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XYZ shipping company's development strategies based on the analysis of Brazil-China iron ore shipping market

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XYZ shipping company's development strategies based on the analysis of Brazil-China iron ore shipping market

By

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A research paper submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

INTERNATIONAL TRANSPORT AND LOGISTICS

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of Dissertation: **XYZ shipping company's development strategies based on the analysis of Brazil-China iron ore shipping market**

Degree: **Master of Science in International Transport and Logistics**

Abstract: Iron ore is one of the most important resources for a county and it is mainly transported by sea. With the rapid and continuous development of China national economy, China import demand for iron ore remains a stable growth. Though the growth rate in 2008 was decreased due to the impact of the global financial and economic crisis, China is still the largest iron ore import country in the world. Brazil, due to its high quality, is becoming an important iron ore export nation, and furthermore, the mutual demand on iron ore trade between the two countries has attracted an increasingly attention from many shipping companies and steel production companies as well.

The paper, beginning with the status quo of the Sino-Brazilian iron ore trade, combines the analysis of Brazil-China iron ore shipping market on both supply and demand side by supply-demand balance model to discuss and investigate the demand of iron ore maritime transport and explain the reason why the BCI index dropped sharply in such a short period. There follows the detail analysis of the fleet of A company, and some economic index will be calculated by economic assessment model to optimize the construction of the ship fleet. Finally, based on the analysis of the Brazil-China iron ore shipping market, the paper will give some practical measures that A company should take for their reference to minimize the loss caused by the global financial and economic crisis.

KEYWORDS: Brazil-China iron ore shipping market, supply-demand balance model, economic assessment model, optimum ship type

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LIST OF ABBREVIATION

BCI	Baltic Capesize Index
RFR	Required freight rate
PBP	Payback period
NPV	Net present value
COSOC	China Ocean Shipping Corporation
MDWT	Millions deadweight tons

CHARPTER 1 INTRODUCTION

1.1 Background and significance

Since China's reform and opening to the outside world, the annual steel output volume in China has grown sharply from 31.78 million tons in 1978 to 502 million tons in 2008, accounting for 38% of the world total, which enable China to be the first country in the world to produce more than 500 million tons of steel in one year. Particularly from 2003 to 2005, China's steel output volume grew up at a high speed with an annual growth rate of 21.9%, 22.7% and 26.8% respectively. Accordingly, with rapid development of China's economy, the domestic steel production enterprises are more and more rely on the international iron ore resources. In 2004, China's iron ore import volume has reached 208 million tons, which is three times bigger than that in 2000, and at that year, China surpassed Japan and became the largest iron ore import country in the world. In 2008, China's iron ore import volume has exceeded 440 million tons, accounting 50% of the world total iron ore export volume.

Generally speaking, though the iron ore resources in China are relatively abundant, the iron content is relatively low, and the average personal status (the Fe_3O_4 content) is only 33%. In China, the lean ore is abundant, but the rich ore is rare, and many iron ore mines are small and medium-size and the distribution of the mines are uneven which make it more difficult and costly to exploit and make use of. The domestic iron ore resources are far from enough to meet the current demand of steel production in China. Comparatively speaking, the international iron ore resources are abundant and

most of them are rich ore which contain high level of iron that is easier to be smelted and the distribution of iron ore mines are more concentrated that facilitates large-scale exploitation. Therefore, importing iron ore from the international market has become an inevitable choice for China to meet the high level of iron ore consumption. Known as the “global magnet”, China is now the world largest buyer in the international iron ore market and will continue to play a leading role in the global steel industry. China imports iron ore mainly from Australia, Brazil and India. In 2008, China imported more than 374.8 million tons of iron ore from these three countries, accounting for 85% of the total import volume. China’s huge amount of iron ore import since 2004 has forcefully brought about a sharp rise of the dry bulk freight rate. At that time, the period rate of Capesize dry bulk vessel has reached its peak. The period rate of A Capesize vessel named HUANGSHAN (175775 dwt) sailing from Brazil to China was around 120 thousand dollar per day. But in 2008 the situation is totally different due to the global economic and financial crisis. It leads the dry bulk shipping market to drop from the peak to a valley. In December 2008, global steel production was reported by the World Steel Association to have reached just 84.4 million tons: down by 1.2% compare with the previous year and meaning that global iron ore maritime transport demand shrunk tremendously. Additionally, Capesize Fleets, main ship type undertakes iron ore transport, have been seriously oversupplied since 2007. These two reasons made the BCI index drop all the way from 19687 points to 830 points within just 6 months. There emerges a phenomenon that many Capesize vessels can hardly find cargo to transport and even some ship owner drop the period rate to 1000 dollars per day.

