Performance Evaluation and Prioritization of Leasing Companies Using the Super Efficiency Data Envelopment Analysis Model

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Abstract: Although the leasing industry is a successful industry in Iran's economic conditions, there are few studies that deal with the assessment of leasing companies' efficiency. This article applies data envelopment analysis (DEA) models for the efficiency assessment and ranking of leasing companies on the Tehran Stock Exchange (TSE). Total asset, P/E, and ROE are considered as inputs and EPS, current ratio, and sales growth are considered as outputs of each DMU. The results indicate that both the CCR and BCC models are not capable of ranking the five considered leasing companies. Due to the failure of the standard DEA models to rank the efficient set of leasing companies, a super efficiency DEA model, namely AP-DEA, is applied. The unique feature of this study is the use of a super efficiency DEA model to rank the leasing companies of the TSE. Concluding remarks are also presented in the final section.

Keywords: performance evaluation; super efficiency; DEA; leasing companies

1 Introduction

One of the most important concepts in the financial market is the lease as an agreement in which one party gains a long-term rental agreement and another party receives a form of secured long-term debt. This means that the lessee gains a long-term contract for use of an asset and the lessor is assured of regular payments for a specified number of years. A leasing company is a financial unit which

serves such services. Since leasing has a vital role in economic development and growth and also contributes a major share in the gross domestic production (GDP) by supporting the channelizing of funds (Alam *et al*., 2011a), assessing the performance of the leasing companies is a most important issue.

Generally, performance evaluation is the process of obtaining, analyzing, and recording information about the specific aspects of a company's or an organization's performance. Although the performance evaluation has various aspects (such as financial, customer, quality and processes), providing an opportunity for organizational diagnosis, improvement and development is the aim of the performance evaluation in all different viewpoints.

Financial performance is one of the main aspects of each company's/organization's performance, which is commonly evaluated using financial statement analysis and financial ratios analysis. For instance, Kantawala (2001) determined the financial performance of non-banking finance companies in India using three groups of financial ratios. He covered ten years from 1985-86 to 1994-95 and concluded that there would exist a significant difference in the profitability ratios, leverage ratios, and liquidity ratios of various categories of non-banking financial companies. Like Kantawala (2001), Ahmad *et al*. (2011a) examined the financial performance of the non-banking finance companies in Pakistan which were providing services such as investment advisory, asset management, leasing, and investment finance. They classified all considered ratios in three groups, profitability, leverage, and liquidity, and used ratio analysis to evaluate the performance. Alam *et al*. (2011a) evaluated the financial performance of Pakistani leasing companies between the years 2008 and 2010 via financial ratio analysis. They used seven financial ratios to assess the performance. Results of their study showed that the performance of leasing companies in 2010 was better than in 2009 due to a positive change of ratios from 2009 to 2010. In another case, Alam *et al*. (2011b) classified leasing companies using financial ratios and made horizontal and vertical analysis among leasing companies for the period 2006-2009. They concluded that leasing companies' ranking on the basis of net investment in finance lease is different from the ranking based on return on assets (ROA), return on equity (ROE), return on revenues (ROR) and lease ratio (LR).

Assessing service quality and customer satisfaction are other aspects of performance evaluation which are considered by Akhundi *et al*. (2010) in auto-industry leasing of Iran. They developed a model for the evaluation of service quality in auto-industry leasing based on indices explained by customers in focus group and surveyed for different periods using statistical techniques based on factor analysis.

Pierce (2003) examined the effects of organizational structure on the firm's strategy and performance of consumer automobile leasing. Pierce (2003) also demonstrated the significant effect of ownership structure on the firm's behavior

and performance. He suggests that being a subsidiary of a larger corporation may lead to a conflict between different goals within the firm and result in poor performance.

