Research on Financial Lease Pricing Model

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Abstract: Financial leasing is a financial innovation product with leasing and financing functions. The research on the theory of financial leasing and risk pricing methods should be highly valued. Rent is set based on the total revenue of the lessor and the total cost of the lessee. The factors that affect pricing include project costs, security deposits, fees, lease terms, revenue, interest rates, *etc*. Using the principle of net present value to elaborate the components of financial leases and constructing a financial lease pricing model from the perspective of maximizing the profit and interests of the lessor, an empirical analysis of the model was carried out using an actual case, thus concluding that the model is effective.

Keywords: Financial lease; Pricing model; IRR

1. Introduction

Financial leasing is a transaction activity in which the lessor purchases leased goods from the supplier, leases them to the lessee for use, and collects rent from the lessee according to the lessee's requirements for the leased goods and the supplier. Financial leasing has financing attributes, and it is a product of the development of market economy to a certain extent. In view of its flexible transaction structure and absence of collateral, financial leasing has been favored by customers since its launch. The penetration rate of the financial leasing market in the United States, Canada, Australia, and Spain has exceeded 20%, becoming the second largest financing method after bank credit.

The leasing industry has entered a high-growth period and benefited from the development of bank-based leasing companies. The establishment of financial leasing companies by banks is not only an inevitable market-oriented operation, but also the result of interest rate marketization. Bank-based leasing companies have flexible transaction structures, multiple profit models, strong financing capabilities, no established deposit and loan spread returns, no housing and land collateral required, and their pricings are not bound by interest rate controls. Therefore, under the conditions of interest rate marketization, an in-depth study of lease pricing methods and models is conducive to the construction of credit pricing models, the adaptation of banks to the competitive environment of interest rate marketization, and their core competitiveness.

Whether from theoretical research or empirical research, financial lease pricing is the core of financial leasing research. From existing studies, there are financial lease pricing based on certain perspectives and also financial lease pricing for a single industry. First of all, neither industrial differences are fully considered nor the different operating characteristics of different industries are integrated to design different pricing schemes in financial lease pricing. Secondly, the design of the pricing scheme of financial leasing products is inflexible in the design of the rental payment method and does not take into account the real economic activities of the lessee, especially the outflow and inflow patterns of the lessee's operating cash

flow. A lease transaction involves three parties and two contracts, namely the purchase contract between the lessor and the supplier as well as the lease contract between the lessor and the lessee. The two contracts correspond to each other, are intertwined, and mutually exist; together, they constitute a financial leasing transaction. Although the lessee is not a party to the purchase contract, the terms of the purchase contract shall be approved by the lessee and the lessee's terms shall be confirmed by the lessee. Although the supplier is not a party to the lease contract, it should be accepted that the leased property of the purchase contract will become the leased property of the lease contract and be shipped directly by the supplier to the lessee. Financial leasing plays a role in serving the real economy. In financial leasing transactions, higher requirements have been put forward for financial lease pricing due to the individual needs of lessees, risk avoidance of lessors, and the development of the financial market.

We reviewed several studies under Section 2 and established a pricing model under Section 3. We discussed the results and analyzed a case under Section 4. We then concluded the study in Section 5.

2. Literature review

The initial results of research on financial lease pricing are as follows: Ding Yong and Ge Xiang [1] quantified the factors affecting the pricing of aircraft depreciation, tax credit, and residual value, and used the net present value method to conduct a static study on leasing pricing; according to Yang Chunmei [2], the main factors affecting the rental pricing of the leasing formula include the leasing company's discount rate, the purchase price of the leased property by the leasing company, and the rate of return required by the leasing company; the study analyzed the income fluctuation model under the influence of interest rate risk, default risk, and exchange rate change; White Clarke Group published a global leasing report [3] that includes real-time information of the global leasing industry, sorted out the current situation and development of the global mainstream leasing companies, and provided authoritative data of the global leasing industry; Chen Wei Ting and Huang Kuan Cheng [4] proposed that with improvement in asset-liability ratio, financial leasing is conducive to reducing costs by establishing a lease pricing model; based on the cost plus method, combined with the lessor's investment in financial leasing aircraft projects, Wu Guoxiang [5] constructed a lessor's aircraft financial leasing rent pricing model under the condition of dynamic interest rate financing and used the the Monte Carlo method, based on the CIR Interest rate model, to simulate the path of dynamic financing interest rate, discount the initial investment cost, expected profit, risk return, and management expenses of the lessor, as well as calculate the rent under this path, concluding that the Monte Carlo simulation method can be used to theoretically determine the rent price.

