Journal of Air Law and Commerce

Volume 74 | Issue 1 Article 2

2009

Investigating the Effects of Financial Benefits of Operating Leases on Air Carriers' Profits

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INVESTIGATING THE EFFECTS OF FINANCIAL BENEFITS OF OPERATING LEASES ON AIR CARRIERS' PROFITS

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ABSTRACT

This article investigates the effects of financial benefits of operating leases on air carriers' profits. For this purpose, this article calculates relative efficiency to realize financial benefits of operating leases using the data envelopment analysis technique and applies the Mann Whitney-U test to observe the effects of DEA results on profits. The key findings of this article are that: (1) efficient realization of financial benefits of operating leases significantly affects air carriers' profits; (2) air carriers taxed in a low tax bracket can utilize operating leases efficiently; and (3) the average of ratios between lease rents to operating expenses of efficient air carriers is lower than that of inefficient carriers.

I. INTRODUCTION

OPERATING LEASES have been considered an important alternative to direct ownership of assets. They are known as an off-balance sheet source of finance because they are not displayed in the balance sheet by a lessee. This procedure to record operating leases in the financial statements enables them

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The authors of this article would like to thank Professor Yong Jae Shin, Department of Business Administration, Soong Eui Women's College, South Korea and Professor Yoon Moon Gil, Graduate School of Aviation Industry & Business Administration, Korea Aerospace University, South Korea for their valuable comments and suggestions. The assistance of Mr. Yang Haewoon, Deputy General Manager, RSVN and Tariffs Team, Korean Air is very much appreciated by the authors.

to be used as a substitute for debt financing and attenuates financial distress of a lessee. Operating leases also separate ownership of the assets from users of the assets. This feature of operating leases ensures proper maintenance of assets and enables depreciation allowances to be used for tax purposes by the lessor. Depreciation allowances of operating leases, of course, may be claimed by both lessor and lessee in the lease contracts. For a lessee, such depreciation allowances and annual lease rentals provide a "tax shield benefit," a substantial and influential determinant of a lease contract.[1]

According to Wilbur G. Lewellen et al., operating leases reduce the instant investment required to acquire an asset, hence protecting the liquidity of a lessee.[2] This kind of liquidity protection is treated in this article as the "liquidity benefit" of operating leases. In addition, because operating leases are not capitalized, a lessee may use operating leases to show a substantially lower debt-to-equity ratio in its financial statements, which we may consider a "debt-equity benefit" of operating leases.[3] Furthermore, operating leases reduce external financing costs of a lessee.[4] The reduction of external financing costs by operating leases is considered an "interest coverage benefit" for this article. All of these financial benefits (tax shield benefit, liquidity benefit, debt-equity benefit, and interest coverage benefit) of operating leases can be used to measure the performance of a lessee to determine how efficiently these benefits are realized from annual operating lease rentals paid by a lessee.

In the airline industry, operating leases are a widely used and homogeneous mode of finance. They offer operational flexibility to handle air carriers' cyclical demand and the aforesaid financial benefits as well. Although it is a controversial issue that the benefits of operating leases are more operational than financial to the air carriers, pervasive use of operating leases by air carriers is found to finance their operations. For example, Rich-

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[1] Wilbur G. Lewellen, Michael S. Long & John J. McConnell, *Asset Leasing in Competitive Capital Markets*, 31 J. FIN. 787, 787–98 (1976); Stewart C. Myers, David A. Dill & Alberto J. Bautista, *Valuation of Financial Lease Contracts*, 31 J. FIN. 799, 799–819 (1976); Clifford W. Smith, Jr. & L. McDonald Wakeman, *Determinants of Corporate Leasing Policy*, 40 J. FIN. 895, 895–908 (1985).

[2] Lewellen et al., *supra* note 1, at 787–98.

[3] Sungjune Kang & Michael S. Long, *The Fixed Payment Financing Decision to Borrow or Lease*, 10 REV. FINANCIAL ECON. 41, 41–55 (2001).

