

Fuzzy Comprehensive Decision on Ship Acquiring by Financing Lease and Loaning

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Abstracts: The paper applied the AHP and Fuzzy comprehensive evaluation method from the aspects of ability of assets and liabilities, cash flow, main operating revenue and the capacity of paying interest. Four financial indicators options are employed to compare the two finance models, namely, ship finance lease and loan financing. The finding of the paper is that in a different economic environment, stakeholders should choose a different mode of operation, which could be regarded as a basis for ship financing decisions.

Key words: Ship leasing; Loans in boats purchase; AHP; Fuzzy comprehensive evaluation; Financial Indicators

1 Introduction

With the development of the global economy, maritime trade plays a crucial role in the development. 2008 outbreak of world's economic crisis has brought an unprecedented disaster to shipping trade, which issued a warning to the shipping industry and increased the risk of shipping trade business. The world's major shipping companies are seeking to reduce business risk, and improve the efficiency of fund utilization, then ship finance lease business' is concerned by many shipping companies again.

There are much literature about ships finance's mode and risk and decision. PC Cheng, American financier, published *Shipping Finance Management* in 1979, which studies shipping invest method, risk and decision. R O Goss, marine economist, studied shipping invest model that include many various financial index. Ruiqing Shao, China, published *Decision method of International Shipping Invest* in 2006, which studies international shipping investment environment, risk, decision, evaluation model.

Paper applies AHP^[1](Analytic Hierarchy Process) and Fuzzy comprehensive evaluation method via ability of assets and liabilities, ability of cash income, main operating revenue and capacity to pay interest to compare comprehensive avail of ship finance lease and loan financing.

2 Overview of Ship Financing Business

Ship financing projects generally require more funds, allowing the source of financing can not be a single one. With the gradual development of the ship finance market and innovations of international finance mode, more options to ship finance are provided, which can not only facilitate to solve the problem of money shortage, but also help shipping enterprises to grasp the fleeting market opportunities, to obtain greater profits. Currently, Ship companies have independent ship management options, including loans to purchase boats operating, finance lease operations, Co-operation, etc. In the current new market environment, practice is to use more financial leasing business, loans to purchase boats operating in two ways.

2.1 Loans to purchase boats operating

Loans to purchase boats operating financing is a traditional way in enterprise. Loans to purchase boats operating, is the operators loans to business when they are in a state of lacking of funds, this approach requires ship operators to provide full property to the bank guarantee, at the same time afford high cost of bank interest and long shipbuilding cycles' risk. However, ship owner has held the ownership, while benefit to the value of enterprises.

2.2 Finance lease operations

Ship finance lease is a lessor according to the specific requirements of the lessee or the choice of shipyard, ships lessor purchase ship from shipyards by contribution (contribution to the shipyards), then lease the ship of ownership to a lessor, which is a finance business model by pay rent installment. The ownership of ship belongs to the lessor in the period, when lease expires, pay out rent and the lessee performs fully its obligations under finance lease contract, ownership of a ship is vested to the lessee. In this way, lessee pay rent installments, solve the problem of the lack of vessels.

2.3 Brief comparison between loans to purchase ship operation and finance lease business

Loans to purchase boats operating and finance lease operating have their own characteristics in enterprise value-added growth, committing pressures of funds and debt, facing the business' risk etc.

(1) The growth of enterprise value-added

The ship owner always enjoy the ownership by loans to purchase. Once the ship put into profit and repay the bank loan over, which have the advantage of increasing the value of corporate assets, while expanding the business scale, completing the business transformation fastly, enhance the visibility of corporate strategy.

Finance leases can afford lower debt burden and lower operational risks, and achieve rapid profitability as operating fragmented and flexible business. The lessee performance all rent and legal obligations of the contract will have the ship's ownership; but the financial leasing business needs long-term and stable funds from income to pay rent, while undertake various risks of contractual legal obligations. Once the operation has problem, which will result in termination of the contract, and the lessee faces risk of losing ownership. Therefore, from the perspective of increasing the enterprise value, financial leasing business bears a certain risk.

