Efficiency of Operating Lease Financing in Airlines Business: A DEA Study

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Efficiency of Operating Lease and It's Impact on Share Prices: A DEA and Mann Whitney Analysis for World Air Transportation Business

Abstract:

Airline companies' uses different type of lease financing like capital lease, operating lease, and sale – and – lease back type lease. Out of them it is found in some earlier researches that sale – and – lease back type lease has influence on share prices. In this paper operating lease has taken under consideration for same purpose and used as input for output oriented DEA model in order to measure relative efficiency of using lease over time for airline companies, to determine benchmark and finally to find out where improvement is essential to be efficient. Here outputs are selected for DEA model based on previous researches where researchers mentioned some benefits of using lease. The result of DEA is found in this study that some companies are handling operating lease efficiently compare to others. Based on this efficiency scores sample companies are grouped and Mann Whitney rank sum test was applied to observe whether efficiency has any influence on share price increase in capital market or not. It is found here that operating lease does not have this kind of influence or impact on market price of shares.

Introduction

Finance experts have conducted number of conceptual and empirical research studies on lease financing. Leasing in that researches also named as off – balance sheet financing, tax – arbitrage security (Franks and Hodges, 1987), or fixed payment financing (Kang and Long, 2001) etc. Disregarding whatever the name of leasing previous studies concentrated mainly on rules of leasing decision, debt substitutability of lease, determinants of lease policy, valuation of lease contracts optimal level of lease amount, nature of lease market etc. Findings of those researches sometimes contradicted with each others-as for example according to Modigliani and Miller substitutive relationship is exist between lease and secured debt which means lease displaces debt where as later on Ang and Peterson (1984), Kang and Long (2001) found a complementary relationship is exist between lease and debt which means that firms with higher debt lease higher. Moreover, researchers found that though lease has some benefits as it separates ownership (Oum et al, 2000) and reduces tax liability (Ezzell and Vora, 2001), transaction or trading costs (Sharpe and Nguyen 1995), agency costs (Kang and Long, 2001) etc. it rises some risky situation as off-balance sheet financing tool for the investors (shareholders) of lessee firms. One of these risks is firms having high debt to equity ratio sometimes might favor to enter lease contract for hiding their real obligation or financial distress. Moreover, in monopoly market leasing is a good technique for the lessor instead of price discrimination (Smith and Wakeman, 1985). That means lease can create disadvantages as price discrimination does for lessee. Due to such risk firms having excessive lease obligation sometimes lost their creditworthiness to the financial institutions (Oum, Zhang and Zhang, 2000). In such a situation it would not be irrational to think about a bankruptcy risk as the recent business world experienced with Enron case. In addition with this another vital source of risk for the shareholders of lessee firms is information asymmetry for which, shareholders will not be able to take correct decision whether to invest or not in a particular lessee firm's stock. But interesting evidence Slovin et al (1990) found in their empirical research that announcement of sale-and-leaseback has a positive impact on share prices of lessees' firms. That means when sale- and- leaseback contracts announced the share prices increased. They mentioned reduction in present value of expected taxes was the reason of such reaction among investors. So, accepting this research finding it would be worthwhile for shareholders to examine

the DEA (Data Envelopment Analysis) efficiency of lease financing as a lever like secured debt before investing in lessee firm's share. Moreover, no work has been found in the area of lease financing on DEA efficiency. So, this paper can create a new dimension to think about lease financing from stockholders standpoint.