[4] John R. Ezzell & Premal P. Vora, *Leasing Versus Purchasing: Direct Evidence on a Corporation's Motivations for Leasing and Consequences of Leasing*, 41 Q. REV. ECON. & FIN. 33, 33–47 (2001).

ard D. Gritta et al. found that for major U.S. air carriers, the percentage of aircraft financed by operating leases increased from thirteen percent in 1969 to eighty-two percent in 1991.[5] The similar trend for operating leases is also estimated in a model developed by Tae Hoon Oum et al.[6] It finds that the optimal demand for operating leases by the twenty-three major air carriers in the world would range between forty to sixty percent of their total fleet.[7] Given this evidence, it seems reasonable to consider that operational and financial benefits are the two key influencing factors to employ operating leases to a greater extent in the airline industry. Outside of these two studies, investigating the financial benefits of operating leases is an unexplored issue in airline literature. Hence, the central theme of this article is to investigate the financial benefits of operating leases on profits of air carriers. This investigation is performed with the help of air carriers' relative efficiency to realize financial benefits of operating leases. For the purpose of measuring such relative efficiency, this article applies the data envelopment analysis (DEA) technique. In addition, the effects of these DEA results on profits of air carriers are observed by applying the Mann Whitney-U test (U test). This investigation is, to our knowledge, the first attempt for off-balance sheet financing.

The remainder of this article proceeds as follows. Section II discusses the reasons to choose the DEA technique to measure the operating lease performance of air carriers. Section III details the methodology and hypotheses used to pursue the objectives of this article. Sections IV and V analyze the data and findings respectively. Finally, Section VI presents some conclusions based on the results obtained in this article.

II. PERFORMANCE EVALUATION AND THE DEA MODEL

Traditional performance evaluation tools have two shortcomings. First, they provide less information about various aspects of firms' performance, provide conflicting signals, and say noth-

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[5] Richard D. Gritta, Ellen Lippman & Garland Chow, *The Impact of the Capitalization of Leases on Airline Financial Analysis: An Issue Revisited*, 30 LOGISTICS & TRANSP. REV. 189, 189–202 (1994).

[6] Tae Hoon Oum, Anming Zhang & Yimin Zhang, *Optimal Demand for Operating Lease of Aircraft*, 34 TRANSP. RESEARCH, PART B: METHODOLOGICAL 17, 17–29 (1997).

[7] *Id.* at 17.

ing about benchmarks needed to evaluate performance.[8] Second, some of these tools, such as return on investment (ROI), return on sales (ROS), and debt-to-equity (D/E) ratios, take into account only one input and output to explain business performance, which is in fact very complex in practice.[9]

According to William W. Cooper et al., the DEA technique is free from the above problems in the sense that it takes into account more than one input and output at the same time for a number of samples (called Decision Making Unit or DMUs).[10] It relaxes functional forms or relationships as other statistical regression models require.[11] The DEA technique uses linear mathematical techniques, which can handle large numbers of variables and constraints to provide "efficient frontier" and "slacks."[12] Slacks in the DEA model can be used to show ways to improve the performance of relatively inefficient DMUs. They also determine a benchmark for the samples under consideration by assigning weights to inputs and outputs according to their relative importance. For these features, the DEA model is considered an appropriate performance-evaluating technique in this article for off-balance sheet financing.

The concept of DEA is introduced by Charnes, Cooper, and Rhodes, and is known as the CCR model.[13] They apply Farrell's notion of technical efficiency to several firms with similar production inputs and outputs.[14] The CCR model is based on constant return to scale (CRS).[15] For the linear form of the CCR model, consider a set of n DMUs, with DMU j having a production function (X_j, Y_j). $X_j = (x_1, x_2, \ldots, x_m)$ inputs and $Y_j = (y_1, y_2, \ldots, y_z)$ outputs. Let $U = (u_1, u_2, \ldots, u_m)$ and $V = (v_1, v_2, \ldots, v_z)$ be weight vectors. We define these variables as follows:

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[8] Can Deniz Köksal & A. Akin Aksu, *Efficiency Evaluation of A-Group Travel Agencies with Data Envelopment Analysis (DEA): A Case Study in the Antalya Region, Turkey*, 28 TOURISM MGMT. 830, 831 (2007).

[9] JOE ZHU, QUANTITATIVE MODELS FOR PERFORMANCE EVALUATION AND BENCHMARKING—DATA ENVELOPMENT ANALYSIS WITH SPREADSHEEETS AND DEA EXCEL SOLVER 1–2 (2003).