The focus of financial lease pricing research has been on option pricing theory. There are challenges in applying the aforementioned methods due to the difficulty in quantifying a company's value. This paper uses a case of financial leasing, adheres to the basic concept of asset pricing model, analyzes the basic elements that affect lease pricing, establishes lease pricing models, and conducts an empirical analysis.

3. Model
3.1. Pricing principle

The lessor owns the leased property, and the lessee pays rent to the lessor on a regular basis. The ownership of the leased property is transferred to the lessee after the lessee pays the rent. From the lessee's perspective, financial leasing is preferred over purchasing, owing to the lessee's own business development strategy and market risk management level. When using a financial lease to procure a leasehold appraisal, it is a requirement of the lessee that the discounted value of the benefit of the leased item is greater than that of the rental income. With financial leasing, the lessee is able to control costs, maintain the stability of cash flow, prevent fluctuations in net profit caused by fluctuations in interest rates, and achieve profit growth. The centralized procurement of leased goods allows for preferential prices, and the bargaining power of

customers can be improved through financial leasing. Financial leasing companies have stronger market risk management level and financing ability with respect to their professionalism.

Leasehold is an investment instrument; the lessee pays the rent on time, and the lessor receives a stable cash flow. The risks faced by the lessor include the lessee's credit default and financial market fluctuations. The lessee's credit risk can be hedged by mortgage or margin. The lessor's lease price includes the follows: the first is principal and interest, in which the principal is the cost of the initial investment, while the interest is generated by the lessor's installment payments; the second is expected profit and risk reward, where the lessor uses the leased property as an investment instrument, with a purpose of obtaining a return on investment and a reward for risk; this means that the lessor obtains a reward for risk based on the lessee's creditworthiness; the third is transaction costs, which include fees incurred, salaries, travel expenses, *etc*.

3.2. Influencing factors of pricing models

On the lessee's side, when calculating the annual rental payment, the size of the expected revenue from the operation of the project may vary to a significant degree among companies of different nature and operating levels. The factors that affect lease pricing are revenue, cost, tax rate, depreciation, *etc*., as shown in **Table 1**.

Table 1. Factors to be considered by lessees when pricing a lease

Factors	Parameters	Meaning
Cost	V_t	Lease cost in period t
Revenue	F_t	Lease revenue in period t
Lease term	n	Lease term
Principal amount	I	Principal amount
Tax rate	π	Tax rate
Rent	H	Rent per period
Residual value	S	Residual value at end of period
Discount rate	i_0	Discount rate
Depreciation period	j	Depreciation period
Depreciation amount	Z_t	Depreciation charged in period t

From the perspective of the lessor, the costs and risks of the financial leasing project need to be considered in the pricing process. The factors that affect pricing are the cost of capital, the cost of risk, the cost of carrying out the project, the term of the lease, and the expected rate of return. The total revenue comes from the rent paid by the lessee in the financial leasing project. The handling fee and deposit are paid in a lump sum, but can be apportioned to the rent of each period. These factors are further discussed in **Table 2**.

