan, M.K. and Bashir, A.H., 2005. *Determinants of Islamic Banking Profitability*, Munawar Iqbal and Rodney Wilson, Islamic Perspectives on Wealth Creation, Edinburgh: Edinburgh University Press.