[10] WILLIAM W. COOPER, LAWRENCE M. SEIFORD & KAORU TONE, INTRODUCTION TO DATA ENVELOPMENT ANALYSIS AND ITS USES—WITH DEA—SOLVER SOFTWARE AND REFERENCES 2–24 (2006).

[11] *Id.*

[12] *Id.*

[13] A. Charnes, W.W. Cooper & E. Rhodes, *Measuring the Efficiency of Decision Making Units*, 2 EURO. J. OPERATIONAL RES. 429, 429–44 (1978).

[14] *Id.*

[15] COOPER ET AL., *supra* note 10, at 136.

a = DMU being evaluated
x_{ik} = quantity of input i used by DMU *k*
y_{jk} = quantity of output j produced by DMU *k*
u_i = weight assigned to input *i*
v_j = weight assigned to output *j*
ε = infinitesimal positive number

According to Charnes et al.,[16] the objective function and the constraints of linear form of CCR model are as follows:

$$\text{Max} \sum_{j=1}^{z} v_i y_{ja}$$

$$\text{Subject to} \sum u_i x_{ia} = 1$$

$$\sum_{j=1}^{z} v_j y_{jk} - \sum_{i=1}^{m} u_i x_{ik} \leq 0, k = \{1, 2, \ldots\ldots., n\}$$

$$-u_i \leq -\varepsilon, i = \{1,2,\ldots\ldots.,m\}$$

$$-v_j \leq -\varepsilon, j = \{1,2,\ldots\ldots.,z\}$$

Banker, Charnes, and Cooper suggest an extension of the above CRS DEA model to account for a variable return to scale (VRS) situation, known as the BCC model.[17] The output-oriented BCC model is as follows:

$$\text{Max} \sum_{r=1}^{z} u_r y_{ro} - u_o$$

$$\text{Subject to} \sum_{r=1}^{z} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} - u_o \leq 0$$

$$\sum_{i=1}^{m} v_i x_{io} = 1$$

$$-u_r \leq -\varepsilon$$

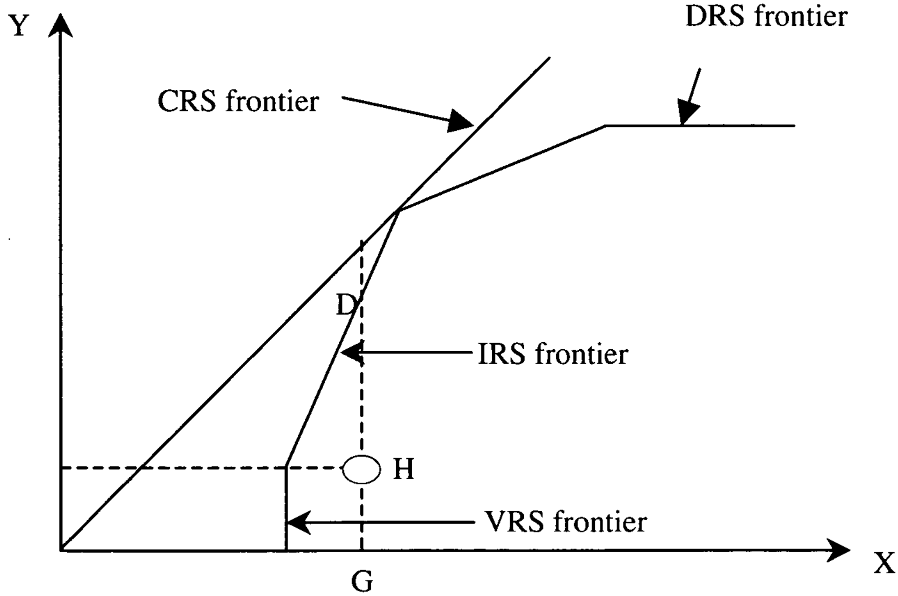
$$-v_i \leq -\varepsilon$$

16 Charnes et al., *supra* note 13, at 429–44.

17 R.D. Banker, A. Charnes & W.W. Cooper, *Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis*, 30 MGMT. SCI. 1078, 1078–98 (1984).