(2) Funds and debt pressure

Loans to boat operating needs amounts of money. After the era of economic crisis, many shipping companies face shortage of funds, only loans to buy ships. The shipping company will bear the huge pressure and high interest loans, having The ownership of a ship, the shipping company fulfill the obligations of daily repair and maintenance. The incidence of these costs will lead to the outflow of corporate cash, bring enormous financial pressure to the business operations. The period of finance lease is generally more long-term, and even over 15 years. According to the functioning of their own charterer of funds to select the term of lease and adjust the pressure of rent and operating costs. In addition, compared with bank loans, finance leases debt burden is average. Unlike the loan financing companies will not only take the pressure of the first phase of funding, but also in the life of loan to pay the same rent. Determine a reasonable lease to match income to reduce the pressure.

(3) Comparison of operators facing business' risk

Loans to purchase boats operating, production capacity of the ship can be used by themselves or rental. If ship operator have strategic partners in the market, production capacity of the ship is able to be fully utilized, the cash income capability will be greatly enhanced. If transport capacity is insufficient, companies can lease out the ship in the way of operating lease. But no matter how the productivity of the ship be used fully, loans to purchase boat bear a huge pressure of debt and interests. In the leasing business, lessee pay the same rent every year, so rent or debt burden is relatively smaller. However, production capacity of ship leasing business mainly by self-use, rental contract can also have agreed, If the ship production capacity is not fully utilized, will be in vain to pay rent, so the ship chartering business is facing the risk of idle production capacity.

(4) Comparison of operating flexibility

After operator of the ship purchases ship by loans, the ownership of a ship belongs to the ship operator, operators can choose the navigation market by shipping market environment, business model, which have greater operating flexibility. In finance lease, lessee should be conducted in accordance with contract management, to pay rent on time. As the lessee only have the right of using ship without the right to dispose it, not easy to get potential profit opportunities by using the change of market. Therefore, in the lessee's mode of operation finance leases are subject to certain constraints.

As can be seen from the above analysis, finance leases and loans to purchase boats have advantages and disadvantages, enterprise make appropriate choice by their own situation.

3.Loans to Purchase Boats Operating and Finance Lease Business Model of Fuzzy Comprehensive Evaluation

3.1 Establishment of evaluation index system

Different sizes and different operating conditions of the shipping company, when making investment decision from loans to purchase a boat or finance leases, financial indicators play a key role in decision-making. From the enterprise's assets liabilities, cash earning capacity, the main operating revenue growth capacity to pay interest, paper analyze different indicators' suitability under the two different financing models.

Four financial indicators for suitability of financing decision are scored by the experts from shipping companies and financial officers who based on shipping market empirical data.

3.1.1 Ability of assets liabilities

Ability of assets liabilities is that level of enterprises to bear the debt or the ability to repay debt. In the financial analysis, ability of assets liabilities can use the debt ratio to measure. Asset-liability ratio is the ratio of debt to equity a point in time of an enterprise. It is usually the ratio total liabilities of enterprises with total assets at the end of year, which is an important indicator to measure corporate debt levels and the level of risk, The greater the index value, the greater the financial risk. In terms of two financing models, The lower the debt ratio, the more easily is able to obtain large funds from bank, and purchase more vessels to expand business scale and enhance their strategic power, the higher debt ratio, the more difficult to obtain large funds to buy a boat.

Table 1 The Ratio Asset-Liability under Two Different Financing by the Expert Scoring

	asset-liability ratio x				
	<0.1 Almost no debt	0.1-0.3 Low debt ratio	0.3-0.5 Higher liabilities	0.5-0.7 High debt	>0.7 Serious debt
Finance lease	2 points	2 points	1 points	-2 points	-3 points
Loaning purchase	3 points	2 points	-2 points	-3 points	-5 points

3.1.2 Ability of cash flow

Capacity of cash income refers to the ability to obtain cash, the company can use the ratio of inflow and outflow of cash from operating activities to measure the ability of cash income. In terms of financing models, the larger the proportion of cash inflows and outflows, the easier and faster to repay huge loans banks, loans to purchase ships can expand business scale and enhance their strategic power.