Theoretical Background of the Study

. Lewellen and McConnell (1976) in a conceptual research showed how lease contract affects shareholders dividend expectation equation of levered and unlevered lessee firms according to value additivity principle. They mentioned tax shield benefit and less burden of required instant investment in assets are consequences of using lease financing. Of course, from another point of view, such financing tool reduces also depreciation tax shield and salvage value benefits provided by direct purchase of assets. So, considering these two types of outcomes of lease financing they opined market value of lease promises made cannot exceed that of the asset expenditure flow saved, net of salvage and depreciation tax recoupments as a decision rule on leasing. Similarly Myers et al (1976) found only tax saving motive is obvious and substantial in valuation of lease contract towards maximize the equilibrium market value of firms considering interactions between lease and other financing instruments. Moreover, increased debt ratios has also been pointed out in the same study as a cause why financial lease getting popularity. In these two papers lease contract has been valued from tax savings and lease – debt substitute standpoint with their extent. Opposing lease – debt substitutive relationship Ang and Peterson (1984) viewed in their study due to four reasons leases and debts are complements instead of substitute - means greater debt associated with greater lease. In another research Smith and Wakeman (1985) have investigated the determinants of corporate leasing based on various incentives affecting lease versus buy decision. They found both tax and non tax items that affects corporate leasing policy with provisions of leasing contracts. There they also found taxes are important in determining the identity of lessor and lessee. Franks and Hodges (1987) had considered leasing as a tax – arbitrage instrument in their study. Explaining tax motives in financing decision, Graham, et al (1998) evident that it is an endogenous variable with a negative relation between tax rates and operating lease where as a positive relation of the same with debt levels was also observed. It means that firms with lower tax rate lease more and have lower debt levels than firms with high tax rate. Similar results have found in another study conducted by Kang and Long (2001) when they examined the factors that influence firm's decision to use fixed payment financing i.e. regular debt plus leasing. They found lower tax positions firm lease more, less information about small firms lease more and in industry where leased equipment monitoring is difficult use less lease. According to them lease is also used for lowering bankruptcy costs too.

Other than tax benefit of lease, Sharpe and Nguyen (1995) found higher financial contracting cost is another reason to lease fixed capital to economize the cost of funding. According to them this motivation for leasing arises when financial market is imperfect that means outside investors are less informed than insiders regarding ongoing operations or future prospects or when conflicts of interest between classes of corporate claimants are costly to resolve. Similar research findings have also been described in Ezzell and Vora's (2001) study where they mentioned lessee's gain from leasing is positively related with external financing costs arises from imperfect market. Accepting the role of lease in providing tax advantages Slovin et al (1990), Ezzell and Vora (2001) examined whether or not lease has any influence on share price of lessee firms. Interestingly their empirical results evident that announcement of sale-and-

leaseback has a positive impact on share prices. That means when sale- and-leaseback contracts announced the share prices increased. They also found that incase of lessor such announcement has no effect. In addition with that Ezzell and Vora (2001) also experienced with increased equity value for sale and leaseback contract of firms having low interest coverage ratio in their study.

Lease in specific industry case Oum, et al (2000) examined financial and operational benefits of leasing in airlines industry. They found from financial benefits point of view that through operating lease airline companies can lower debt to equity ratio in their balance sheet than traditional debt. It also separates the ownership of an aircraft from the aircraft's user to use depreciation effectively. On the other hand, from operational point of view lease can help to manage flexible (uncertain and cyclical) capacity of airlines companies.

From the above mentioned research works it is evident that lease financing increases tax shield benefits, reducing external financing costs, increasing liquidity, lowering financial distress and bankruptcy costs etc. It is also empirically proved that due to aforesaid advantages share prices of the lessee firms increased in response of announcing sale and leaseback contracts or operating lease contracts. This means investors' reacted positively to lease financing. But, in this study operating lease and its impacts are treated as input and output respectively for DEA model instead of sale and lease back type lease because of complexity of data collection.

Objective of the Study

The objective of the study is to measure and compare efficiency over time for operating lease as input of financial performances for airline companies. It also aims to identify airline companies efficiency score for using operating lease, ranks based on that efficiency score and determine benchmark for inefficient year of using operating lease for airline companies. Thereafter testing corresponding year's stock prices in capital market of those airlines companies whether or not affected by efficiency scores of using operating lease has been set as another objective of this study too.

Lease Financing and DEA Model

Leasing as off balance sheet financing has some impacts on corporate financial performance that have been discussed before. So, how efficiently corporations are handling lease financing is difficult to measure by traditional way - specially relating all such impacts with lease in one evaluating tool. Moreover, traditional performance evaluating tools like ratio analysis have certain drawbacks. As for example, a single ratio, though it has some calculation advantages, does not provide enough information about various aspects of a firm's performance, conflicting signals and nothing about benchmark to evaluate univariate or multivariate score (Koksal and Aksu, 2007). Another problem with traditional performance measuring tools (ROI, ROS, D/E ratios) is that they considered only one input and output to explain business performances. But in practice it is not so simple to explain performance. It is more complex (Zhu, 2003). Considering these entire, Data Envelopment Analysis (DEA), a non-parametric tool is used for pursuing this study in the light of aforesaid objectives.

