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Diversification Business Performance Evaluation of Shipping Industry in China

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ABSTRACT

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International trade is the economic key of a nation, and shipping is an inevitable factor in international trade that shipping industry presents a critical role in international trade. The diversification development of shipping companies is related to the success of a shipping company, which connects shipping service for one-stop service to reveal the importance of shipping diversification. Moreover, global shipping market is closely related to global economy. Under the globalization of international trade, the correlation between China economy and global economy is worth discussion. For this reason, it is necessary to discuss the diversification business performance of shipping industry in China.

DEA is applied in this study to evaluate diversification business performance of shipping industry in China. With the calculation of Modified Delphi Method, inputs/outputs which could measure diversification business performance of shipping industry in China are selected. The efficiency evaluation results, through DEA, show that 1 DMU presents strong business efficiency, 4 DMUs are marginal inefficient, with the business efficiency in 0.9-1, and 5 DMUs are obvious inefficient, with the diversification business efficiency lower than 0.9. From Slack Variable Analysis, the excessive shipping companies in China and the improvement direction for short inputs are realized. Finally, suggestions, according to the results, are proposed, expecting that a shipping business could spread the risk of single industry operation through proper diversification and improve the operation performance.

ADDITIONAL INDEX WORDS: *Shipping industry, diversification, business performance, performance evaluation.*

INTRODUCTION

International trade has long been the economic key of a nation, and shipping is an inevitable element in international trade that shipping industry plays a critical role in international trade. Since goods in global trade are delivered through shipping that the prosperity of shipping industry could reflect global economic cycle. Advanced countries extremely emphasize the development of shipping industry. In addition to the consideration of economic factors, the number of merchant ships of a nation also stands for the national power. Shipping industry, as a traditional industry, is getting high obstacle, low technology substitutability, and long product lifecycle, and the profits of an enterprise is largely affected by the economy. The upstream/downstream industries covered in shipping industry are broad, e.g. customs brokers, insurance industry, forwarders, transportation industry, storage industry, container freight industry, and shipbuilding industry. The boom of shipping industry therefor is related to the economic development of a nation. The rise of Mainland China in past year has attracted a lot of resources being invested in China market to make China a primary role in international economy. Economy in China therefore shows certain correlations with the shipping market in international trade (Del Carmen Martinez-Valenzuela *et al.*, 2017; Koneri and Nangoy, 2017; Mahmoud *et al.*, 2018; Singh *et al.*, 2017).

The business of a shipping company is greatly affected by international economy. A lot of large shipping companies, due to low freight market, could not support the recurrent expenses of ships with the revenue and suspend the ships. Similar to real estate, ship owners would adopt high-ratio financing from banks and financial institutions. When shipping is in a slump, the reduced freight income could not pay the interests for banks. Besides, the value of ships is largely reduced that the margin call for collateral from banks would result in ship owners' financial strait to declare the bankruptcy (Duan *et al.*, 2018; Liu and Liu, 2010). The diversification development of shipping companies is related to the business. Most of them have extra investment in the vertically integrated industries of container industry, e.g. ships, containers, logistics industry,

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forwarder or shipping agency, inland fleet, container freight station, and dock infrastructure to connect the entire shipping service for one-stop service. It reveals the importance of shipping diversification. Furthermore, global shipping market is closely related to global economy that, under the globalization of international trade, the correlation between China economy and global economy are worth discussion. Consequently, the discussion of diversification business performance of shipping industry in China in this study is essential.