During the prosperous period, the demand is so strong that many shipping company use irrational ship type or low condition vessel to undertake the transports task, but it still earn money since the freight rate is high. When it comes to depression in shipping market, the shipping company has to consider readjust and optimize the structure of their fleet, eliminate, or sale old low-condition vessel in order to maximize the profit or even reduce the loss to a minimum level. Therefore, standing on the side of the

shipping company, under such recessionary circumstance, how to rationally adjust the management strategy and select a right size vessel to sail a specific line is now becoming an important issue for many dry bulk shipping company to concern in order to survive during this tough period.

1.2 Research purpose

The main purpose of this paper is to conduct a research on Brazil-China iron ore shipping market based on a deep market analysis of the supply and demand and to make a scientific decision on the ship type selection by using economic assessment model in order to put forward some practical measures to help XYZ shipping company get over the tough period.

1.3 Research Methodology

The author has conduct a comprehensive survey on Brazil-China iron ore shipping market and collected a large number of important data such as global iron ore trading volume, import volume in China and Sino-Brazilian iron trading volume in the near 5 years from the internet and some related statistic reports.

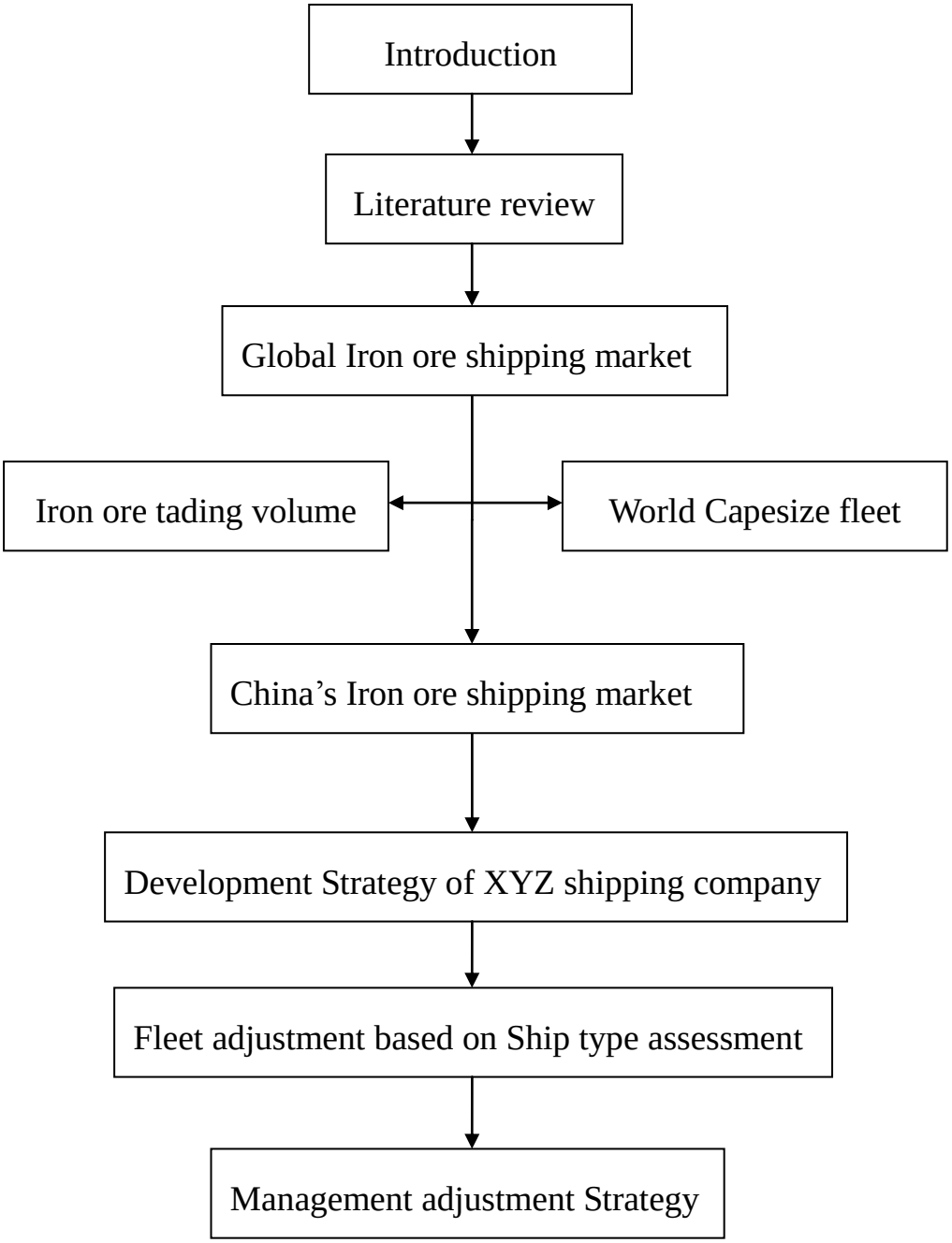
The dissertation applies the supply-demand balance model and the economic assessment model. The supply-demand balance model is based on the principle of the supply and demand and combines some unique characteristics of shipping market, and the economic assessment model is used to select the ship styles. The Both qualitative and quantitative analyses have been applied in the dissertation to conduct a research on the Brazil-China iron ore shipping market and the selection of the ship type.