In DEA model all such problems have been removed by taking into account more than one inputs and outputs (in calculating efficiency ratio) at the same time to measure performance of number of observations called 'Decision Making Units (in

this study each year is considered as one DMU)', assigning weights to inputs and outputs, relaxing functional forms or relationship as other statistical regression model requires. Not only that, DEA model is based on linear mathematical techniques which can handle large number of variables and constraints. It also uses efficient frontier, slacks to show ways – either by reducing inputs usages or increasing output for inefficient DMUs to improve their performance (Cooper et al, 2006). The basic DEA model initiated by Charnes, Cooper and Rhodes in 1978 is –

$$Efficiency = \frac{u_1.y_{1j} + u_2.y_{2j} + \ldots\ldots\ldots\ldots}{v_1.x_{1j} + v_2.x_{2j} + \ldots\ldots\ldots\ldots}$$

u_l = weight of input i,

y_{lj} = quantity of output l derived from unit j

v_l = weight of input j

x_{lj} = quantity of input - l used by unity j

Using linear programming model to solve it will be according to them -

$$Max\ h_k = \sum_{r=1}^{s} U_{rk}.Y_{rk}$$

Subject To,

$$\sum_{I=1}^{m} V_{ik}.X_{ik} = 1 \quad \text{[Weighted sum of inputs set to unity]}$$

$$\sum_{r=1}^{s} U_{rk}.Y_{rk} - \sum_{I=1M} V_{ik}.X_{ij} \le 0,$$

[For k and j = 1, 2, ……., n Decision making]

$U_{rk} \ge 0$; r = 1, 2, ……. s outputs

$V_{ik} \ge 0$; I = 1, 2, ……. m inputs.

Detail explanation of DEA model is not main purpose of this study. If someone interested to know more about that they can consult with the book written by Cooper et al (2006).

Inputs/Outputs for DEA Model and Hypothesis of the Study

It is found in literature review section of this study that lease financing has impacts on corporate financial performance. These impacts are on tax shield benefits, liquidity, book profits, external financing costs, financial distress and bankruptcy costs - of which some are measured with relevant ratios. All these consequences of lease financing are considered here as Outputs and yearly lease payments especially operating lease payment is considered as input for DEA model to measure efficiency over time of operating lease financing used by the airline companies. So, outputs of lease financing and the ratios in parentheses that are used to measure them are shown in the following table-

Table – 1: List of input and outputs for DEA model

Input	Outputs
➢ Yearly operating lease payments	➢ Tax shield benefit ➢ Liquidity (Liquidity Ratio) ➢ External financing costs (Interest Coverage Ratio) ➢ Financial distress (Debt – Equity Ratio) ➢ Operating Profit

Again, according to Slovin et al (1990) findings - sale and lease back announcement increases share price in the market – based on this following null and alternative hypothesis have also been used to check whether or not operating lease efficiency has any significant influence on share prices.

H_0 **:** *Efficient operating lease financing does not have any impact on market price of shares.*

H_1 **:** *Efficient operating lease financing has impact on market price of shares.*

Methodology

Sample and Data:

The output oriented CCR model (constant return to scale) of DEA demo software from www.banxia.com is applied in this study for measuring operating lease efficiency over time for air carriers. All required data have been collected from Airline Company's consolidated Annual Reports published in online and a total of such 62 reports for 15 Airline Companies all over the world have been investigated and shown in Appendix – 1. Then a primary screening process is applied on that reports to ensure necessary data and information. As a result of this process 37 annual reports are dropped from the consideration in this study because of having operating loss, ambiguity to find annual operating lease payments and depreciation for leased assets, tax and other required information for the model used in this study. A description of such exclusion with reasons is provided in Appendix – 2 of this study. The remaining 25 annual reports that provided necessary data and information are considered appropriate for the study and out these 25 reports only 12 have been considered because of limitation of demo version of software. From them how required data related to input and outputs have been collected describe below-

Input: Yearly operating lease rents that companies income statements showed have been taken and used as input for DEA model. But for Korean Airline Company it is taken from yearly operating lease payment schedule showed in their annual reports.

Tax Shield: To calculate tax shield operating lease payment and depreciation charged for leased assets for each year have been added and multiplied by the corresponding year's Statutory Tax Rates mentioned in annual reports. But in case of Thai Airways statutory tax rate was not given in Annual report so, it was calculated by dividing tax paid by income before tax.

Interest Coverage Ratio: According to the formula of calculating this EBIT and interest expenses have been taken from companies Income Statement and ratio is calculated accordingly.

