OPERATING LEASE OF AIRCRAFT: A DECISION MODEL FOR THE AIRLINES

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Abstract

This paper examines the lease/own decision from an airline's standpoint, recognizing explicitly the uncertain and pro-cyclical nature of air transport demand. Both the financial and operational aspects of the aircraft lease are considered to derive optimality conditions which relate owned capacity, leased capacity, and expected traffic demand to operating lease premiums. The results obtained by applying the model to the world's major airlines and suggest that the optimal demand for operating lease for these airlines would range between 40 and 60 percent of their total fleet, for the reasonable range of operating lease premiums. For leasing companies, this indicates that there is still a large potential for growth of the demand for operating lease.

INTRODUCTION

Due to the increasing deregulation and liberalization of airline markets, competitive pressure has forced airlines to operate on a very thin profit margin. This makes cost control and capacity planning a critical issue of the airline management. Currently, the airlines are relying on aircraft leasing as a source of capital . Traditionally, the benefits of leasing - as opposed to owning - are viewed as financial. One such benefits is off-balance-sheet financing. As operating lease is not capitalized, air carriers can substantially lower their debt/equity ratio on their balance sheet if they finance their fleet by leasing rather than by traditional debt. Another well-known financial benefit is that leasing separates the ownership of an aircraft from the aircraft user. This separation of ownership enables valuable depreciation allowances to be used more effectively by the lessors for tax purposes.

Recent developments of the aircraft leasing market indicates that operational concerns may be more important than financial reasons. Research has shown that the income elasticity of air travel is around 2 (Cigliano, 1980, for example), and so air transport is pro-cyclical. Very few goods or services in the economy are as responsive to income as is air transport. The pro-cyclical behaviour has likely been exacerbated by airline deregulation/liberalization in many countries over the last two decades and by the recent globalization of the industry. Given pro-cyclical demand for air travel, a key for better management of aircraft fleet is to have a reliable forecast. Despite the economists' effort to forecast business cycles, significant forecasting errors and thus uncertainty in demands remain in their forecasts. As a consequence, airlines often have limited capacity during economic boom and excess capacity during recession. To make the situation even worse, there is a lag (or lead) in aircraft delivery. More specifically, during the boom, aircraft manufacturers usually have long order backlog, and delivery will take a long time. In 1988-89 boom, for instance, the order for new aircraft reached peak. However, the peak in delivery only occurred in 1991-92, when the economy had entered a recession.

With these operating environments as background, aircraft leasing provides airlines much needed flexibility in fleet management. Operationally, aircraft leasing allow airlines to manage fleet size and composition as closely as possible, to match to their expanding and contracting demand. This benefit, however, is to be balanced against the higher cost of operating lease to compensate for the risks born by the leasing companies. Therefore, the use of aircraft leases presents a trade-off between operational flexibility and higher financial costs inherent in short-term leases.

In this paper we examine the lease/own decision from an airline's standpoint, recognizing explicitly the uncertain and pro-cyclical nature of air transport demand. Both the financial and operational aspects of the aircraft lease are taken into account in deriving the optimality conditions which relate owned capacity, leased capacity, and expected traffic demand to the operating lease premium. The historical trend so far has been an ever-increasing use of operating leases, in tandem with the development of active aircraft leasing market. In 1981, for instance, only about 6% of the aircraft of the world's airlines were on operating lease. Now, about half of the airline fleet is on some sort of lease, the majority of which are on operating lease. With the market becoming mature, whether airlines should continue to increase their reliance on operating leases has become an important strategic question for airlines.

Our theoretical model can be applied to the major airlines in the world so as to assess the future potential for the growth of the aircraft leasing market. The results will be valuable to the management of both airlines and leasing companies. As far as we are aware, this is the first attempt to model the operational aspect of aircraft leases and to integrate the operational aspect with the financial aspect in the analysis of buy/lease decisions for airlines. In section 2, we derive optimality conditions, relating owned capacity, leased capacity, expected traffic demand to operating lease premium. In section 3, we examine empirically the optimal demand for operating lease of aircraft for the world's major airlines. Section 4 concludes.