In the above model, u^*_o (the * indicates an optimal value determined via equation 5) indicates return to scale possibilities.[18] If $u^*_o < 0$, this implies local increasing return to scale (IRS).[19] If $u^*_o = 0$, this implies local constant return to scale (CRS).[20] Finally, $u^*_o > 0$ implies decreasing return to scale (DRS).[21] The CRS, VRS, and movement of any point outside the efficient frontier can be presented graphically in Figure 1. The solid lines in Figure 1 represent efficient frontier and dashed lines represent possible movements toward efficient frontier. The possible movements toward efficient frontier of sample air carriers are accounted for in this article by the target input and outputs of DEA models. Tables 4 and 6 in section V display these targeted input and outputs.

FIGURE 1
A COMPARISON BETWEEN CONSTANT RETURN TO SCALE AND VARIABLE RETURN TO SCALE



The DEA model presumes existence of relationships among input and output data. Therefore, *R*-matrix would be con-

18 *Id.* at 1087.
19 *Id.*
20 *Id.*
21 *Id.*

structed in this article to observe correlation between input and outputs. In addition, this article ensures the condition of a sufficient number of airlines or degrees of freedom to check the efficiency discrimination of the DEA model by the following equations, which are suggested by Cooper et al.[22]

$$n \geq \max\{m \times s\}$$

$$n \geq \max\{3 \times (m+s)\}$$

Here, n = no. of DMUs = 21 airlines, m = input = 1, s = outputs = 4.

III. METHODOLOGY AND HYPOTHESES

This article applies BCC and CCR models discussed in Section II for measuring air carriers' relative efficiency to obtain financial benefits (discussed in Section I) of operating leases. For these two DEA models, an air carrier is considered a DMU (k =1, 2, False . . , 21) variable, the yearly operating lease rent is considered an input variable (*i.e.*, x_i, where i=1), and financial benefits of operating leases are considered as output variables (*i.e.*, y_j, where j =1, 2, False, 4). Based on the efficiency scores calculated by the BCC model, air carriers are grouped into "efficient" and "inefficient" carriers.[23] The efficient group consists of all air carriers having a BCC efficiency score of one.[24] On the other hand, all carriers whose BCC efficiency scores are less than one are included in the inefficient group.[25] The same grouping method is also applied for the efficiency scores calculated by the CCR model.[26] After this grouping, the operating profits of efficient and inefficient air carriers under the two DEA models are taken into account to construct the following hypotheses:

$H_{1_{BCC}}$: Efficient and inefficient airlines' operating profits are significantly different.

$H_{1_{CCR}}$: Efficient and inefficient airlines' operating profits are significantly different.

For testing the above hypotheses, this paper applies the Mann Whitney-U test. For this test, lease "efficiency" of air carriers is considered a group variable and "operating profit" a test varia-

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22 *Id.*
23 COOPER ET AL., *supra* note 10, at 2–24.
24 *Id.*
25 *Id.*
26 *Id.*

ble. The reason to apply the U test is that data used in this article is not normally distributed.

In addition, the relationship among scale efficiency (SE), CCR, and BCC efficiency scores[27] is applied to formulate three rules to investigate sources of inefficiency of the air carriers to realize financial benefits of operating leases. For this purpose, the first decision rule applied in this article is that a carrier is said to be working in an unfavorable financial environment if it is CCR- and Scale-inefficient. Secondly, a carrier is to be considered inefficient itself rather than working in an unfavorable financial environment if it is CCR- and BCC-inefficient. Thirdly, a carrier is to be considered the most productive user of operating leases if it is CCR- and BCC-efficient.

In addition to the DEA results, this article compares average tax rates of efficient and inefficient carriers to segregate the influence of tax rates on operating lease performance. Finally, the average of ratios between lease rents to total operating expenses (LROE) for efficient and inefficient carriers are also compared in order to check the consistency of the DEA results with other empirical findings of operating leases.

IV. DATA

All required data in this article are collected from annual reports of the air carriers. For this purpose, twenty-one air carriers are selected randomly to pursue the research objectives of this article. Based on the data and information of these air carriers, ratios in Table 1 are calculated to determine input and outputs for the DEA model.