Liquidity Ratio: It is also calculated by taking total current assets and total current liabilities from Balance Sheets of the companies.
Debt – Equity Ratio: For this ratio only long term debt and shareholders equity have been taken from annual reports of the sample companies and calculated according to formula.
Operating Profit: This is considered as also the output of operating lease according to Myers et al (1976) and collected from Income Statement of airline companies' annual report.

For ensuring unified measuring unit all figures in different currencies have been converted to dollar value using respective years exchange rates mentioned in annual reports. In some cases it was not possible to collect exchange rates from annual reports then for such cases it has been collected from www.exchangerate.com.

Testing hypothesis: Mann Whitney – *U* test is used for testing the hypothesis that has been constructed to test whether efficiency of operating lease has any significant influence on higher share prices or not using SPSS 12.00 statistical package. According to Slovin et al (1990) findings about sale and lease back type lease and share prices in this study the year highest share prices have been collected to test the same result in case of operating lease from companies' annual report, companies' own and some other websites like http://finance.yahoo.co, www. Reuter.com. These share prices are also converted to dollar when it requires using exchange rates collected from mentioned earlier source.

Results

Sample related Results: Regarding samples for this study it is found that out of 12 DMUs or financial years for airline companies five (41.67%) are found efficient and others found inefficient in using operating lease. The descriptive statistics of sample related input and outputs in Table – 2 reveal the nature of data is non-parametric because of high range in maximum and minimum values. Table – 3 in appendix displays actual input and outputs for all DMUs, targeted input and outputs relative to efficient DMUs, benchmarks or peers for inefficient DMUs and frequencies of such benchmarks or peers for sample companies.

DEA related Results: As one of the conditions for DEA sufficient samples or DMUs to check efficiency discrimination according to Cooper et al (2006) is desirable to be either equal or greater than combined number of inputs and outputs. Alternatively, $n \geq \max\{m \times s\}$ or $n \geq \max\{3 \times (m+s)\}$ where, n = no. of DMUs, m = input, s = outputs. In this study the first condition is satisfied by the number of DMUs (12), input (1) and outputs (5) where as the second condition could not be satisfied due to the software limitation.

DEA results in Table – 3 showed that out of 12 DMUs THA04 (Thai airways for 2004), THA05 (Thai airways for 2005), BRI05 (British airways for 2005), BRI04 (British airways for 2004), SIA05 (Singapore airlines for 2005) are efficient in using operating lease and others are inefficient. Moreover, these five DMUs or years are used as benchmark year for other 7 inefficient DMUs or years. Among them BRI05 is referred 5 times as best practicing year where as THA04, THA05, BRI04 are referred 2 times each respectively and SIA05 is referred 1 time as benchmark.

Statistical Test Result: Due to the non-parametric nature of data and grouping of DMUs based on efficiency scores is unbalanced or unequal so Mann Whitney rank sum test is applied to compare mean scores of efficiency. For this test 'efficiency' is considered as group variable and 'highest share price' is considered as test variable. The result of this test is shown below-

Table – 4: Comparing efficiency of airline companies according to their operating profit.

Efficiency	No. of airline companies	Mean Rank	Sum of ranks	Mann Whitney Value
Efficient Airline Companies	5	6.40	32.00	17.00
Inefficient Airline Companies	7	6.57	46.00	
Asymptotic significance (2 tailed)= 0.935, $p > 0.05$				

From the above table it is found that alternative hypothesis is rejected ($p > 0.05$). It means that efficiency of operating lease has no impact on highest share prices of airline companies.

Though the hypothesis is rejected it is obvious from the average (67.64%) inefficient DMUs efficiency score that inefficient airline companies should improve the outputs of operating lease financing substantially to be efficient. It is also shown in Figure – 1 that which output has to improve what extend for all inefficient DMUs. It shows that interest coverage ratio, operating profit, debt-equity ratio, liquidity ratio and tax shield have to improve 43.64%, 29.48%,14.87%,7.34% and 4.67% respectively for all inefficient DMUs. For individual case, as for example if we will consider Korean air from table – 3 for target outputs of 2005 we have seen that it has to improve tax shield, liquidity ratio, and interest coverage ratio, operating profit and debt-equity ratio up to 332.93, 1.33, 5.87, 1382.44 and 1.74 respectively by following BRI05,THA04 as benchmark.