MODEL

Consider an airline. The airline faces an uncertain demand $y = y(\tau)$, where τ represents future state of nature. The capacity of the airline is $Z = K + S$, where K is the capital stock owned or leased for long-term, S is the capital stock leased for short-term. K is inflexible in the sense that once acquired, it cannot be easily disposed of, whereas S is flexible in the sense that it can be obtained any time as needed. For simplicity, we will call long-term leasing as capital leasing and short-term leasing as operating leasing.

The airline profits can be expressed as

$$\pi = R[y(\tau), Z] - V[y(\tau), Z] - w_k K - w_s(\tau) S$$

where R is the revenue, V is the variable cost, w_k and w_s are the costs of long-term capital and short-term capital, respectively. Note that w_k is known at the beginning while w_s depends on the future uncertain state. The airline's capacity decision is made in two stages. In the first stage, the airline acquires the long-term capital through either purchasing or capital leasing. Then, in the second stage, after the state of nature is revealed, the airline acquires additional capacity, if necessary, through operating lease.

In the first stage, the airline determines K to maximize its expected profits, i.e.,

$$\max_{K} E\{R(y,Z) - V(y,Z) - w_k K - w_s S\}$$

$$= \max_{K} \int [R(y,Z) - V(y,Z) - w_k K - w_s S] f(\tau) d\tau \qquad (1)$$

where K and S are nonnegative. Then, in the second stage, when K is fixed and the uncertain state, τ, is revealed, the airline chooses the amount of operating lease, S, to maximize profits conditional on K and τ. We assume that the following second order condition is satisfied over all the states:

$$\frac{\partial^2 R}{\partial Z^2} - \frac{\partial^2 V}{\partial Z^2} < 0. \qquad (2)$$

This condition states that the marginal effects of capacity on revenue and variable costs are diminishing as capacity increases.

In the second stage, given the capacity K and the state, the airline's problem is

$$\max_{S} R(y,Z) - V(y,Z) - w_K K - w_s S.$$

Let

$$T_1 = \left\{ \tau \left| \left[\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_s \right]_{s=0} \geq 0 \right. \right\},$$

$$T_2 = \left\{ \tau \left| \left[\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_s \right]_{s=0} < 0 \right. \right\}. \qquad (3)$$

Then, the optimal solution S^* is zero, if $\tau \in T_2$.

If $\tau \in T_1$, the optimal solution S^* is implicitly determined by the following first order condition:

$$\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_s = 0 \cdot \qquad (4)$$

Differentiating the above equation with respect to K gives:

$$\left(\frac{\partial^2 R}{\partial Z^2} - \frac{\partial^2 V}{\partial Z^2} \right) \left(1 + \frac{\partial S^*}{\partial K} \right) = 0 .$$

Thus, in sum, we have

$$\frac{\partial S^*}{\partial K} = \begin{cases} -1, \ \tau \in T_1 , \\ 0, \ \tau \in T_2 \ . \end{cases}$$

In the first stage, the first order condition to determine K is:

$$\int \left[\left(\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} \right) \left(1 + \frac{\partial S^*}{\partial K} \right) - w_k - w_s \frac{\partial S^*}{\partial K} \right] f(\tau) d\tau = 0 . \qquad (5)$$

Substituting and rearranging gives:

$$\int_{T_1} (w_s - w_k) f(\tau) d\tau + \int_{T_2} \left(\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_k \right) f(\tau) d\tau = 0,$$

or,

$$\int (w_s - w_k) f(\tau) d\tau = - \int_{T_2} \left(\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_s \right) f(\tau) d\tau . \qquad (6)$$

From (3), the right hand side of (6) is positive. Hence,

$$\int (w_s - w_k) f(\tau) d\tau = E(w_s) - w_k > 0 .$$

This inequality has an intuitive interpretation. From the standpoint of the leasing companies (lessors) which own capital stock and then lease to airlines, short-term operating lease is riskier than long-term capital lease due to uncertainties in the future terms of lease. Therefore, the above inequality shows that leasing companies should expect to earn a positive risk premium on operating lease.