Among different performance evaluation approaches, DEA has been considered as an appropriate tool for measuring and analyzing efficiency and performance (Galagedera and Silvapulle, 2002; Joro and Na, 2006; Ho and Oh, 2008; Lo and Lu, 2009; Rouyendegh and Erol, 2010). Therefore, the DEA approach is applied in the present study.

In the literature, indices such as earnings per share (Samaras *et al*., 2003; Kimyagari and Amini, 2007; Lo and Lu, 2009; Ho and Oh, 2008; Fasangari and Montazer, 2010), current ratio (Tiryaki and Ahlatcioglu, 2005; Albadvi *et al*., 2007), total assets (Lo and Lu, 2009), price/earnings ratio (Tiryaki and Ahlatcioglu, 2005; Samaras *et al*., 2006; Xidonas *et al*., 2009), return on equity (Samaras *et al*., 2003; Tiryaki and Ahlatcioglu, 2005; Kimyagari and Amini, 2007; Xidonas *et al*., 2009), Sharpe, Jensen and Treynor (Redman *et al*. 2000) are considered for assessing the performance and ranking of companies. The indices considered in the current research are earnings per share, current ratio, total assets, price/earnings ratio, return on equity, and sales growth.

Data from Iran over 2005 show that the Iranian GDP was about 32 billion USD, 2 billion of which was earned from leasing companies (Akhundi *et al*., 2010). This fact confirms the success of this industry in Iran. Unfortunately, despite the industry's success, there are few studies about this industry, especially as regards the performance of leasing companies. Considering this gap, we are motivated to evaluate the performance of leasing companies listed on the Tehran Stock Exchange (TSE). The other detected gap in the literature is the lack of prior data envelopment analysis (DEA) study on assessing performance of leasing companies, in spite of the ability and advantages of DEA in the performance evaluation area. Therefore, the aim of this study is to design a performance evaluation model based on DEA for Iranian leasing companies.

2 Research Methodology

This section outlines the research methodology. As stated, in this study, DEA is used for assessing the performance of Iranian leasing companies. Therefore, a brief introduction to performance evaluation systems (PES) design, DEA, considered input and output variables, and a description of data source are presented in this section.

2.1 Performance Evaluation Systems (PES)

Developing an effective PES is required to achieve a precise appraisal and effective efficiency improvement. The primary goals of a PES are to provide a measure for comparing the same units, to produce accurate appraisal documentation, to plan an improvement scheme, and to obtain a high level of quality and quantity in the desirable outputs of the unit. The following steps can help managers to create an effective PES for financial appraisal:

1 Identify performance measures,

2 Develop an appropriate appraisal model,

3 Implement the model,

4 Draw a rough sketch for weak aspects,

5 Develop an improvement plan,

6 Set an evaluation schedule.

In the first step, standard performance measures must be extracted from the literature and other sources, such as expert opinion. Although identifying these measures may be one of the time-consuming steps of PES creation, the careful definition of such measures is very important for achieving a precise evaluation. In the second step, the PES should be developed in an unbiased manner. Therefore, an appropriate model must be chosen according to the special conditions of the case study. Then, the model should be implemented. The recognition of weak aspects of the performance, according to the results of the model, is done in the fourth step. Then, an improvement plan is designed based on the weak aspects. Finally, an evaluation procedure should be scheduled.

2.2 Data Envelopment Analysis

DEA, initially introduced by Charnes *et al*. (1978), is a nonparametric method to evaluate the efficiency of decision making units (DMUs). While not considering any assumption about the functional form of the frontier, DEA evaluates the performance regarding a number of inputs and outputs simultaneously. The DEA approach also does not require priori assumptions of the relationship between inputs and outputs, and they can have very different units. There are different versions of DEA according to its features. Two well-known features of DEA model are the structure of its returns to scale and orientations in efficiency analysis.