Table 2 The Ratio of Cash Inflows and Outflows under Two Different Financing by the Expert Scoring

	Ratio of operating cash inflow and outflow				
	<0.6 Poor ability to obtain cash	0.6-1.0 Less able to obtain cash	1.0-1.1 Preservation	1.1-1.5 Can quickly obtain cash	>1.5 Fast access to cash quickly
Finance lease	-2 point	1 point	2 point	2 point	3 point
Loaning purchase	-5point	-3 point	-2 point	2 point	5 points

3.1.3 Capacity of the main operating revenue growth

The growth of main operating revenue reflect the main business' stage of development, capacity of the main operating revenue growth can use rate of main operating revenue to measure. Main operating revenue growth rate can be used to measure the company's product life cycle, to judge the stage of development of the company. Generally, If the main operating revenue growth is over 10%, which shows that our products in the growth stage, will continue to maintain good growth momentum; If the main business revenue growth of 5% to 10%, which shows our products have entered the stable stage, will enter a recession soon, need to start developing new products; if the ratio is less than 5%, which shows our products have entered a recession, it is very difficult to maintain market share, operating profit began to decline. In terms of two financing models, the greater growth rate of the operating revenue, the ability to hold market share is stronger, more suitable for leasing quickly to seize the market.

Table 3 Growth rate of Main Operating Revenue under the Two Different Financing Methods for Rate of Suitability by Expert Scoring

	growth of main operating revenue			
	<5% Business recession	5%-10% Stable business	10%-20% The market is more suitable for enterprise development	>20% The market is most suitable for enterprise development
Finance lease	1 point	2 point	3 point	5 point
Loaning purchase	-2 point	1 point	2 point	3 point

3.1.4 Capacity to pay interest

Capacity to pay interest refers to the ability to repay debt interest, which can use interest cover ratio to measure. The ratio company EBIT to interest expense, higher multiples, shows the ability of enterprises to pay interest costs is stronger. Creditors usually analyze debt indicator of interest coverage ratio to measure the degree of safety. In terms of two financing models, the greater the interest coverage ratio, the ship to pay high bank interest and rent more quickly, it is more suitable for financial leasing to develop company.

Table 4 Interest Cover

	The interval of Interest coverage ratio z			
	<1 Difficult to pay interest on the profit	1-2 Profits Burden interest	2-5 Profits sufficient to pay interest	>5 Profits to pay interest quickly
Finance lease	-2 point	2 point	3 point	5 point
Loaning purchase	-5 point	-2 point	2 point	3 point

According to suited grade of two ships finance model under the same finance factor, criteria of scoring is shown in the following.

Table 5 Criteria for Scoring

Very suitable	Not suitable for more	Improper	Barely or basic for suitable	More suitable	More for suitable	Very suitable
-5 point	-3 point	-2 point	1 point	2 point	3 point	5 point

3.2 Establishment of evaluation index weights

evaluation index weights are acquired by APH with Questionnaires.

3.2.1 Experts Questionnaires to index financial factors

Using Questionnaires to analyze the importance of each indicator (Assets and liabilities, and cash flow capacity, the main operating revenue growth ability, capacity to pay interest) with each other.

According to many experts Questionnaires' result, the four financial factors are indexed as the following.

C. capacity of the main operating revenue growth> A .ability of assets and liabilities > B. ability of cash flows> D. capacity to pay interest

3.2.2 Comparing scale of financial factors

According to APH^[1] procedure, the comparing scale tabel to index financial factors by importance for selecting financial model is shown in the following.

Table 6 Comparing Scale of Financial Factors

	A	B	C	D
A	1	2	1/2	3
B	1/2	1	1/3	2
C	2	3	1	4
D	1/3	1/2	1/4	1

3.2.3 Judgment matrix^[1] of financial factors' weight

Judgment matrix of financial factors' weight for selecting financial model is designed as the following.

$$G = \begin{pmatrix} 1 & 2 & 1/2 & 3 \\ 1/2 & 1 & 1/3 & 2 \\ 2 & 3 & 1 & 4 \\ 1/3 & 1/2 & 1/4 & 1 \end{pmatrix}$$