Overall, eqn (6) shows the trade-off between owning and leasing capacity from the standpoint of the airline. On one hand, a marginal increase of owned capacity reduces expected capital cost; on the other hand, since owned capacity cannot be disposed of when demand is low, a marginal increase of owned capacity increases the expected costs of excess capacity. The optimal mix of owned and leased capacity then constitutes a balance between these two costs.

AN EMPIRICAL EXAMINATION

The optimality condition (6) determines the airlines' optimal mix of owned and leased capacity, thereby the condition can be used to forecast airlines' demand for operating lease of the aircraft. Needless to say, the ability to forecast such demand is highly valuable to the leasing companies as well.

In this section, we illustrate the use of condition (6) by considering the optimal demand for leased capacity from twenty-three of the world's major airlines.

Methodology

We start with estimating a variable cost function for the airlines. The cost function may be written as follows:

$$V = V(Y, W, Z, D)$$

where Y is output, W is the vector of the prices of variable inputs, Z is total capacity, and D is a vector of operating characteristics. Based on the estimated cost function, we take the expectation of the right-hand side of (6) conditional on Z to obtain

$$G(Z) \equiv -E\left\{\frac{\partial R}{\partial Z} - \frac{\partial V}{\partial Z} - w_s \mid \tau \in T_2\right\}. \tag{7}$$

For given expected premiums on operating lease, $E(w_s) - w_k$, the optimal owned capacity for each airline, K^*, can be solved by equating G(Z) with $E(w_s) - w_k$. Then, comparing K^* with the total capacity gives the optimal demand for leased capacity.

For empirical specification, we use the conventional translog functional form for the variable cost function, namely,

$$\ln V = a_0 + \sum a_i G_i + \sum a_{T_i} T_i + \sum a_{D_i} \ln D_i + a_Y \ln Y + a_Z \ln Z$$

$$+ \sum a_{W_i} \ln W_i + .5 b_Y \ln Y \ln Y + .5 b_Z \ln Z \ln Z + .5 \sum b_{ij} \ln W_i \ln W_j \qquad (8)$$

$$+ \sum b_{Y_i} \ln Y \ln W_i + \sum b_{Z_i} \ln Z \ln W_i + .5 \sum c_{ij} \ln D_i \ln D_j$$

$$+ \sum c_{Y_i} \ln Y \ln D_i + \sum c_{Z_i} \ln Z \ln D_i + \sum e_{ij} \ln W_i \ln D_j$$

where the vector of operating characteristics D_i consists of load factor and the average stage length, T_i is the time dummy capturing effects of technical change and G_i is the regional dummy differentiating airlines headquartered in different continents (North America, Europe, and Asia and Oceania). There are three variable inputs: labour, fuel, and materials. As standard practice, two of the three variable cost share equations are estimated jointly with eqn (8).

Taking into account the flexibility of the short-term capacity expansion afforded by operating lease, eqns (3) and (5) give the following optimality condition for the total capacity of an airline:

$$\frac{\partial R}{\partial Z} - \frac{\partial R}{\partial Z} - w_s \leq 0 \qquad (9)$$

where inequality holds if capacity is rigid and excessive. Rewrite (9) as

$$w_s \geq \frac{R}{Z}\frac{\partial \ln R}{\partial \ln Z} - \frac{V}{Z}\frac{\partial \ln V}{\partial \ln Z}$$

or

$$\frac{w_s Z}{V} = \frac{R}{V}\eta - \frac{\partial \ln V}{\partial \ln Z} + u \qquad (10)$$

where η is the elasticity of revenue with respect to capacity and u is a non-negative error. Note that η is related to the elasticity of travel demand with respect to airline's scheduled frequency (See, for example, Morrison and Winston, 1986; Oum, Zhang, and Zhang, 1995, for further discussion). Since u is caused by rigid capacity which cannot be adjusted downward in short-run, we assume

$$u = e_1\, rig + e_2\, rig^2$$

where *rig* is the share of owned capacity out of total capacity (owned plus leased) which reflects the rigidity of the capacity. e_1 and e_2 are coefficients to be estimated.