Based on the structure of returns to scale, there are two versions called constant returns to scale (CRS) or CCR (Charnes *et al*., 1978) and variable returns to scale (VRS) or BCC (Banker *et al*., 1984). In the CRS version, it is assumed that an

increase in the amount of inputs would lead to a proportional increase in the amount of outputs. In the VRS version, the amount of outputs is deemed to increase more or less than proportionally than the increase in the inputs. The CRS version is more restrictive than the VRS and usually produces fewer numbers of efficient units and also lower efficiency scores for all DMUs. This is due to the fact that the CRS is a special case of the VRS model.

Related to orientations in the efficiency analysis there are two well-known orientations. Input-oriented models are models where DMUs are supposed to produce a given amount of outputs with the smallest possible amount of inputs. Output-oriented models are models where DMUs are supposed to produce the highest possible of outputs with a given amounts of inputs (Charnes, 1994).

Suppose *n* DMUs with *m* inputs and *k* outputs; the CCR and BCC model related to DMU_p are shown in Table 1 as model (1) and (2), respectively, where, θ_p indicates the efficiency score of DMU_p, x_{ij} indicates the i^{th} input of the j^{th} DMU, y_{rj} indicates the r^{th} output of the j^{th} DMU, and λ_j indicates the weight of the j^{th} DMU.

Table 1
CCR and BCC version of DEA

CCR Model	**BCC Model**
$Min\ \theta_p$	$Min\ \theta_p$
s.t.	*s.t.*
$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_p x_{ip}$	$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_p x_{ip}$
$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp}$ (1)	$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp}$ (2)
$\lambda_j \ge 0,\ j = 1...n,\ i = 1...m,\ r = 1...k$	$\sum_{j=1}^{n} \lambda_i = 1$
	$\lambda_j \ge 0,\ j = 1...n,\ i = 1...m,\ r = 1...k$

2.3 Data Sources and Description

All data have been gathered from the TSE and from leasing companies' websites. Five companies, the Leasing Company of Iran (DMU_1), Iranian Leasing (DMU_2), Khodro-Ghadir Leasing (DMU_3), Rayan-Saypa Leasing (DMU_4), and Sanat-Madan Leasing Company (DMU_5), are selected for the performance evaluation.

The present study uses the financial statements of the selected companies in 2010 because all required data were available in this year. The values of the six

considered ratios are calculated to use in the performance analysis and shown in Table 2.

Table 2
Financial Indices of Leasing Companies

Index	Input (I) Output (O)	DMU				
		1	2	3	4	5
Earnings Per Share (EPS)	*I*	421	656	8	1339	307
Current Ratio (CR)	*I*	1.68	1.58	1.03	0.91	1.23
Total Assets (TA)	*O*	2612591	6108496	1200294	8394899	3030865
Price/Earnings Ratio (P/E)	*O*	7.7	5.7	5.0	5.7	4.8
Sales Growth (SG)	*I*	69.23%	116.40%	16.50%	76.10%	34.08%
Return On Equity (ROE)	*O*	27.96%	32.30%	0.77%	51.96%	16.85

The six ratios are defined and interpreted as follows:

- The *earnings per share* (EPS) index is the amount of earnings per each outstanding share of a company's stock. Two companies may generate the same value of EPS, but one could do so with less equity (investment). The company which uses less equity to generate the EPS would be a "better" company.
- The *current ratio* (CR) is a financial ratio that measures whether or not a firm has enough resources to pay its debts over the next year. Low values for the CR (values less than 1) indicate a lower ability to meet current obligations.
- The *total assets* (TA) is the sum of current and long-term assets.
- The *price/earnings* (P/E) ratio is the most common measure of how expensive a stock is. Companies with high P/E ratios are more likely to be considered “risky” investments than those with low P/E ratios.
- The *sales growth* (SG) is defined as increase in sales over a specific period of time.
- The *return on equity* (ROE) is amount of net income returned as a percentage of shareholder equity. In fact, ROE reveals how much profit has been generated with the money that a company’s shareholders have invested.