[27] Cooper et al. mentioned the equation for efficiency sources to be - $\theta^*_{CCR} = \theta^*_{BCC} \times SE$, where θ^*_{CCR} represents CCR efficiency, θ^*_{BCC} represents BCC efficiency, and SE represents Scale efficiency.

TABLE 1
LIST OF INPUT AND OUTPUTS FOR DEA MODEL AND CALCULATION METHODS

Input	Outputs
➢ Yearly operating lease rent.	➢ Tax shield benefit = Annual Lease Installment × Tax rate
	➢ Liquidity Ratio = $\frac{\text{Current Assets}}{\text{Current Liability}}$
	➢ Interest Coverage Ratio = $\frac{\text{EBIT}}{\text{Interest}}$
	➢ Debt – Equity Ratio = $\frac{\text{Long Term Debt}}{\text{Equity}}$

V. RESULTS

The descriptive statistics of input and outputs reveal that the nature of data is non-parametric because of a high range in the maximum and minimum values, high fluctuation in standard deviations, etc. (Table 2). This nature of data allows us to apply a non-parametric model such as the DEA model in this article.

TABLE 2
DESCRIPTIVE STATISTICS OF INPUT AND OUTPUTS

	Operating lease	Tax shield	Interest coverage ratio	Liquidity Ratio	Debt equity Ratio
Max	2028.00	709.80	32.95	2.57	6.05
Min	18.40	5.00	0.65	0.32	0.19
Average	392.38	121.34	6.87	1.17	1.16
SD	511.29	165.54	7.35	0.48	1.35

The correlation coefficients between input and four outputs are positive in the *R*-matrix. Therefore, input and outputs can be included in the DEA model.

TABLE 3
CORRELATION MATRIX FOR INPUT AND OUTPUTS

	Lease installment	Tax shield	Interest coverage ratio	Liquidity ratio	Debt equity ratio
Lease installment	1				
Tax shield	.975(**)	1			
Interest coverage ratio	.034	.043	1		
Liquidity ratio	.030	.018	.443(*)	1	
Debt equity ratio	-.068	.022	-.365	-.196	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The results of the BCC model in Table 4 reveal that seven out of twenty-one air carriers are efficient to obtain financial benefits of operating leases. They are called BCC-efficient air carriers and the remaining fourteen are called BCC-inefficient air carriers in this article. The BCC-efficient carriers are Japan Airlines Limited, China Air, FedEx, Ryan Air, Jet Air, Air Pacific, and Com Air.

As mentioned in the methodology, the operating profits of the seven BCC-efficient and fourteen BCC-inefficient airlines are divided into two groups to test whether or not they differ significantly from each other according to the U test. The test results are shown in Table 5. These results do not reject the alternative hypothesis of this article, meaning that operating profits of BCC-efficient and BCC-inefficient air carriers are significantly different. That is, efficient realization of financial benefits of operating leases significantly influence the operating profit of the air carriers (Tables 4 and 5).