Following standard procedure, all variables in the cost function except the dummies are normalized at the respective sample means. Eqns (8), (10) and two of the three variable cost share equations are then jointly estimated by a maximum likelihood method after standard normal disturbance terms are appended to each of the equations. The parameters of the cost function are then used to forecast the optimal demand for operating lease by the airlines.

Data

Our data sample consists of annual observations on 23 major international airlines over the 1986-93. The airlines in our sample are chosen mainly on the basis of availability of consistent time-series data. The data is compiled mainly form the Digest of Statistics series published by the International Civil Aviation Organization (ICAO). Some additional data is obtained directly from the airline companies. The annual reports of carriers were used to supplement, cross-check with, and correct errors in the ICAO data. We contacted the airline companies for clarification when the two sources of data could not be reconciled period (see Oum and Yu, 1998 for more detailed description of the data).

The estimation of the variable cost function requires detailed data on outputs, input prices, and operating characteristics. Five categories of output data are collected from ICAO's annual publication series, Commercial Traffic and Financial Data: scheduled passenger service, scheduled freight service, mail service, non-scheduled passenger and freight services, and incidental services. A multilateral output index is formed by aggregating the five categories of outputs using the multilateral index procedure proposed by Caves, Christensen, and Diewert (1982).

Five categories of inputs are considered: labour, fuel, material, flight equipment, and ground property and equipment. The price of labour input is measured by the average compensation (including benefits) per employee. Both the total labour compensation and the number of employees are collected from ICAO's annual series, Fleet and Personnel, and supplemented by data obtained directly from airline companies and from their annual reports. It was not possible to compute average hourly compensation per employee because labour hour data was not available for many of the airlines in our sample. Total fuel cost is obtained from ICAO's annual series, Financial Data, and fuel price is obtained by dividing total fuel cost by gallons of fuel consumed (note that a fuel quantity regression model was used to estimate fuel consumption for those airlines whose fuel consumption data are not available to us.

For flight equipment, a fleet quantity index is constructed by aggregating 14 types of aircraft using the multilateral index procedure. The number of aircraft by type is collected from ICAO's annual series, Fleet and Personnel. The leasing price series for these aircraft types were kindly supplied to us by Avmark, Inc. and are used as the weights in the aggregation. The stock of ground properties and equipment (GPE) is estimated using the perpetual inventory method. Data on the 1986 benchmark capital stock and the net investment series are compiled from ICAO's annual series, Financial Data. The annual cost of the GPE input is computed by multiplying the GPE service price to the GPE stock. The GPE service price is constructed using the method proposed by Christensen and Jorgenson (1969) which reflects the interest rate, depreciation, and effects of taxes.

The last category of input is materials. The materials input is the residual input which is not included in any of the input categories discussed above. As such, materials cost is the catch-all cost. We compute materials cost by subtracting the labour, fuel and capital related costs from the total operating costs. The price index for the materials input is constructed using the US GDP deflator and the intercountry purchasing power parity index for GDP from the Penn World Table (Summers and Heston, 1991). The purchasing power parity index for GDP and GDP deflator together reflect a country's general price level, and are appropriate to be used as a proxy for materials price since the materials costs include numerous items. Since the GPE costs are small relative to other categories of costs, GPE costs are further aggregated into the materials costs. GPE is often aggregated with flight equipment to form capital stock. However, since the purpose of this paper is to examine the optimal lease of aircraft, we decided to keep flight equipment separate from the rest of the inputs.

The variation of operating characteristics of the airlines is reflected by average load factor and average stage length of each airline in each year. The average load factor is computed as the ratio of total passenger mile to total seat mile flown. The average stage length is the average distance between takeoff and landing.