It should be noted that EPS, SG, and CR are considered as input variables and P/E, ROE, and TA are considered as output variables. The variables are selected based on the variables chosen in earlier DEA studies in the related literature (See Powers and McMullen (2000), Luo (2003), Seiford and Zhu (1999), Ho and Zho (2004), Shih-Fang and Wen-Min (2006)). Before performance measurement, the

data are normalized by dividing the values of each index to its maximum value. Table 3 shows the normalized data.

3 Performance Measurement

In order to test the applicability of the different DEA models, four different models, including both input-oriented and output-oriented versions of both CCR and BCC models, are applied to the set of the 5 leasing companies. Table 4 shows the efficiency scores of the mentioned companies under the specific conditions of the four versions of DEA.

Table 3
Normalized data

Index	Input (I) Output (O)	DMU				
		1	2	3	4	5
Earnings Per Share (EPS)	*I*	0.314	0.490	0.006	1.000	0.229
Current Ratio (CR)	*I*	1.000	0.940	0.613	0.542	0.732
Total Assets (TA)	*O*	0.311	0.728	0.143	1.000	0.361
Price/Earnings Ratio (P/E)	*O*	1.000	0.740	0.649	0.740	0.623
Sales Growth (SG)	*I*	0.595	1.000	0.142	0.654	0.293
Return On Equity (ROE)	*O*	0.017	0.019	0.000	0.031	1.000

Table 4
Efficiency scores of DMUs

DMU	Efficiency Score			
	CCR		*BCC*	
	Input-oriented	*Output-oriented*	*Input-oriented*	*Output-oriented*
1	0.90	1.11	1.00	1.00
2	1.00	1.00	1.00	1.00
3	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00

As Cooper *et al*. (2001) stated, if the number of DMUs is less than the total number of inputs and outputs, a large number of the DMUs will be identified as efficient; the results of the four basic models of DEA demonstrate that these models do not work as a discriminant of an efficient unit from inefficient unit. Based on the CCR models, only one out of five units is detected as inefficient (DMU_1) and there are no inefficient DMUs according to the results of the BCC models.

As we know, the reference set for inefficient DMU is defined as the set of units on frontier that is considered as a target unit for it. According to the lambda's coefficients in the optimum solution presented in Table 5, the reference set of DMU_1 identified as the only inefficient unit is as equation (3).

$$RS\left(DMU_1\right) = \left\{DMU_3, DMU_4, DMU_5\right\} \tag{3}$$

Table 5
Coefficient of lambda in the optimum solution

	λ_1	λ_2	λ_3	λ_4	λ_5
DMU_1	0.00	0.00	1.22	0.27	0.01
DMU_2	0.00	1.00	0.00	0.00	0.00
DMU_3	0.00	0.00	1.00	0.00	0.00
DMU_4	0.00	0.00	0.00	1.00	0.00
DMU_5	0.00	0.00	0.00	0.00	1.00

Due to the failure of the standard DEA models to rank the efficient set of leasing companies, the super efficiency DEA model introduced by Andersen and Petersen (1993) is applied to rank the efficient units. This mathematical model is shown in equation (4).

$$\begin{aligned} &Min\ \theta_p \\ &s.t.\quad \sum_{\substack{j=1 \\ j\neq p}}^{n} \lambda_j x_{ij} \le \theta_p x_{ip} \quad ; \quad i = 1,2,...,m \\ &\qquad \sum_{\substack{j=1 \\ j\neq p}}^{n} \lambda_j y_{rj} \ge y_{rp} \quad ; \quad r = 1,2,...,s \\ &\qquad \lambda_j \ge 0 \quad ; \quad \forall j \\ &\qquad \theta \text{ is free} \end{aligned} \tag{4}$$

In the AP-DEA model, a DMU is efficient if its efficiency score is equal or greater than one. In other words, all inefficient DMUs have efficiency scores of less than one.