LITERATURE REVIEW

Diversification

Research on diversification first appeared in 1957, when H.I. Ansoff proposed diversification strategy in Harvard Business Review. A lot of companies in the UK and the USA broadly expanded to different product markets in 1950-1980, and the peak of diversification development appeared in 1970 (Cao *et al.*, 2017). Fuentes and Adelaida (2015) defined diversification from the aspect of an enterprise making changes for developing new products and coping with market needs that diversification was the method of enterprise growth, e.g. extending to new markets for the development of new products and process as well as satisfying customers' new needs. Ahn and Min (2014) referred diversification as a company getting into core industry or new industry beyond the original industry to make profits by producing and selling new products (Hinterhuber and Liozu, 2014). Chen and Riordan (2013) defined the state of a company at distinct business operation with business line, rather than industries to avoid difficult definition of industry line. An enterprise would implement the diversification strategy when operating in diverse industries or markets (Komini, 2016). Chang and Hung (2013) pointed out four basic methods, four major strategies in a matrix, for an enterprise attempting to increase revenue or profits or getting into new industry. (1) Market penetration required to enhance the market share of existing products in current markets (Tran and Haasis, 2015). (2) Market expansion required the identification of new customers to existing products. (3) Product expansion required the development of new products, aiming at existing customers. (4) Diversification strategy required the development of new products, aiming at new markets. Chen *et al.* (2014) regarded diversification strategy as a high-growth strategy, along with which there were high risks that careful planning and analyses were necessary for developing diversification strategy. It was considered that diversification was a particularly important development strategy to request an organization breaking through past models and tradition. To get into a new and unknown market, new skills, technology, and resources were necessary (Schumann *et al.*, 2014).

Diversification Risks and Performance in Shipping Industry

Kuo (2017) studied potential users of inland container freight stations, including shipping companies, shipping agency, shipping forwarders, and logistics companies, and discovered that diversification business would improve the competitiveness, service quality, and performance of enterprises. Akman (2015) pointed out low correlations between newly developed businesses with complex diversification and existing businesses of enterprises that the application of diversification development strategy aimed to improve the profitability and operational flexibility of an enterprise. Deb *et al.* (2016) referred diversification as a company getting into core industry or new industry beyond the original industry to make profits by producing and selling new products. A company staying in an industry was difficult to maintain successful business models and strategies along with time change, due to the changing environmental conditions. Zelenyuk (2015) stated that technology advance or customer need changes accompanied with the development of science and technology would change the production methods and appear risks. Major technology changes could appear in an industry, e.g. generation of containerization. Resources sharing and ability: One or more business units in a company would effectively collect, share, and utilize expensive resources or abilities to save costs or differentiate advantages. Gul *et al.* (2016) indicated that the technology advantage of an enterprise lied in the internal properties similar to public goods. In sum, internalization theory explained that an enterprise could enhance control ability, increase market power, avoid uncertainties of knowledge transfer among organizations, and reduce unnecessary transaction risks to acquire maximum profits (Wu and Lin, 2015). Chellappan *et al.* (2017) mentioned that getting into a new domain might result in disappearing value of an enterprise. Such disappearing of value might be larger than other strategic decisions. Nevertheless, diversification could release a company from single industry and provide opportunities for new growth. Kang *et al.* (2015) indicated that, in the more competitive liner shipping industry, shipping companies could create synergy and diversification related to economics of scale through diversification business to reduce costs and achieve unrelated diversification of economic risk spreading and financial resources (Wang and Peng, 2015). Cao and Dehmer (2015) evaluated potential users of inland container freight station, including shipping companies, shipping agency, shipping forwarders, and logistics companies, and discovered that diversification business could improve the competitiveness, service quality, and performance of enterprises. Dorotic *et al.* (2014) pointed out user satisfaction with following functions of diversification business, covering being able to help businesses provide customers with more convenient service, provide multi-service, enhance competitiveness, offer larger service flexibility, enhance customers service quality, promote customer satisfaction, and provide one-stop service. Meng (2014) studied the diversification business programs of shipping agency in Taiwan and considered that the transformation strategy of diversification business could be classified into product transformation, business model transformation, technology transformation, and market transformation (Wang, 2014).

Data Envelopment Method

Ng (2015) stated that Data Envelopment Method was an efficiency evaluation mathematical model developed by Charnes *et al.* in 1978, which substituted common default functions with non-default production functions to estimate efficiency and calculated efficiency frontier curve with mathematical programming model. The actual outputs were compared with the original production function, as the efficiency. Envelopment was the theoretical basis of DEA, which was established based

on Pareto Optimality proposed by Pareto, an Italian economist, in 1972. It defined that "no one could enhance the profit without damaging others' benefits". DEA is an efficiency model without taking weight-setting multi-output to multi-input into account, compares the quantitative results of all DMUs to select DMUs with better performance, and then draws a curve with all efficient DMUs, which is the efficiency frontier. The relative efficiency is acquired by calculating the distance between individual DMU observed value and efficiency envelope. In short, DEA is a relative indicator to measure the efficiency of various organizations through linear programming, according to the efficiency boundary constructed with actual observed value, and regarding the gap between individual observed value and efficiency boundary as the relative inefficiency.