The 23 major air carriers used in the study and the key descriptive statistics of our sample is listed in Tables 1 and 2. The variable costs are the sum of labour, fuel, and materials costs. The stock of flight equipment is used to represent capacity.

Table 1 Sample of Carriers Used in the Study

North America			
American	86 - 93	United	86 - 93
Continental	86 - 93	US Air	86 - 93
Delta	86 - 93	Air Canada	86 - 93
Northwest	86 - 93	CAI	86 - 93
Europe			
Air France	86 - 93	KLM	86 - 92
Alitalia	86 - 93	Lufthansa	86 - 93
British Airway	86 - 93	SAS	86 - 93
Iberia	86 - 93	Swiss Air	86 - 92
Asia and Oceania			
ANA	88 - 93	Qantas	86 - 93
Cathay Pacific	88 - 93	SIA	86 - 93
JAL	86 - 93	Thai	86 - 93
KAL	86 - 93		

Table 2 Descriptive Statistics of Key Variables in the Sample

Variable	Mean	Minimum	Maximum
Total Revenue ($million)	4730	794	14737
Total Cost ($million)	4817	823	14589
Variable Cost ($million)	4301	714	13028
Ave. Wage ($thousand)	44.428	8.436	107.46
Fuel Price ($/gal.)	0.74	0.51	1.55
Output (index)	1.296	0.295	4.361
Ave. Load (%)	67	56	79
Ave. Stage length (km)	1608	657	4371

Note: $'s are in US dollar or equivalent.

Results

The coefficients of the estimated cost function is reported in Table 3. Based on the coefficient on output, economies of density appears to be present at the sample mean point. According to Caves, Christensen, and Tretheway (1986), returns to density at sample mean is $(1 - a_K) / a_Y = (1 - .224) / .586 = 1.32$. However, this does not imply the presence of economies of scale which requires consideration of the size of the network of the airlines (see, for example, Caves, Christensen, and Tretheway, 1984; Xu et al, 1994; Jara-Díaz and Cortés, 1996, and Oum and Zhang, 1997, for more discussion). Since we do not have consistent data on the measurement of the size of the network of the airlines, we are unable to estimate returns to scale.

Table 3 Estimated Coefficients of Translog Variable Cost Function

Variable	Coef.	S.E.	Variable	Coef.	S.E.
Log Likelihood Function	**1367.525**				
A0	8.2910	0.0296	LD	-0.1113	0.0238
Y	0.5861	0.0653	LS	-0.0811	0.0107
D	0.2663	0.0627	FY	0.0024	0.0125
S	-0.3157	0.0335	FD	0.0789	0.0129
L	0.3121	0.0046	FS	0.0086	0.0055
F	0.1460	0.0023	KY	1.2671	0.2150
K	0.2243	0.0581	KD	-1.0483	0.2042
YY	-1.4307	0.2708	KS	0.1689	0.1010
DD	-1.1350	0.2068	Europe	-0.0677	0.0238
SS	0.1892	0.0626	Asia	0.0243	0.0279
YD	1.2381	0.2156	T87	-0.0653	0.0210
YS	-0.3457	0.1299	T88	-0.0878	0.0227
DS	0.1819	0.1009	T89	-0.0863	0.0246
LL	0.1556	0.0238	T90	-0.1021	0.0251
FF	0.0884	0.0054	T91	-0.1419	0.0249
KK	-1.0989	0.2041	T92	-0.1689	0.0261
LF	-0.0409	0.0065	T93	-0.1978	0.0251
LK	-0.0583	0.0238	eta	0.0525	0.0206
FK	0.0226	0.0114	e0	0.0486	0.0530
LY	0.0543	0.0244	e1	-0.0140	0.0583

Variables are as follows: Y is output, L is labour price, F is fuel price, K is capacity, D is load factor, and S is stage length. Labour price and fuel price are normalized by materials price.