Limitation of the Study

The effective use of DEA depends on accurate data regarding input and outputs. In this study it was very difficult to collect exact required data according to literary findings because of different style of financial statements followed by different airline companies over the world. It creates problem to calculate input and outputs for DEA model in this study. For this reason, necessary input and outputs have been carefully collected during data collection period. Besides this exchange rate between US dollar and other currencies which are used here to make data uniform may also influence the findings of this study. Moreover, because of demo version of DEA software all DMUs could not use for evaluation in this study.

Conclusion

The main advantage of using DEA technique is that it facilities comparison between best practicing units or benchmarks and inefficient performing units regarding operating lease which can not be possible with other traditional financial performance measuring techniques. In this study with the help of DEA it has been tested whether efficiency of operating leases has influence on share price hike or not. It is important for share investors to know the efficiency of lessee firms how they are handling their operating lease as off balance sheet financing source. Though it is found in this study that efficiency of operating lease has no influence on high share prices in capital market but still it may help investors and other financial institutions to discover lease related financial yardsticks yet to improve compare with best performing units. DEA showed the ways of improvement providing the appropriate reference cells or peer groups or benchmark corporations or years. It also fixed up the target outputs in quantity by which decision makers will be able to determine how much they have to improve in every output to enhance their performance.

References

1. Ang James, Peterson P. Pamela, (1984), The Leasing Puzzle, *The Journal of Finance,* Vol. XXXIX, No. 4.

2. Charnes A. Cooper W. W. Rhodes E.,(1978), Measuring the efficiency of decision making units, *European Journal of Operational Research* 2, 429-444.

3. Cooper W. William; Seiford M. Lawrence; Tone Kaoru (2006), *Introduction to Data Envelopment Analysis and Its Uses- With DEA – Solver Software and References*, Springer Science + Business Media Inc, New York, USA; PP- 2-24.

4. Ezzell R. John, Vora P. Premal, (2001), Leasing versus purchasing: Direct evidence on a corporation's motivations for leasing and consequences of leasing; *The Quarterly Review of Economics and Finance* 41, 33-47.

5. Franks R. Julian, Hodges D. Stewart, (1987), Lease Valuation When Taxable Earnings Are a Scarce Resource, *The Journal of Finance* Vol. XLII, No. 4.
6. Graham R. John, Lemmon L. Michael, Schallheim S. James, (1998), Debt, Leases, Taxes and the Endogeneity of Corporate Tax Status; *The Journal of Finance*, Vol LIII, No. 1.

7. Kang Sungjune, Long S. Michael, (2001), The fixed payment financing decision to borrow or lease; *Review of Financial Economics* 10, 41-55.

8. Koksal Can Deniz and Aksu, Akin A, (2007), Efficiency evaluation of Agroup travel agencies with data envelopment analysis (DEA): A case study in the Antalya region, Turkey; *Tourism Mnagement*, 28, 830-834.

9. Lewellen G. Wilbur, McConnell Long S. Michael, McConnell J. John, (1976), Asset Leasing in Competitive Capital Markets, *The Journal of Finance*, Vol. XXXI, No. 3.

10. Myers C. Stewart, Dill A. David, Bautista J. Alberto,(1976), Valuation of Financial Lease Contracts, The Journal of Finance, Vol. XXXI, No. 3.

11. Oum Hoon Tae, Zhang Anming, Zhang Yimin (2000); Optimal Demand for Operating Lease of Aircraft; *Transportation Research Part B* 34, 17-29.

12. Sharpe A. Steven, Nguyen H. Hien (1995); Capital Market Imperfections and the incentive to lease; *Journal of Financial Economics* 39, 271-294.

13. Smith W. Clifford, Wakeman Macdonald L., (1985), Determinants of Corporate Leasing Policy, *The Journal of Finance*, Vol. XL, No. 3.

14. Slovin B. Myron, Sushka E. Marie, Polonchek A. John, (1990), Corporate Sale – and – Leasebacks and Shareholder Wealth, *The Journal of Finance* Vol. XLV, No. 1.

15. Zhu, Jeo; (2004) *Quantitative Models for Performance Evaluation and Benchmarking- Data Envelopment Analysis with Spreadsheeets and DEA Excel*

Solver; Second Print; Kluwer's International Series; Massachusetts; USA; PP- 1-2.