RESEARCH DESIGN

DEA is applied in this study to evaluate diversification business performance of shipping industry in China. Appropriate inputs/outputs should be selected to efficiently evaluate the system performance of DMUs. In order to combine the selection of inputs/outputs with expert opinions, reduce input costs, and avoid fuzziness in the survey process, Modified Delphi Method is used for selecting inputs and outputs. Total 30 copies of questionnaire are distributed, and 24 valid copies are retrieved, with the retrieval rate 80%. Researchers indicated that public opinions with more than 5 participants could be the analysis reference. Besides, the interviewed experts in this study cover industry, official, and academia, with frequent interaction with diversification business evaluation of shipping industry that it should present certain representativeness.

After the computing with Modified Delphi Method, the geometric mean is used as the consensus of experts' evaluation of inputs/outputs, and the median of the evaluated inputs/outputs is used as the selection standard to select inputs/outputs which could measure diversification business performance of shipping industry in China. Total 4 input/output variables are selected, and, with strict selection, 13 shipping companies in listed A shares are taken as the samples.

The variable data used in this study are acquired from public prospectus and annual reports.

Definition of Variable

(1) Input Variable

a. Number of employees: Total number of employees; b. Operation cost: Expenses invested in the diversification business of shipping industry; c. Diversification degree: Number of relevant diversification investment.

(2) Output Variable

Net operating revenue: Net operating revenue-sales return and allowance.

EMPIRICAL ANALYSIS OF CUSTOMER RELATIONSHIP MANAGEMENT EFFICIENCY

Analysis of Diversification Business Efficiency of Shipping Industry in China

The efficiency evaluation results with DEA could help understand the efficiency of diversification business of shipping industry in China. Efficiency=1 stands for a DMU achieving relative efficiency; while efficiency<1 refers to the DMU being relatively inefficient. Empirical results, Table 1, show that 1 shipping company in China, with efficiency=1, is relatively efficient, revealing the ideal diversification business of the shipping company in China. The rest shipping companies in China are relatively inefficient in the diversification business.

Table 1. *Relative efficiency of shipping companies in China.*

Shipping Company	Overall Efficiency	Pure Technical Efficiency	Scale Efficiency
Phoenix	0.75	0.76	0.75
Hainan Strait Shipping	0.82	0.82	0.81
China Shipping Development	0.85	0.85	0.84
Zhang You	0.78	0.77	0.79
Cosco Shipping	0.91	0.91	0.91
Yatong Company	0.98	0.98	0.97
Tianjin Shipping	0.90	0.90	0.90
Ningbo Shipping	0.84	0.83	0.85
Hainan Haisheng Shipping	0.82	0.80	0.84
China Shipping Container Lines	0.96	0.95	0.96
China Merchants Energy Shipping	0.86	0.85	0.86
China Cosco Shipping	0.72	0.73	0.71
Bohai Ferry	1.00	1.00	1.00

Slack Variable Analysis

Regarding the analysis of returns to scale, Table 2, 1 shipping company in China appears fixed returns to scale, with the diversification business efficiency achieving the optimal. The rest 12 shipping companies in China show increasing returns to scale, revealing that the efficiency could be promoted by expanding the scale to enhance the marginal returns.

In terms of Slack Variable Analysis, the excessive shipping companies in China and the improvement direction for short inputs are shown in Table 2. A business could achieve efficient management by reducing inputs from items with excessive inputs and increasing inputs to items with short inputs.