The estimated elasticity of revenue with respect to capacity, η, is about 0.05. η is related to the elasticity of travel demand with respect to scheduled flight frequency and is identical to the latter if output price is fixed and if scheduled frequency increases in proportion to the increase in total capacity. Morrison and Winston (1986) estimated that the elasticity of passenger travel demand with respect to scheduled flight frequency was about 0.05 for leisure travellers and 0.21 for business travellers.

Regarding the operating characteristics, the first-order coefficient on average stage length is negative, as expected, indicating that long-haul flight is economically more efficient than short-haul flight. On the other hand, the sign of the first-order coefficient of average load factor is positive, which at first glance seems to suggest that increasing load factor while keeping all other variables unchanged would increase variables costs at the sample mean point. However, we believe that the coefficients on load factor should be interpreted with caution. Essentially, average load factor depends on output to capacity ratio; increasing load factor with both output and capacity fixed is counterfactual. Therefore, a clear interpretation of the coefficients on load factor is difficult.

To derive optimal demand for operating lease based on the estimated cost function, we still need the distribution of firm-specific demand for air transportation facing each carrier. For simplicity, we assume that the annual growth rate of demand for air service follows a normal distribution. Specifically, since the mean and standard deviation of the growth rate of our data sample are 1.094 and 0.127, respectively, we assume that the traffic demand facing carrier I in year t conditional on the demand in year t - 1 has the following distribution:

$$Y_{i,t} = Y_{i,t-1}\,(1+\tau)\,, \qquad \tau \sim N(\mu = 0.094,\ \sigma = 0.127)\,. \tag{11}$$

Since our focus is on the optimal allocation of capacity between owning and leasing under uncertain future state, the main factor is the uncertainty in traffic demand. Hence, given the distribution of traffic demand, without loss of generality, we take all other variables as given except load factor which we assume will vary proportionally with the output to capacity ratio. Substituting (11) into (7) gives

$$G(Z) = -\int_{T_2}\left[\frac{\partial R(\tau)}{\partial Z}-\frac{\partial V(\tau)}{\partial Z}-w_s\right]f(\tau)\,d\tau\,.$$

Numerical integration on the right-hand-side is taken conditional on Z (For numerical integration, the distribution of τ is truncated to be between $\mu - 3\sigma$ and $\mu + 3\sigma$.) and then the optimal owned capacity K^* is obtained by solving the following equation:

$$G(K^*) = E(w_s) - w_k\ .$$

The difference between the observed total capacity, $Z_{i,t}$, and $K^*_{i,t}$ is the optimal demand for aircraft lease by carrier *I* in year *t*.

As an illustration, we applied the above procedure to derive the optimal demand for aircraft leasing for the 23 major airlines in 1993. The results are presented in Table 4. It is shown that when the cost premium defined as $[E(w_s) - w_k] / w_k$ is at 5%, the optimal demand for operating lease of aircraft would be about 66% of the existing total fleet for the 23 major airlines. The demand for lease decreases as the premium increases. When premium is at 30%, the demand for lease would be about 40% of the total fleet. This reveals that the flexibility of operating lease is highly valuable to the airlines. In 1993, the actual share of leased aircraft, including both operating lease and capital lease, for the 23 airlines was 45.7% of their total fleet. Since long-term capital lease accounted for about 20% of total lease, the actual share of aircraft under operating lease would be around 37%. Thus, it appears that there is still potential for the growth of the demand for operating lease.

Table 4 Optimal Demand for Aircraft Lease: Homogeneous forecast of traffic growth

Cost premium of lease	5%	10%	15%	20%	25%	30%
Share of lease (%)	66.4	60.2	55.7	53.9	50.1	40.4
Demand for lease contributed by the region: (Out of 100 %)						
North America	61.5	65.1	68.2	68.2	70.8	67.5
Europe	20.2	15.4	11.3	11.2	7.6	9.2
Asia and Oceania	18.3	19.5	20.5	20.6	21.6	23.3

Estimation based on 1993 data.
Cost premium of lease is defined as $[E(w_s) - w_k] / w_k$.