As can be seen in Table 6, the DMUs are ranked in ascending order as follows: DMU_5, DMU_3, DMU_4, DMU_2, and DMU_1. Furthermore, DMU_1 is identified as an inefficient unit in the AP-DEA model as well as in both the input-oriented and output-oriented CCR model. Therefore, Sanat-Madan Leasing Company (DMU_5) and Iran Leasing Company are best and worst, respectively. These results are graphically shown in Figure 1 and Figure 2.

Table 6
Ranking of DMUs

DMU	1	2	3	4	5
Score	0.90	1.13	34.17	2.39	104.14
Rank	5	4	2	3	1

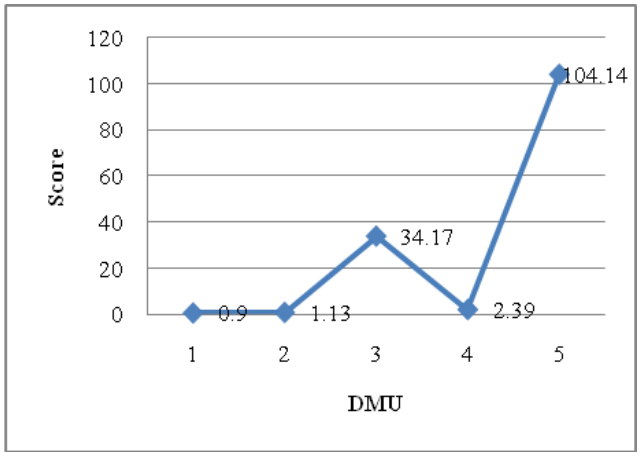

Figure 1
Score of five DMUs (AP-DEA)

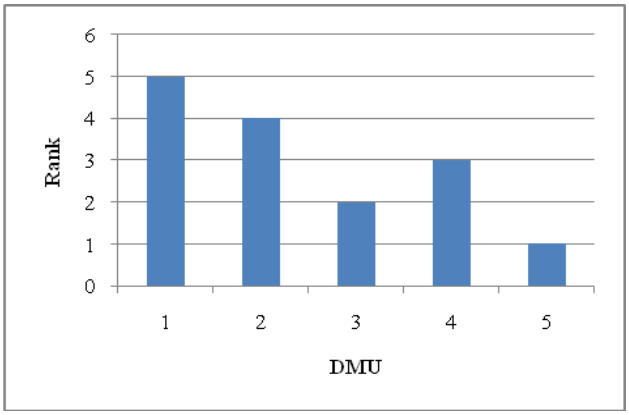

Figure 2
Ranking of five DMUs (AP-DEA)

Conclusions

Historically, the leasing operation in Iran goes back to the establishment of the Leasing Company of Iran, which was jointly financed by Iran's private sector, the Credit bank of Iran, and one of the leading French companies in this area, which legally began operation in 1975. In 1977-78, Sanat-Madan Leasing Company started its operations. Despite nearly four decades of leasing industry activities in Iran, few studies have dealt with an efficiency assessment of leasing companies or

leasing industries. Hence, the present research studied the performance of leasing companies on the TSE in the year 2010. Three input variables (EPS, CR, and SG) and three output variables (TA, P/E, and ROE) were considered in the current study. The results show that the Sanat-Madan Leasing Company, the second company established in the leasing industry of Iran, has better performance than the other leasing companies, and only the Leasing Company of Iran, the first company established in the leasing industry of Iran, is inefficient. Also, it was shown that the Sanat-Madan Leasing Company, Khodro-Ghadir Leasing, and Rayan-Saypa Leasing can be set as possible targets for the Leasing Company of Iran in order to improve its performance.

The results of the basic DEA models show their inability in ranking the efficient leasing companies. Although the present study applied the AP-DEA model to rank efficient leasing companies due to the failure of basic DEA models, there are other methods that can be used to rank the DMUs (See Seiford and Zhu (1999)) in future studies. Determining critical inputs and outputs can also be considered as another direction for future research.

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