TABLE 4
BCC EFFICIENCY SCORES, TARGET OUTPUTS AND BENCHMARKS

Airlines	Input (Operating lease payment, in Million $)	Actual Outputs: Tax Shield (In million $)	Actual Outputs: Liquidity Ratio	Actual Outputs: Interest coverage Ratio	Actual Outputs: Debt - Equity Ratio	BCC Efficiency Scores	Target Outputs: Tax Shield (In million $)	Target Outputs: Liquidity Ratio	Target Outputs: Interest coverage Ratio	Target Outputs: Debt - Equity Ratio	Benchmarks or Peers	Frequencies of Peers
KAL	266	73	0.59	0.65	0.62	**0.6842**	106.92	0.86	1.61	4.07	JAL, CHI, Airpacific	
AF	851	297	1.51	2.51	1.35	**0.9646**	307.97	1.57	7.21	2.79	JAL, FedeX, Ryanair	
SIA	203	41	1.27	17.49	0.19	**0.6589**	61.63	1.92	26.55	0.30	FedeX, Ryanair, Jetair	
BRI	199	60	0.95	4.06	1.19	**0.7539**	79.30	1.30	5.39	2.45	JAL, Jetair, Airpacific	
THIA	137	43	0.73	2.50	1.89	**0.7917**	54.01	1.01	3.16	2.51	JAL, CHI, Airpacific	
JAL	556	226	1.20	2.26	6.05	**1**	-	-	-	-	JAL	**12**
LUF	192	67	1.00	1.51	0.52	**0.8790**	76.33	1.14	3.68	2.73	JAL, CHI, Airpacific	
ANA	266	107	0.83	3.68	3.44	**0.9998**	106.84	1.14	3.68	3.44	JAL, CHI, Jetair, Airpacific	
AIZ	235	78	1.34	9.22	0.39	**0.8466**	91.60	1.58	10.89	2.63	JAL, Ryanair, Jetair, Airpacific	
CHI	18	5	0.51	0.72	2.51	**1**	-	-	-	-	CHI	**5**
Fedex	2028	710	1.11	15.44	0.25	**1**	-	-	-	-	FedeX	**5**
Qantas	97	29	0.90	4.55	1.00	**0.7816**	37.18	1.32	5.82	1.42	JAL, Jetair, Airpacific	
Ryanair	43	5	2.57	5.73	0.75	**1**	-	-	-	-	Ryanair	**7**
Cathep	627	110	1.17	9.32	0.21	**0.5892**	186.23	1.99	15.81	0.47	FedeX, Ryanair, Jetair	
Airchina	216	71	0.32	2.07	0.64	**0.8257**	86.24	0.97	2.51	3.35	JAL, CHI, Airpacific	
TMAL	1591	398	1.28	1.48	0.51	**0.8279**	480.46	1.55	12.04	0.62	JAL, FedeX, Ryanair	
Jetair	45	11	1.84	32.95	0.20	**1**	-	-	-	-	Jetair	**8**
IberaL	492	172	1.66	8.19	0.80	**0.9500**	181.22	1.75	8.62	2.81	JAL, FedeX, Ryanair, Jetair	
Airpacific	25	8	1.33	5.65	0.72	**1**	-	-	-	-	Airpacific	**9**
comair	23	7	1.06	4.81	0.57	**1**	-	-	-	-	comair	**0**
Aeroflot	129	31	1.49	9.57	0.63	**0.7059**	43.69	2.11	13.56	1.45	JAL, Ryanair, Jetair, Airpacific	

The mean and standard deviation of inefficient scores are 87 and 13 percent respectively.

TABLE 5
RESULTS OF MANN WHITNEY–U TEST FOR BCC EFFICIENCY SCORES

Airlines	No. of Airlines	Mean Rank	Sum of ranks	Mann Whitney Value	Asymptotic Significance at 95% confidence level
Efficient	7	9.71	68	40	0.502
Inefficient	14	11.64	163		

Asymptotic significance at 95% confidence level (2-tailed) = 0.502(p) > 0.05.

The same methodology is also applied for the CCR model in Tables 6 and 7. The only exception for this model is that five air carriers are found CCR-efficient to obtain financial benefits of operating leases compared to the total number of BCC-efficient air carriers. In this case, FedEx and Com Air become inefficient airlines. For CCR-efficient and CCR-inefficient air carriers, it is also found that operating profits of these two groups of air carriers differ significantly from each other (Tables 6 and 7).