Table 2. *Relative efficiency of shipping companies in China.*

Decision-making Unit (DMU)	Improvable Value of Input			Improvable Value of Output	Returns to Scale
	Number of Employees	Operation Cost	Diversification Degree	Operating Revenue	
Phoenix	-2	-3	-3	-1	IRS
Hainan Strait Shipping	0	-3	0	0	IRS
China Shipping Development	0	-1	-2	0	IRS
Zhang You	-1	-1	-1	0	IRS
Cosco Shipping	0	0	0	-2	IRS
Yatong Company	-1	0	0	0	IRS
Tianjin Shipping	0	-2	0	0	IRS
Ningbo Shipping	-2	0	-1	0	IRS
Hainan Haisheng Shipping	-3	-2	0	-2	IRS
China Shipping Container Lines	0	-1	-1	0	IRS
China Merchants Energy Shipping	-2	0	0	-2	IRS
China Cosco Shipping	-2	-2	-6	-3	IRS
Bohai Ferry	0	0	0	0	CRS

Data source: *Organized in this study.*

CONCLUSIONS

Researchers further classified DMUs into strong efficiency, marginal efficiency, marginal inefficient, and obvious inefficient, where strong efficiency referred to efficiency=1 and slack variable=0, implying huge intensity exceeding inefficient DMUs. Such units could remain the efficiency unless there were major changes in inputs/outputs. Marginal efficiency referred to efficiency=1 but at least one slack variable not being 0. Such units would reduce the efficiency below 1 by increasing inputs or reducing outputs. Marginal inefficient referred to efficiency being in 0.9-1 which could be easily enhanced to 1. Efficiency<0.9 was regarded as obvious inefficiency. Such units could hardly become efficient in short time. Units with efficiency<0.75 would remain inefficient unless there were major changes in inputs/outputs.

The efficiency acquired with DEA and the information of variables are classified in Table 1. It shows that 1 DMU, about 8% of all DMUs, presents strong business efficiency, with the efficiency=1, showing the better relative diversification business efficiency. Four DMUs, about 31% of all DMUs, are marginal inefficient, with business efficiency in 0.9-1, showing the relative diversification business efficiency could be more easily enhanced. Five DMUs, about 38% of all DMUs, present obvious inefficiency, with the diversification business efficiency lower than 0.9, where China Cosco Shipping appears the lowest diversification business efficiency 0.72.

DISCUSSION

The DEA results reveal that Bohai Ferry is the shipping company in China with the most diversification business efficiency. Bohai Ferry establishes the large-scale passenger-transport fleet in Bohai Bay, eliminates 10 old passenger-transport ships, and builds 10 new-style luxury passenger-transport ships. The passenger-transport ship quantity, transportation capability, and modernization are ranked on the top in Asia. The carrying capacity, comfort, technology advance, and safety of ships are leading in Asia. Besides, it first completes the optimization of capacity structure to win the development opportunity. Bohai Ferry applies diversification to integrate advantageous resources, takes passenger-transport businesses as the basis, and drives with international cruise industry and international passenger businesses to create the large-scale comprehensive group. In the diversification development, Bohai Ferry Group interferes in the upstream and downstream transportation services step by step to constantly move the businesses forward, fulfill the integrated operation in transportation, and promote the comprehensive competitiveness.

SUGGESTION

According to the research results, suggestions aiming to the diversification business of shipping industry are proposed as following.

(1) Shipping businesses are suggested to slightly adjust the investment strategies. A shipping company, when not intending to expand diversification investment, could concentrate the investment on certain industry, e.g. fleet, pier, and logistics, to reinforce the competitiveness.

(2) The function of shipping businesses is to attract customers with low transportation costs. Since shipping businesses show highly homogeneous service, the industrial chain could be integrated through diversification to establish freight structure with better offer than competitors to deliver goods to the destinations or devote to differentiation service to enhance the competitiveness.

(3) A shipping business could stabilize the stable share and expand the market with diversification. Meanwhile, it could

benefit the promotion of resource optimization distribution. The industrial chain with complementary advantages among companies could be integrated with diversification to form the shipping group advantages and develop the comprehensive function, realize economics of scale, and better develop the advantages. Furthermore, the core competitiveness of shipping businesses could be enhanced to synchronously enhance the international market competitiveness.

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