1.4 Framework and content of this dissertation

In the dissertation, Chapter 1 is the introduction to the paper, the author introduced the

background of China's iron ore shipping market and explain the significance the iron ore import to china. Chapter 2 is the literature review in which the author listed some current study on the dry bulk market analysis and some theoretical models applied in selecting the ship type. In Chapter 3, the author made a general introduction on the international iron ore market, especially the Brazil-China iron ore trading market and then conduct a market analysis of Brazil-China iron ore shipping market from the angle of vessel supply and demand of maritime transport by using supply-demand balance model. In Chapter 4, the author will have a brief introduction of XYZ shipping company and its fleet, and find out the existing problem that the company is confronted with. In Chapter 5, a scientific decision on the fleet structure adjustment is made by analyze each vessel's economic index using economic assessment model, and the author will give some practical suggestions according to the market analysis and the report of vessel assessment to the company for their reference. The following figure is the framework of the paper.

Figure 1-1 Framework of the paper



CHARPTER 2 LITERATURE REVIEW

2.1 Current research on the dry bulk market

As an important component of the world shipping market, the international dry bulk shipping market has always been focused and studied by colleges, institutions and even government sectors. And scholars and experts from home and aboard have done a large number of researches on the international dry bulk shipping market.

In the early 1930s, Tinbergen (1931) established an equation model of the freight rate market:

$$F(t) = -rK(t)$$

$$DK(t) = Q(t-u)$$

$$Q(t-u) = lF(t-u)$$

Differentiate the equation we will get:

$$DK(t) = -\alpha K(t-u)$$

In his model he defined $F(t)$ is the freight rate, and $K(t)$ is the size of the fleet at time t, and Q is the fleet in orders, and $(t-u)$ means the lag effect. In this model, Tinbergen (1931) assumed that demand is exogenous and equal to supply, which is affected by the fleet size, bunker prices, and the freight rate.

Standenes (1984) conducted a research on the relationship between time charter rates and second-hand ship prices. In her model, the time charter rate at time *t* is determined by two measures: short term time charter equivalent and expected long term time charter equivalent. In her research, she explored the relationship between ship prices and short and long profits

In the early 1990s Michael Beenstock and Andreas Vergottis published a series of papers in integrated econometric model of the tanker and dry cargo markets. Beenstock and Vergottis (1993b) successfully applied the past econometric model in this area and published *Econometric Modeling of World Shipping* that heavily influenced the modern analysis of the dry bulk shipping market. In their study, they provided an excellent structural econometric model of the tanker and dry cargo freight market. Beenstock and Vergottis (1993b, p. 73) showed that the implied elasticities derived from the model are 0.94 for fleet size, 0.23 for bunker prices, and 0.59 for freight rates, which means that fleet size is proportional to demand and demand itself is inelastic with respect to freight rates and bunker costs.

In china, Zhang lin-hong and Chen Jia-yuan (2001) in *Study on fright index forecasting of international shipping market* put forward the use of market integrated factor and shipping supply to forecast the Baltic Freight Index (BFI). They use the curve imitation method in software are of MATLAB and making use of curing imitation computer program of FORTRAN language to brings up a new method for freight index forecasting mathematical model of the shipping market.

