

# Operation Efficiency Analysis of Commercial Hull Insurance Business —— Based on DEA model

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## ABSTRACT

Hull insurance is a kind of Marine insurance, which takes various types of ships as the subject matter of insurance and covers all or part of the losses caused by natural disasters and accidents and the possible liability compensation incurred by them when they are sailing on the sea or berthing in the harbor. A time policy or a voyage policy shall be adopted for Hull insurance. Its characteristic is insurance liability is limited to water only. With the development of economy and the expansion of shipping, China's Hull insurance industry has developed rapidly. However, no one has studied the operating efficiency of China's commercial Hull insurance. This paper analyzes the operating efficiency of Hull insurance through DEA analysis method and puts forward relevant suggestions.

## 1. The Introduction of Hull Insurance

Hull insurance is right ocean-going vessel, with the ship, include its hull, lifeboat, machine, equipment, instrument, rigging, fuel and material are insurance mark, by the underwriter undertakes the loss that the insurance mark suffers natural disaster and accident to wait for cause and charge insurance in whole carriage process<sup>[1]</sup>.

The most important part of Hull insurance is ship inspection. The occurrence of ship survey originates from the development of Hull insurance business. Once the insured ship has a Marine accident within the scope of insurance liability, the insured will claim against the insurer for the losses and expenses arising therefrom in accordance with the provisions of the insurance clause. Damaged person always hopes to be able to get compensation from underwriter place as soon as possible, insurance person satisfies requirement of both sides, make them all

can pay compensation rationally and get compensation, must appoint inspect division to inspect to damage ship to undertake meticulous inspection, in order to safeguard bilateral rights and interests. So that the inspection work is the premise of the insurer to settle claims, is the important basis of settling claims<sup>[2]</sup>. Surveyor's main function is to use skilled professional knowledge, standing on the position of fair, involving ships, cargo insurance mark with natural calamities and accidents, such as the loss or damage caused by the test, put from the technical analysis on happened reason, reasonable to determine the extent of the damage and range, to ask for repair, to test the applicant submit inspection report.

With the development of modern shipbuilding industry technology, the structure of ships is becoming more and more complex, which leads to the gradual expansion of the scope of ship inspection business. Through the supervision and inspection of ships, cargoes, Marine facilities

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and Marine materials, machinery and equipment to make them conform to the provisions and requirements of international conventions, national laws and regulations and rules promulgated and implemented by ship inspection agencies, so as to equip ships with the technical level of ensuring safe navigation and preventing pollution of oceans and rivers<sup>[3]</sup>.

To ensure the safety of ships, Marine installations and personnel and to prevent pollution of the waters. So, ship inspection is the service of Hull insurance, is the technical guarantee of Hull insurance, and directly related to the disaster prevention and loss of the ship. The nature of damage inspection by surveyors is crucial to the economic interests of insurers.

## **2. The Current Situation of China's Hull Insurance**

China's Hull insurance is mainly underwritten by large property insurance companies. The risk of ship insurers is increasing due to the large-scale and high-value of ships. With the development of global shipping market, China's Hull insurance is also facing great challenges.

### **2.1 Shipping Dilemma and Hull Insurance Challenge**

The data show that since the 1990s, the total tonnage and the number of ships of more than 300 gross tons in the world have increased steadily. The rising speed of the total tonnage of ships is much higher than that of the number of ships, and the trend of large-scale ships is more and more obvious. Although shipbuilding presents the trend of large-scale development, the more complex the shipbuilding is, the higher and the value is, which makes the insurer's underwriting risk bigger. Feng Jianhua said that from a global perspective, the average amount of claims per ship is increasing, and the proportion of high-value claims also shows an overall trend of steady increase. In the event of a 20,000 TEU accident, it will be difficult for the existing vessels to deal with the largest loss quickly<sup>[4]</sup>.

The occurrence of major accidents increases the insurance company's compensation risk. According to statistics, the global fleet is showing a trend of rejuvenation in recent years. It can be predicted that bulk carriers under 10 years old will become a common phenomenon in recent years. With the younger global fleet and the advanced shipbuilding technology, the claim frequency of Hull insurance has decreased. However, once an accident occurs, the severity of the loss will rise sharply, which will have a comprehensive and extensive impact on the entire shipping insurance industry, such as the explosion

accident in Tianjin port. IUMI once suggested at last year's annual meeting that ship insurers should pay more attention to the risks of network attack, Ro / Ro ship and passenger ship fire, structural defects of container ships, wrong declaration of container cargo, potential accidents of aircraft damage caused by low-speed navigation, and rescue capacity of extra-large container ship accidents in the next year. It can be seen that the trend of global fleet rejuvenation has not reduced the risk of ship insurer's compensation<sup>[5]</sup>.