TABLE 6
CCR EFFICIENCY SCORES AND TARGET OUTPUTS AND BENCHMARKS

Airlines	Input (Operating lease payment, in Million $)	Actual Outputs: Tax Shield (In million $)	Actual Outputs: Liquidity Ratio	Actual Outputs: Interest coverage Ratio	Actual Outputs: Debt - Equity Ratio	CCR Efficiency Scores	Target Outputs: Tax Shield (In million $)	Target Outputs: Liquidity Ratio	Target Outputs: Interest coverage Ratio	Target Outputs: Debt - Equity Ratio	Benchmarks or Peers	Frequencies of Peers
KAL	266	73	0.59	0.65	0.62	**0.6792**	107.70	0.86	2.35	3.00	JAL, Airpacific	
AF	851	297	1.51	2.51	1.35	**0.8582**	346.15	1.84	3.45	9.26	JAL	
SIA	203	41	1.27	17.49	0.19	**0.5383**	75.44	2.35	32.49	2.04	JAL, Jetair	
BRI	199	60	0.95	4.06	1.19	**0.7535**	79.35	5.39	1.27	2.43	JAL, Jetair	
THIA	137	43	0.73	2.50	1.89	**0.7891**	54.19	3.17	0.92	2.39	JAL, CHI	
JAL	556	226	1.20	2.26	6.05	**1**	-	-	-	-	JAL	**16**
LUF	192	67	1.00	1.51	0.52	**0.8758**	76.61	1.14	3.95	2.34	JAL, Airpacific	
ANA	266	107	0.83	3.68	3.44	**0.9975**	107.10	0.83	3.68	3.45	JAL, CHI	
AIZ	235	78	1.34	9.22	0.39	**0.8362**	92.74	1.60	11.02	2.75	JAL, Jetair	
CHI	18	5	0.51	0.72	2.51	**1**	-	-	-	-	CHI	**2**
Fedex	2028	710	1.11	15.44	0.25	**0.8622**	823.29	4.89	17.91	21.99	JAL, Jetair	
Qantas	97	29	0.90	4.55	1.00	**0.7771**	37.40	1.15	5.85	1.33	JAL, Jetair	
Ryanair	43	5	2.57	5.73	0.75	**1**	-	-	-	-	Ryanair	**0**
Cathep	627	110	1.17	9.32	0.21	**0.4377**	250.68	2.68	21.28	6.82	JAL, Jetair	
Airchina	216	71	0.32	2.07	0.64	**0.8142**	87.45	0.55	2.54	2.33	JAL, Jetair	
TMAL	1591	398	1.28	1.48	0.51	**0.6143**	647.56	3.43	6.46	17.32	JAL	
Jetair	45	11	1.84	32.95	0.20	**1**	-	-	-	-	Jetair	**12**
IberaL	492	172	1.66	8.19	0.80	**0.8695**	198.00	1.91	9.42	5.52	JAL, Jetair	
Airpacific	25	8	1.33	5.65	0.72	**1**	-	-	-	-	Airpacific	**12**
comair	23	7	1.06	4.81	0.57	**0.9240**	7.30	1.14	5.21	0.62	JAL, Jetair	
Aeroflot	129	31	1.49	9.57	0.63	**0.6483**	47.57	2.30	14.76	1.91	JAL, Jetair	

The mean and standard deviation of inefficient scores are 82 and 16 percent respectively

TABLE 7
RESULTS OF MANN WHITNEY–U TEST FOR CCR EFFICIENCY SCORES

Airlines	No. of Airlines	Mean Rank	Sum of ranks	Mann Whitney Value	Asymptotic Significance at 95% confidence level
Efficient	5	9.20	46	31.00	0.457
Inefficient	16	11.56	185		
Asymptotic significance at 95% confidence level (2-tailed)= 0.457 (p) > 0.05					

The investigation of sources of air carriers' inefficiency to realize financial benefits of operating leases is accomplished by the three rules set forth in the methodology section of this article. Of these rules, the first rule, that a CCR- and Scale-inefficient carrier is working in an unfavorable financial environment, shows that FedEx and Com Air in Table 8 are inefficient due to working in an unfavorable financial environment for operating leases. This financial environment for operating leases may consist of tax rules, rules for charging depreciation for leased assets, and an imperfect lease market of the respective country where the air carrier is operating its business. According to the second rule, a CCR- and BCC-inefficient carrier is inefficient itself rather than working in an unfavorable financial environment. Korean Airlines, Air France, Singapore Airlines, British Airlines, Thai Airlines, Lufthansa Air, All Nippon Airlines, New Zealand Airlines, Qantas Airlines, Cathay Pacific Airlines, Air China Limited, TMAL, Iberia, Líneas Aéreas de España, S.A, and Aeroflot Airlines are using operating leases inefficiently by themselves. This means that their inefficiency is not because they are working in an unfavorable financial environment for operating leases (Table 8).