Zhang lan-fang (2005) in *Analysis of international dry-bulk shipping market* emphasized on the analysis of ship scale, ship age, and factors affecting supply and set up ARCH model to precisely modulates the BFI, and conducted a short-term prediction with tiny error has been made with Eviews

Zhang chen (2006) in *Study on china Factor in International Dry Bulk Transportation Market* analyzed china factors that affecting the demand of shipping market in quantitative method by adopting grey relational analysis model into the major bulks to show the growing impacts of china on the dry bulk shipping market.

2.2 The model applied in ship selection

Veenstra (1999) provided a convergence of these themes and re-examined the term structure relationship between spot and time charter and voyage rates by using vector

autoregressive (VAR) model. In his model, the market is assumed to be efficient, and there is a definite link between the time charter and voyage rates.

Veenstra(1999,p. 202) expressed his model as:

$$S_t = \frac{1}{1-\delta^n} \sum_{i=1}^{n} \delta^i E_t \Delta sp_{t+i} + \lambda$$

Manolis G. Kavussanos, Amir H. Alizadeh-M (2001) in *Seasonality patterns in dry bulk shipping spot and time charter freight rates* investigates the nature of seasonality in dry bulk freight rates, and compares it across freight rates of different fleet size, contract duration and market conditions. He found out that: "Spot rates for larger vessels exhibit higher seasonal fluctuations compared to smaller vessels, although differences in seasonal fluctuations between sectors are eliminated as the contract duration increases."

Xu zhi-gang (2005) in *Research on development of international bulk fleet in the future* studied the factors affecting the supply of the dry bulk market in quantitative method by using Eviews analytical tools, and analyzed the structure of dry bulk fleets by the use of econometric models VAR to accurately describe the trend of shipping supply and prove the trend of bulk fleet's enlargement.

Cai tao (2006) in *Economic analysis of China's Ocean Dry Bulk Ship Styles* set up a single-ship model to choose the best style. The result served as a reference for shipping companies in fleet development decision.

Dang wen-tao (2006) in *A model study of dynamic planning based on the oil tanker fleet planning* build a dynamic planning model based on the minimum cost on a given period to arrive at an optimum development strategy

2.3 Dry bulk market survey by major consultant company

The dry bulk shipping market analysis is also greatly conducted by a large number of

consultancy companies, such as Clarksons. Drewry. Fearnleys, Platou etc. These consultancy companies publish a series of statistic reports, periodicals and research papers to provide a very detailed collection of related market information, reports of the demand and supply of the market and the forecasting of the ongoing market.
Clarkson Research Services publishes *Dry Bulk Trade Outlook* twelve times a year. It reviews dry bulk supply & demand, commodity information, and developments in the markets. Clarkson found supply-demand balance to analyze supply and demand systematically, which offer a comparatively scientific business decision for dry bulk shipping companies.

Dry Bulk Insight published by Drewry monthly offers a concise analysis of the dry bulk market with up to date information for ship owners, ship managers, financiers and other stakeholders involved in this sector who need a precise overview of the dry bulk market.

2.4 Summary

In the dissertation, the author use the supply-demand balance model to conduct a market survey since it can reflect the market more clearly and provide the decision maker with a real market situation and its trend. As to the ship selection model, the author use a simple economic assessment model since the target fleet is small, and specific and the data of the fleet is easy to collect. A simple economic assessment model can accurately reflect the advantage and disadvantage of each vessel.

CHARPTER 3 ANALYSIS OF BRAZIL-CHINA IRON ORE SHIPPING MARKET

3.1 Analysis of the global iron ore distribution

3.1.1 Global iron ore reserves and distribution

The world's iron ore resources are abundant; it is reported by the U.S. Geological Survey in 2004 that the world's iron ore identified resources are up to 140 billion tons, and the reserve bases are about 310 billion tons. The indentified resources and reserve bases by nation are showed at the below Table.