Appendix – 1
List of investigated Airline Companies for the study

SL. No.	Name of Airlines Company	Initials	No. Annual Reports for each company
1.	Korean Air	KAL	7
2.	Thai Airways	THA	5
3.	Singapore Airways	SIA	5
4.	Emirates Airways	EMI	4
5.	Japan Airlines	JAL	6
6	Malaysian Air	MAL	4
7.	British Airways	BRI	6
8.	Air France	AF	3
9.	Lufthansa Air	LUF	2
10.	Alaska Air	ALA	5
11.	Delta Air	DEL	1
12.	AMR Airlines	AMR	5
13.	Air New Zealand	AIZ	4
14.	Air Canada	AIC	3
15.	American West Airlines- Us Air Groups	AMW	4
		Total	**62**

Appendix – 2
List of Airline Company's Annual Report not considered for the study with reasons

SL. No.	Name of Airlines Company	No. of Reports	Reasons to drop from the study
1.	Korean Air	2	Couldn't collect share prices
2.	Thai Airways	1	Couldn't collect share prices
3.	Emirates Airways	4	Tax rate, share prices problem
4.	Japan Airlines	4	share prices problem
5.	Malaysian Air	4	For operating loss
6.	British Airways	2	share prices problem
7.	Alaska Air	5	For operating loss
8.	Delta Air	1	For operating loss
9.	AMR Airlines	5	For operating loss
10.	Air New zealand	3	For operating loss, not having tas rate
11.	Air Canada	2	Couldn't find required data
12.	American West Airlines- Us Air Groups	4	For operating loss
	Total	**37**	

Table –2: Descriptive statistics of input and outputs

Input and Outputs	Mean	Std. deviation	Maximum	Minimum
Operating Lease (Input)	361.44	245.75	850.50	131.16
Tax Shield	244.35	147.52	485.23	55.72
Interest Coverage Ratio	4.37	4.93	17.49	0.31
Liquidity Ratio	1.15	0.77	3.42	0.57
Debt – Equity Ratio	1.72	1.75	6.05	0.19
Operating Profit	624.91	464.10	1775.10	88.00

Table –3
DMUs, Input – Output values, Efficiency scores, Targeted Outputs and Benchmarks or Peers and Frequencies of Peers

DMUs	Input (Operating lease payment, in Million $)	Actual Outputs					**Efficiency Scores (%)**	Target Outputs					**Benchmarks or Peers**	**Frequencies of Peers**
		Tax Shield (In million $)	Liquidity Ratio	Interest coverage Ratio	Debt – Equity Ratio	Operating Profit		Tax Shield (In million $)	Liquidity Ratio	Interest coverage Ratio	Debt – Equity Ratio	Operating Profit		
KAL05	266	146.73	0.59	0.65	0.62	250	44.07	332.93	1.33	5.87	1.74	1382.44	BRI05, THA04	
KAL04	301	163.25	0.57	0.96	0.53	368	39.84	409.76	1.44	6.14	1.79	1649.82	BRI05	
AF06	777	391.06	3.42	4.42	1.00	1775	72.01	543.06	4.75	23.64	7.48	2926.95	BRI05, THA04	
AF05	851	485.23	1.51	2.51	1.35	671	41.91	1157.80	4.07	17.34	5.06	4661.70	BRI05	
SIA05	203	114.65	1.27	17.49	0.19	822	100	114.65	1.27	17.49	0.19	822		1
SIA04	207	148.12	0.92	10.45	0.19	398	89.13	179.15	1.18	12.64	0.58	948.52	SIA05, BRI05	
BRI05	199	271.28	0.95	4.06	1.19	1092	100	271.28	0.95	4.06	1.19	1092		5
BRI04	247	297.56	0.92	2.32	1.87	847	100	297.56	0.92	2.32	1.87	847		2
THA05	137	68.84	0.73	2.50	1.89	263	100	68.84	0.73	2.50	1.89	263		2
THA04	131	55.72	0.87	4.53	1.46	401	100	55.72	0.87	4.53	1.46	401		2
JAL05	556	429.39	1.20	2.26	6.05	524	97.44	440.67	2.58	8.08	6.21	1414.00	BRI04, THA05	
JAL03	462	360.38	0.86	0.31	4.31	88	89.13	404.31	2.06	6.24	4.83	1257.05	BRI04, THA05	

The mean and standard deviation of inefficient scores are 67.64 and 25.24 percent respectively.

Figure – 1: Total improvement of inefficient DMUs.