On the contrary, in the context of insurers facing more severe test and greater cumulative risk, the premium rate has not been increased. One of the most important reasons is the excess underwriting capacity. From the domestic perspective, due to the continuous low interest rate market and the influx of a large amount of capital into the insurance market, the underwriting capacity will continue to be surplus, which will impact the underwriting conditions and underwriting profits, and the growth of shipping insurance premium rate will also be constrained. The insurance industry is not short of money in terms of the total amount of capital. If too much capital is put in, the whole market will be relatively soft and its bargaining power will be weak. Because there are too many insurance companies and too many subjects, each other has become competitive bidding, even vicious competition. And the situation is hard to change in a short period of time.

### **2.2 Operational Pressure of Hull Insurance Companies**

As far as China's commercial insurance companies are concerned, Hull insurance is not their main item, accounting for only a few percent of their insurance share, so they do not have the demand for consolidation in this regard. At the same time, in China, the merger of insurance companies depends on many factors. First of all, there is no way to merge private and state-owned insurance companies. Secondly, for the state-owned insurance companies, the most important factor is the decision-making at the national level. If the national level has realized that there is vicious competition and should be merged, it will merge like COSCO and COSCO. However, the insurance market is far from being developed to that stage, the contradiction of the insurance industry has not reached the irreconcilable stage, and the vicious competition has not appeared.

From this point of view, the merger and reorganization of the insurance industry has its particularity compared with other industries. However, with the changes in the shipping industry, the large-scale and intelligent ships, and the rapid increase of new risks such as cybercrime, how to improve the underwriting capacity of the insurance

industry and meet the needs of customers is a major problem facing the shipping insurance industry. Therefore, the current Hull insurance industry to innovation is relatively difficult, and the space is not big. Under the influence of the new epidemic situation, the global shipping market will also face greater pressure in the future. How can the insurance companies, as the main business entities, solve these problems become the focus of attention at present<sup>[6]</sup>.

To sum up, this paper analyzes the operational efficiency of 19 major domestic property insurance companies, and analyzes the influencing factors, comprehensively analyzes the problems of Hull insurance operation and puts forward relevant suggestions<sup>[7]</sup>.

### 3. Empirical Analysis

The basic research framework of data envelopment analysis (DEA) method is proposed by chanes, Cooper and rod based on the viewpoint of production efficiency proposed by Ferrell. DEA method can not only measure the effectiveness of DMU, but also point out the reasons and degree of DMU inefficiency. According to the different assumptions of return to scale, DEA model can be divided into C2R model with constant returns to scale and BC2 model with variable returns to scale. Figure 1 shows the basic forms of input-oriented C2R model and BC2 model respectively. Among them, C2R model is used to judge whether DMU is both technology efficient and scale effective, and BC2 model is used to judge whether DMU is technology effective or not<sup>[8]</sup>.

$$\begin{aligned}
 & \min \theta = V\rho \\
 & \left\{ \begin{array}{l}
 \text{s. t. } \sum_{j=1}^n x_j \lambda_j + s^- = \theta x_0 \\
 \sum_{j=1}^n y_j \lambda_j - s^+ = y_0 \\
 \lambda_j \geq 0, j = 1, 2, \dots, n \\
 s^- \geq 0, s^+ \geq 0
 \end{array} \right. \\
 & \left\{ \begin{array}{l}
 \min \theta = V\rho \\
 \text{s. t. } \sum_{j=1}^n x_j \lambda_j + s^- = \theta x_0 \\
 \sum_{j=1}^n y_j \lambda_j - s^+ = y_0 \\
 \sum_{j=1}^n \lambda_j = 1 \\
 s^- \geq 0, s^+ \geq 0, \lambda_j \geq 0, j = 1, 2, \dots, n
 \end{array} \right.
 \end{aligned}$$

**Figure 1.** Basic forms of input-oriented C2R model and BC2 model respectively

In this paper, DEA Data Envelopment method and deap2.1 software are used to analyze the efficiency of property insurance companies in Hull insurance. The selected decision-making units are: seven major property insurance companies operating Hull insurance in 2018. After comparative analysis, the input indicators and out-

put indicators are selected as Table 1.

**Table 1.** The input indicators and output indicator

Index type	Index name	Unit
Decision making units	Seven insurance companies	
	Financial capital	Million yuan
Input indicators	Operating expenses	Million yuan
	Human resources	Ten thousand
Output indicators	The premium income	Million yuan
	Pay for spending	Million yuan

According to the selected indicators, DEAP2.1 software is used to calculate, and Table 2 shows the operation efficiency of property insurance and the state of return on scale of each insurance company in the sample year.

**Table 2.** The operation efficiency of property insurance and the state of return on scale

firm	crste	vrste	scale	
PICC <sup>1</sup>	1	1	1	-
CLIC <sup>2</sup>	1	1	1	-
CTL <sup>3</sup>	0.977	1	0.977	drs
PAIC <sup>4</sup>	1	1	1	-
SSIG <sup>5</sup>	0.967	1	0.967	drs
DIC <sup>6</sup>	0.456	0.468	0.974	irs
COSCO <sup>7</sup>	1	1	1	-
mean	0.899	0.939	0.957	

**Note:** 1. Property and Casualty Company Limited; 2. China Life Insurance (Group) Company; 3. China Taiping Life Insurance Co., Ltd; 4. PING AN INSURANCE (GROUP) COMPANY OF CHINA, LTD; 5. Sunshine Insurance Group; 6. DongHai Insurance Company; 7. COSCO SHIP-PING GAPTIVE INSURANCE CO.,LTD

Most of the insurance companies have increased their business efficiency, but the results show that the operation efficiency of some insurance companies is still poor. According to the results of the empirical analysis, I put forward several suggestions on the operation of Hull insurance by insurance companies.