Table 4 also lists the breakdown of total demand for operating lease by the 23 major airlines by the regions. It shows that the North American major carriers account for about two thirds of the demand in the leasing market. As the leasing premium is low, the European and Asian and Oceania major carriers have about the same demand; however, as the leasing premium increases, Asian and Oceania major carriers demand twice as much as the European carriers do.

The results of Table 4 are based on the assumption that all of the major carriers face the same stochastic distribution of traffic growth. This assumption may be unrealistic given that there are substantial differences in growth rates experienced in the different regions of the world in the past. As a further illustration, we divide our data sample into three major regions. Based on the sample statistics of the major carriers in each of the regions, we assume

$$Y_{i,t} = Y_{i,t-1}\,(1+\tau)\,, \quad \tau \sim N(\mu,\ \sigma)\,.$$

where $\mu = .109$, $\sigma = .164$ fr North American major carriers; $\mu = .072$, $\sigma = .102$ for European major carriers, and $\mu = .102$, $\sigma = .083$ for major carriers in Asia and Australia. The same procedure to derive firm-specific demand for operating lease is applied again to each of the 23 major carriers and the aggregate results are reported in Table 5. The results are quite similar to those reported in Table 4. The basic pattern of regional demands in Table 4 remains true in Table 5 that the North American major carriers contribute about two thirds of the total demand and the Asian and Oceania major carriers contribute more relative to the European major carriers as leasing premium increases.

Table 5 Optimal Demand for Aircraft Lease: Differential forecast of traffic growth

Cost premium of lease	5%	10%	15%	20%	25%	30%
Share of lease (%)	66.6	63.2	55.5	53.6	44.2	40.1
Demand for lease contributed by the region: (Out of 100 %)						
North America	62.1	62.4	68.3	68.0	67.1	67.4
Europe	20.2	19.5	11.5	11.5	8.7	9.4
Asia and Oceania	17.7	18.1	20.2	20.5	24.2	23.2

Estimation based on 1993 data.

Cost premium of lease is defined as $[E(w_s) - w_K] / w_K$.

The results in Tables 4 and 5 also illustrated the risks to the leasing companies since the lease premiums seem to be quite sensitive to the swings in demand. In view of this, although the industry has good reason to be optimistic about future growth in aircraft lease, there is considerable uncertainties regarding the profitability to the lessors. During the last recession, many leasing companies failed and the leasing industry is still undergoing consolidation as the airline industry has recovered. The empirical methodology illustrated in this section would also be useful to the leasing companies to forecast demand on the aircraft lease.

SUMMARY

The airline industry all over the world has been increasingly relying on aircraft lease. While previous researchers mostly focused on financial aspects of the leasing, this paper emphasizes the operational aspects of aircraft leasing. It is shown that short-term operating lease provides a vehicle for risk shifting or risk sharing between the airlines and the leasing companies. Operating lease of the aircraft gives the airlines flexibility in capacity management when demand for air transport service is uncertain and cyclical. As the demand for air services increases, the airlines will be able to quickly expand capacity by leasing aircraft. However, during a downturn of demand, the leasing companies which supply the aircraft will suffer from excess capacity. Leasing companies compensate this risk by charging a premium on operating leases. Thus, the airlines are facing a trade-off between flexibility of capacity and higher costs.

This paper developed a model for the airlines to determine their optimal mix of leased and owned capacity. Empirical results based on the data from 23 major airlines in the world suggested that the optimal demand by these airlines would range between 40 and 60 percent of their total fleet, for the reasonable range of operating lease premiums. To the leasing companies, this indicated a huge potential for growth given the strong growth forecasts of air transport services in the next decade. However, the extent of the risks in this market should not be underestimated. Our empirical results reveal a high sensitivity of the profitability of aircraft leasing to the swings in the demand. Therefore, the leasing companies should also be cautious in the management of their inventory. The approach illustrated in this paper is also useful to leasing companies for forecasting the demand for operating lease of the aircraft and to assess the extent of risks in the market, and thereby, better manage the supply side of the market.

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