Table 2. Factors to be considered by lessors when pricing a lease

Factors	Parameters	Meaning
Cost of risk	R	All risks included
Cost of funds	C	Cost of funds
Purchase cost	u	Price
Rent	H	Rent per period

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Factors	Parameters	Meaning
Lease duration	N	Lease duration
Age of aircraft	Y	Years of use
Down payment percentage	λ	Percentage without financing
Residual value rate	ε	Residual value rate
Depreciation	Z_t	Depreciation per period
Cost of capital	b	Cost of capital
Risk premium	w	Risk premium
Depreciation period	N_0	Depreciation period
Tax rate	π	Tax rate
Discount rate	i_0	Discount rate
Earnings rate	g	Revenue net of cost of capital and cost of risk
Internal rate of return	IRR	Real rate of return

3.3. Model establishment

The determination of rent is a game between the lessor and the lessee to maximize revenue. From the lessee's perspective, financial leasing expands the scale compared to the purchase of equipment, which is more beneficial to the customer's own operations and superior in financing difficulties. From the lessor's perspective, the premise of financial leasing is that the expected recovery will cover the total investment in the project and bring profit. Financial lease pricing considerations include calculating the price of rent distribution and rent based on the lessor's cost, while taking into account of the lessee's risk and the lessor's expected profit; as well as considering the lessee's rental affordability, where the discounted value of the rent should be less than the lessee's additional benefit from the lease.

3.3.1. Pricing models for lessees

The lease price is affected by the rights, obligations, risks, and rental payment method. The rental price can be determined only by setting reasonable trading conditions. The following assumptions are made: (1) the lease contract stipulates that the ownership of the leased property is transferred to the lessee after the payment of the last installment of rent; (2) the lessee has a stable income; (3) the lessor uses leverage lease, the initial investment is raised from the market, and the lessee provides guarantee. The equal principal method is used by the lessor to repay the capital. The rolling loan method is adopted, and the principal and interest repayment method is consistent with the lease contract. The lessee should meet the basic assumptions when using financial leasing; the present value of rent should be less than the profit and tax saving effect of the lessee, which can bring benefits to customers.

When

$$F_t = \frac{F(i_0+1)^n i_0}{(i_0+1)^n - 1}, \quad V_t = \frac{V(i_0+1)^n i_0}{(i_0+1)^n - 1}, \text{ and } \sum_{t=1}^{n} \frac{(1-\pi)(F_t - V_t) + D_t \pi}{(i_0+1)^t} \geq \sum_{t=1}^{n} \frac{H}{(1+i_0)^t},$$

the results are as follows:

$$\sum_{t=1}^{n} \frac{(1-\pi)(F_t - V_t) + D_t \pi}{(i_0+1)^t} \times \frac{(i_0+1)^n i_0}{(i_0+1)^n - 1} \geq H.$$

Therefore,
(1) if depreciation is accrued by the sum of years method,

$$Z_t = \frac{2(1-t+j)}{j(1+j)} \times (I-S);$$

(2) if the straight-line depreciation method is adopted,

$$Z_t = \frac{I(S+1)}{j};$$

(3) if the double declining balance depreciation method is adopted,

$$Z_t = \frac{I}{2} \times \left[\left(1-\frac{2}{j}\right)^{j-3} - S \right]$$

$$Z_t = I \times \left[\left(1-\frac{2}{j}\right)^{t-1} - \left(1-\frac{2}{j}\right)^{t} \right]$$

There are many factors that affect the rental income, such as risk preference and credit rating, so the transaction structure must be designed according to the needs of customers. The risk portfolio management requirements and risk management objectives are achieved using the risk premium to adjust the asset structure.

3.3.2. Pricing models for lessors
Trading conditions may have an impact on the yield. The impact of different trading conditions on the lease offer is analyzed. The following assumptions are made: (1) customers can generate stable cash flow; (2) the principle of profit maximization for lessors; (3) the equal principal method is the rental payment method. Direct leases, which generally use the equal principal method, are considered in this paper. The payment method of rent is postpaid without security deposit.

For the lessor, the present value of the cost recovery is the purchase price of the aircraft less the salvage value and the present value of depreciation. Translating this cost into rent is shown in the following equation:

$$H = \left[u(1-\varepsilon) - \sum_{t=1}^{N} \frac{Z_t \pi}{(i_0+1)^t} \right] \frac{IRR(IRR+1)^n}{(IRR+1)^n - 1},$$

where $\frac{IRR(IRR+1)^n}{(IRR+1)^n - 1}$ is the investment return factor, and $\left[u(1-\varepsilon) - \sum_{t=1}^{N} \frac{Z_t \pi}{(i_0+1)^t} \right]$ is the purchase cost of the machine net of salvage value less the tax credit gain. $IRR = b + w + q$.