## 4. Development Countermeasures and Suggestions

### 4.1 In Line with the National Development Strategy

One belt, one road strategy, one belt, one road, will be adopted to promote the investment and trade facilitation

in China. The construction of Shanghai international financial center, international shipping center and shipping insurance center will provide significant assistance for the development of China's shipping insurance industry. In addition, according to the statistics of International Hull insurance Union (IUMI), China is now the world's largest Hull insurance market and the world's second largest cargo insurance market. As the guarantee of shipping industry, the development prospect of Hull insurance in China is still very promising. Therefore, in spite of the heavy pressure on the current Hull insurance market, we are still glad to see that many insurance companies have started to set foot in Hull insurance such as ships and shipping. We hope that with the help of a series of national policies, we can lay out ahead of time and wait for a good opportunity.

#### **4.2 Broaden Information Channels and Establish Data Sharing Platform**

Insurance companies should keep close contact with relevant departments. Through strengthening cooperation with banks, we can understand the credit rating and capital operation of customers. Through the communication with the maritime management department, understand the customer's enterprise safety management and ship maintenance. Improve the anti-fraud law enforcement cooperation mechanism with government departments to crack down on insurance fraud. Through the communication with various functional departments, strengthen customer information management, in order to strengthen the risk control of Hull insurance business, and build a good and harmonious market environment of Hull insurance business.

Insurance companies should also strengthen communication and cooperation among the same industry and establish information sharing mechanism. Insurance companies should be both competitors and partners. The competition lies in their respective service level, claim settlement skills and professional level, while the cooperation lies in the common management and control of information exchange, resource sharing and underwriting risk. For the Hull insurance business with higher insurance amount and higher risk, CO insurance can also be carried out among the same trade. We can try to take the lead of the industry association to establish a Hull insurance data platform, improve the regional Hull insurance claims file, for the reference of the insurance subject in the rate formulation and underwriting plan.

#### **4.3 Increase Personnel Training, Take the Road of Team Monopoly**

In order to build a qualified ship management team, the

insurance company should not only recruit high-quality ship professionals from outside, but also strengthen the internal personnel training. By means of expert lectures, regular training, etc., and in the form of going out and inviting in, the professional skills training covering the whole process of Hull insurance business is provided for employees with multi-dimensional, differentiated, targeted and covering the whole process of Hull insurance business, so as to enhance the market adaptability and improve the practical level. In addition, it can also help grass-roots companies to solve business problems and promote the improvement of the overall quality of the ship employees of grass-roots companies by means of talent exchange of branch companies and the establishment of Hull insurance expert groups.

With the progress of science and technology and the need of maritime trade and transportation, today's ships have developed to large-scale specialization. The original small transport ships with small technology content and extensive management have gradually faded out of the market. With the development of maritime transportation, the professional and technical requirements of Hull insurance operators are higher and higher. Therefore, it is not suitable for the development of Hull insurance to develop individual business in a decentralized way. It is necessary to have a professional team with rich experience and proficient business. Insurance companies can try to form a professional Hull insurance team in various provinces and cities to implement the centralized operation of Hull insurance business in the whole city. Through centralized operation, one is to concentrate the limited strength of Hull insurance industry, make the most of the existing professional talents, and realize the effective integration of talent resources. Second, it can improve the ability of information management. After the implementation of specialized management and franchise, through the data analysis of all the insured ships of the company, the risk assessment can be carried out effectively, and the underwriting scheme can be formulated more scientifically and reasonably. Third, it can effectively solve internal friction, put an end to the phenomenon of competing for business within the system, form a joint force internally, reduce the loss of resources, and establish a good image of insurance companies externally.

#### **4.4 Develop New Types of Insurance to Meet Diversified Market Demands**

In order to get closer to the market and enhance the development potential of Hull insurance business, insurance operators should speed up the renewal and transformation of Hull insurance products. The product

transformation should focus on the main line of customer-centered work and effectively combine with the market reality to adjust and update the relevant product rate rules and terms, so as to further improve the traditional Hull insurance product market. On the basis of attractiveness, it can effectively meet the various needs of customers. For example, in view of the rapid development of Zhoushan's tourism industry, we should timely promote yacht insurance, appropriately expand the insurance liability of shipbuilding insurance in view of the increasing number of marine construction projects, and add oil pollution liability insurance to coastal inland river Hull insurance, and additional tugboat towing liability insurance for coastal inland river ships, which are marketable and well received by shipowners in the market. In order to sell products, we should speed up the pace of renewal and reform, stimulate the market through the promotion and development of new products, and increase the power of the development of Hull insurance business.

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