3.2.4 Computing financial factors' weight^[1]

Judgment Matrix is executed with conforming columns to 1 and summing up rows, details is shown in the following.

$$G = \begin{pmatrix} 6 / 23 & 4 / 13 & 6 / 25 & 3 / 11 \\ 3 / 23 & 2 / 13 & 4 / 25 & 2 / 11 \\ 12 / 23 & 6 / 13 & 12 / 25 & 4 / 11 \\ 2 / 23 & 1 / 13 & 3 / 25 & 1 / 11 \end{pmatrix} = \begin{pmatrix} 88909 / 82225 \\ 51481 / 82225 \\ 150218 / 82225 \\ 30817 / 82225 \end{pmatrix} = \begin{pmatrix} 0.277 \\ 0.160 \\ 0.467 \\ 0.096 \end{pmatrix}$$

So the weight of four financial factors is acquired as (0.277, 0.160, 0.467, 0.096).

3.3 Establishment of fuzzy comprehensive evaluation model^[1]

Loans to purchase vessels located in the asset-liability ratio, ratio of cash inflows and outflows, the main operating revenue growth, interest coverage ratio under the four financial indicators of value interval variable is the appropriate grade level

X={x1,x2,x3,x4}T, asset-liability ratio, ratio of cash inflows and outflows, the main operating revenue growth, interest coverage ratio for the four financial ship weight financing options for the W ={w1, w2, w3, w4}, Loan to purchase the boat under the conditions of the four financial indicators appropriate level fuzzy comprehensive evaluation function value Td, Td to meet:

$$T_r = W \cdot Y$$

Come to Td and Tr compared boat loans and financing leases purchased four financial indicators in the appropriate level under the conditions of the comprehensive evaluation results.

4. Analyse Results of Comparison

Use loans to purchase boats and two modes of finance leases under the conditions of the four financial indicators for comprehensive rate and extent of experts the weight of the four indicators, makes a comprehensive rating scale for two financing models under the same conditions. Eventually get the comprehensive evaluation results from 400 kinds of combinations under two financial models. From the last comprehensive evaluation results, finance leases is appropriate (suitable) choice in most cases. Only when the asset-liability ratio less than 0.1, cash inflow and outflow rates greater than 1.5, main operating revenue growth rate is between 5% -20%, interest coverage ratio is between 2 and 5, loans to purchase boats is more suitable, this is fit for the shipping industry’s current condition which demand much capital and guarantee the stability of operation in post-crisis era.

Table 7 Sample of Fuzzy Comprehensive Evaluation to Select Financing Mode

Range of asset-liability ratio	range of cash inflows and outflows	range of main revenue growth	range of Interest Coverage ratio	Loaning purchase T _d	Finance lease T _r	Result of Comparison
a	b	c	d	X _{1a} · W ₁ ⁺ X _{2b} · W ₂ ⁺ X _{3c} · W ₃ ⁺ X _{4d} · W ₄	Y _{1a} · W ₁ ⁺ Y _{2b} · W ₂ ⁺ Y _{3c} · W ₃ ⁺ Y _{4d} · W ₄	

5. Conclusion and Outlook

Firstly, Paper comparing the basic characteristics of the finance lease and loan financing models purchased ship, through the assets and liabilities (Balance capacity), and cash earning capacity, the main operating revenue growth capability and capacity to pay interest on the two ships of four financial indicators to rate the appropriateness of financing model analysis, score the appropriate of four financial indicators under two financing model and analysis. Fuzzy comprehensive evaluation method was used to compare and select the four financial indicators under the two financing modes, so as to provide basis for shipping companies making financing decisions. Scoring the importance of four financial indicators according to empirical data of the shipping market and expert survey, comparing the importance of the four indicators mainly rely on expert questionnaire scoring, so this is a gap to the actual market environment, we need to use more market financial data further to do quantitative analysis and confirme. At the same time, the paper mainly demonstrate comparison under the comprehensive evaluation of the two financing modes using financial indicators. However, ship financing and decision-making is a complex process and many factors to be considered, external influences is an important factor can not be ignored while making decisions, these need to be considered fully while making ship finance model in practice.

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