When the lessor's return is 0, $IRR = b$.

(1) When $N_0 \leq Y$,

$$H = u(1-\varepsilon)\frac{b(b+1)^n}{(b+1)^n - 1};$$

(2) When $N_0 - N \leq Y \leq N_0$,

$$H = \left[u(1-\varepsilon) - \sum_{t=Y}^{N_0}\frac{Z_t\pi}{(i_0+1)^n}\right]\frac{b(b+1)^n}{(b+1)^n - 1};$$

(3) When $0 \leq Y \leq N_0 - N$,

$$H = \left[u(1-\varepsilon) - \sum_{t=1}^{Y+N}\frac{Z_t\pi}{(i_0+1)^n}\right]\frac{b(b+1)^n}{(b+1)^n - 1}$$

The rent is related to the market power of the lessee and the lessor. Small airlines have weak resistance to market risk and high credit risk, resulting in weak bargaining power and high rents for small airlines and leasing companies; on the other hand, big airlines have an advantage in market share and scale and will hold down rents. In market segment regional aircraft leasing, some leasing companies have a monopoly in the selection of aircraft, fleet planning, and lease term; the rent is the result of negotiations between the two sides.

4. Analysis

Considering macroeconomic and regional economic characteristics, the pricing offset by industry risk premium and regional risk premium, leasing company funding sources, and liquidity risk pricing are not only conducive to the use of price leverage to optimize the asset mix and adjust the asset structure, but also to the achievement of business objectives and risk management.

The pricing model established is used in the empirical analysis. The financial reports published by Shanghai Stock Exchange were compiled to analyze the composition of NH Airlines' fleet and estimate the annual cash flow that a particular aircraft could generate. Subsequently, the data were used in the pricing model for analysis to derive the model's quoted price, and the quoted price was compared with the transaction price of the actual business to verify the reasonableness of the model.

The revenue structure of NH Airlines is shown in **Table 3**.

Table 3. Proportion of income in 2019

Revenue	Amount (M USD)	Proportion
China	16,320.14	68.74%
Europe	2,687.58	11.32%
North America	2,191.37	9.23%
Asia-Pacific	2,542.75	10.71%
Total	23,741.84	100%

In terms of the percentage of aircraft types, NH Airlines' aircraft types are divided into passenger and cargo aircraft. NH Airlines' 2019 fleet composition is shown in **Table 4**.

Table 4. Number of aircrafts in 2019

Model	Self-possession	Financial leasing	Operating lease	Total
380	4	1	0	5
350	0	8	0	8
330	4	29	12	45
320	96	103	116	315
787	4	25	8	37
777	8	21	0	29
737	157	81	163	401
747	2	0	0	2
EMB190	6	0	6	12
ARJ21	1	4	0	5
Total	282	272	305	859

NH Airlines' return on equity (ROE) is shown in **Table 5**.

Table 5. Financial analysis (M USD)

Year	Net profit	Income tax	Shareholders' equity	Depreciation	Interest	EBIDT	ROE
2019	476	150	12,092	2,323	1,138	4,087	3.94%
2018	531	159	12,015	2,077	785	3,552	4.42%
2017	1,051	302	9,554	2,046	169	3,568	11%
2016	906	271	8,415	1,831	892	3,900	10.77%

Abbreviations: EBIDT, earnings before interest and taxes; ROE, return on equity

The data in **Table 5** were taken from the financial statements in NH Airlines' annual reports from 2016–2019. EBIDT, which is an abbreviation for earnings before interest and taxes, is the net income plus interest, depreciation, and corporate income tax for the year. Using EBIDT to determine the company's revenues is more logical than using net income because the airline industry is capital-intensive with high depreciation charges, and NH Airlines has high financial leverage and pays a high amount of interest per year. Adding net income to the current year's depreciation, interest, and income taxes paints a better picture of the airline's profitability.