TABLE 8
INEFFICIENCY INVESTIGATION

Airlines	CCR Efficiency Scores	BCC Efficiency Score	Scale Efficiency* Score	RTS** for Efficient Airlines	RTS for Inefficient Airlines	Excess use of Operating Lease
Korean Air	0.6792	0.6842	0.9927		Constant	
Air France	0.8582	0.9646	0.8897		Decreasing	
Singapore	0.5383	0.6589	0.8170		Decreasing	–12.1051
British Air	0.7535	0.7539	0.9994		Constant	
Thai	0.7891	0.7917	0.9967	.	Constant	
Japan	1	1	1	Constant		
Lufthansa	0.8758	0.8790	0.9963		Constant	
All Nippon	0.9975	0.9998	0.9976		Constant	
AIZ	0.8362	0.8466	0.9877		Constant	
China	1	1	1	Constant		
Fedex	0.8622	1	0.8622	Decreasing		
Qantas	0.7771	0.7816	0.9942		Constant	
Ryanair	1	1	1	Constant		
Cathay	0.4377	0.5892	0.7429		Decreasing	–78.2845
Airchina	0.8142	0.8257	0.9861		Constant	
TMAL	0.6143	0.8279	0.7420		Decreasing	–213.329
Jetair	1	1	1	Constant		
Iberia	0.8695	0.9500	0.9153		Decreasing	
Airpacific	1	1	1	Constant		
Com Air	0.9240	1	0.9240	Increasing		
Aeroflot	0.6483	0.7059	0.9184		Constant	

* Scale Efficiency is the ratio between CCR and BCC score.
** Return to Scale Efficiency.

On the other hand, according to the third rule, a CCR- and BCC-efficient carrier is the most productive user of operating leases. Japan Airlines, China Airlines, Ryan Air, Jet Airways (India) Limited, and Air Pacific are realizing four financial benefits of operating leases most productively. Among these air carriers, Japan Airlines is acknowledged as a benchmark of twelve and sixteen times for the CCR and BCC models respectively (Tables

4 and 6). This means that Japan Airlines is the most capable airline to obtain four financial benefits of operating leases in the existing financial environment (Table 8).

This article finds that the average tax rate of efficient air carriers is lower than that of inefficient air carriers. In contrast, the average of ratios between lease rents to operating expenses of efficient carriers is lower than that of inefficient air carriers (Table 9). Hence, these two results contradict the finding of Graham et al. that lower taxed firms use more leases.[28]

TABLE 9
AVERAGE TAX RATES AND LROE RATIOS

Airline	Tax Rates of Efficient Airlines	Tax Rates of Inefficient Airlines	LROE For Efficient Airlines	LROE For Inefficient Airlines
Korean Air		27.50%		0.0457
Air France		34.93%		0.3592
Singapore		20.00%		0.0314
British Air		30.00%		0.0146
Thai		31.11%		0.0373
Japan	40.70%		0.0287	
Lufthansa		35.00%		0.0075
All Nippon		40.16%		0.0235
AIZ		33.00%		0.0805
China	25.00%		0.0433	
Fedex	35.00%		0.0754	
Qantas		30.00%		0.0134
Ryanair	12.50%		0.0332	
Cathay		17.50%		0.1046
Airchina		33.00%		0.0503
TMAL		25.00%		2.4516
Jetair	25.00%		0.0554	
Iberia		35.00%		0.1024
Airpacific	31.00%		0.1048	
Com Air	29.00%		0.0972	
Aeroflot		24.00%		0.0559
Average	**28.31%**	**29.73%**	**0.063**	**0.241**

LROR = Lease to Operating Expenses Ratio

VI. CONCLUSION

This article applies the DEA model and finds that efficient utilization of financial benefits of operating leases influences operating profits of the air carriers. It also finds that lower-taxed air carriers are relatively more efficient than higher-taxed air carriers. The models applied in this article also determine tar-

[28] John R. Graham, Michael L. Lemmon & James S. Schallheim, *Debt, Leases, Taxes, and the Endogeneity of Corporate Tax Status*, 53 J. FIN. 131, 131–61 (1998).

get lease rentals and financial benefits for the inefficient carriers in comparison with their benchmark carriers. Following these targeted amounts, inefficient air carriers would be able to use operating leases efficiently. Moreover, finance managers, investors, and financial institutions may apply the findings of this article to analyze performance of off-balance sheet financing.

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