The aircraft types for European and North American routes are mainly large passenger aircrafts, such as the A350 and B787, and the revenue from this segment is excluded from EBIDT as a percentage of total revenue. Most of the Chinese domestic airlines operate international routes at a loss, and extrapolating the above ratios to estimate the revenue of aircraft other than those flying to Europe and the United States would underestimate the EBIDT. From the financial leasing company's perspective, a deal can be reached if the final pricing rate is within an acceptable range for both parties.

With the exception of European and American routes, the revenue from other routes accounts for 79.45% of the total revenue, and the EBIDT is 18,862.89M USD (18,862.89 $=$ 23,741.84*79.45%). The models that generated this EBIDT and the relevant data are shown in **Table 6**.

Table 6. Number of aircrafts

Model	Number	Seating capacity	Total seats
A330	45	301	13,545
A320	315	177	55,755
B737	401	159	63,759
Total	761	637	13,3059

This short- and medium-haul model has a 79.93% level passenger load factor, and the EBIDT generated is 178.43K USD (178.43K USD $=$ 18,862.89M USD/[13,3059*79.45%]).

The case study is based on Boeing B737. One B737 can generate an annual revenue of 25.09M USD (25.09M USD $=$ 177*18,862.89/13,3059). The above data were matched with the model parameters shown in **Table 7**.

Table 7. NH Airlines' related data

Parameter	Amount (M USD)	Description
$F_0 - V_0$	25.09	Cash flow in period 0
u	76	Boeing 737 price
Z_t	3.8	Depreciation amount
N_0	20	Depreciation period
π	25%	Tax rate
q	6%	Growth rate
i_0	3.80%	Discount rate
ROE	7.53%	Return on net assets

In **Table 7**, the Boeing B737 price is the price of the B737 aircraft purchased by NH Airlines in December 2019, the discount rate is the interest rate of China's three-year treasury bonds, the growth rate is projected according to the level of China's GDP growth, and the return on net assets refers to the average of the last 4 years for NH Airlines.

Following the input of the above data into the established pricing model, it has been found that NH Airlines paid a minimum of 6.12M USD and a maximum of 8.43M USD per year with an IRR between 5.71% and 10.65%.

5. Conclusion

This paper establishes a financial lease pricing model based on the financial lease offer strategy, taking into account the cost of capital, operating capacity, depreciation, residual value, and other factors. The model was empirically validated through a case study of Boeing B737 aircraft lease pricing, concluding that the model can provide a more accurate price floor for financial leasing companies. Based on the established pricing model, once the transaction price floor of the financial leasing company is determined, the financial leasing company can play the price game with the lessee according to the market competition and develop a leasing plan that is more in line with the maximization of revenue based on its own price floor. If there are other parameters that are measured and found to have a greater impact on the lease pricing results in the aircraft leasing case, these parameters can be dealt with by referring to the aforementioned method of establishing the pricing model, so as to further optimize the existing model and better protect the interests of the financial leasing company.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Ding Y, Ge X, 2015, Pricing Model Research on Aircraft Operating Lease. Journal of Xi'an Aeronautical University, 2015(7): 16–22.

[2] Yang CM, Liang CH, Wang ZS, 2015, Innovative Research on Financial Lease Pricing – Portfolio Decomposition Method Based on Complex Real Options. Financial Market, 2015(3): 90–92.

[3] The White Clarke Group, 2017, Global Leasing Report, The White Clarke Group, London, 1–16.

[4] Chen WT, Huang KC, Ardiansyah MN, 2018, A Mathematical Programming Model for Aircraft Leasing Decisions. Journal of Air Transport Management, 69: 15–25.

[5] Wu GX, Zeng XZ, Shen JY, 2019, Research on the Rent Pricing of Aircraft Financial Leasing Based on Monte Carlo Simulation. Journal of East China Jiaotong University, 2019(6): 64–71.