Table 3-1 Global iron ore resource and reserve base

Nation	Iron ore	
	Identified resource	Reserve base
America	6900	15000
Australia	18000	40000
Brazil	7600	19000
Canada	1700	3900
China	25000	50000
India	2800	6200
Kazakstan	8300	19000
Russia	25000	56000
Sweden	3500	7800
Ukraine	22000	50000

Others	17000	38000
World Total	140000	310000
		Unit: million tons

(Source: U.S. Geological Survey 2004)

From the Table above, we can clear see that the global iron ore resources are mainly distributed in Australia, Brazil, Russia, Ukraine, Kazakstan, India, America, Canada and China. In order to have a closer acknowledge of the detail of the world iron ore distribution, We need to know the major large-scale iron ore mines and the world famous mining company as well, which is showed at the below Table.

Table 3-2 World main iron ore mines distribution

Nation	Mining district	Reserve (Billion tons)	Personal status Fe%	Mining Corp
Australia	Hamersley	32	57	Hamersley Corp、BHP
Brazil	Brocuto, Fabria Nova,Fazendo, Itabia	30	35-69	CVRD, MBRCorp
Brazil	Carajás	18	60-67	CVRD
Bolivia	Montero	58	50-53	
India	Orissa	6.7	〉60	MMTC
Canada	Labrador	20.6	36-38	IOC, QCM
America	Superior	16.3	31	
Russia	Kursk	43.5	46	
Russia	KachKanar	14		KachKanar Corp
France	Lorraine	7.7	33	
Sweden	Kiruna	3.4	58-68	LKAB Corp
Venezuela	Bolivar	2	45-69	CVG Ferrominera Orinoco CA

Liberia, Guinea	Nimba	2	57-60	

(Source: U.S. Geological Survey 2004)

CVRD (Brazil), Rio Tinto (Australia) and BHP Billiton (Australia) are the three biggest iron ore supplier and exporter, the total output volume of these three company accounts for 1/3 of the world total.

CVRD is the world largest iron ore supplier, owning around 8.6 billion high personal status iron ore reserve, mainly concentrated in Brocuto, Fabria Nova,Fazendo and Itabia. The iron ore resources they own can be exploited for around 400 years. From Table 3-2 we can see that the iron content of iron ore exploited from the mine in Caraj ás can reach 60%-67% which is very high compare to the others. Around 80% of the total output of CVRD is exported. In 2008, the iron ore output volume of CVRD reached 301 million tons, accounting for 75% of the total iron ore output in Brazil. But in 2009, due to financial crisis, the global iron ore demand declined a lot, CVRD planned to reduce their annual output by 25%.

Rio Tinto is the second largest iron ore supplier in the world and largest iron ore producer in Australia, owning around 11 billion iron ore reserve. The major iron ore resources of the company are located at Pilbara, a region in the north of Western Australia. In 2008, Rio Tinto's two main mine: Hamersley and Robe River produced around 175.3 million tons of iron ore, accounting for 50% of the output in Australia, and also 80% of the products are exported. In 2009, Rio Tinto expected to produce 200 million tons.

BHP Billiton is the world third largest iron ore supplier, owning 7 billion iron ore reserve, mainly in Mt.Newman, Yandi (Western Australia), and 90% of their output are exported. In 2008, they have produced more than 130 million tons of iron ore.

This year, they plan to hold their output volume at 130 million.

FMG, the 4th biggest global iron ore supplier, is the new force in Iron Ore with over 2.4 billion tons of Resources, including 1.1 billion tons of reserves, the largest in the Pilbara. All the iron ore the company supplied is used for export, and 95% are exported to China.

3.1.2 Iron ore reserves and distribution in Brazil

Brazil's iron ore industry ranked first in the world, and its annual output exceeds 200 million tons. After mergers and acquisitions many small mines in Brazil have belonged to CVRD, which turns CVRD into the biggest iron ore supplier in Brazil and even in the world. It have a large scale of mines that can produce 164 million tons of iron ore a year. Brazil announced that they have 34 billion tons of iron ore reserve in four main mine regions and 18 billion tons in Carajás which is much more abundant than the report issued by U.S. Geological Survey.

In Brazil, the main mining companies are CVRD, MRB, Ferteeo, and Samareo. CVRD is the world largest iron ore supplier and exporter. Now, it not only owns its north and south mine producing system, but also acquire some stockholdings of MRB, Ferteeo, and Samareo. The following Table will show the stockholding of CVRD.

Table 3-3 CVRD stockholdings

Mining Corp	Annual output (million tons)	Stockholdings proportion	Annual output CVRD controls
CVRD south system	750	100%	750
CVRD north system	475	100%	435
Samareo	120	50%	60
MBR	270	50%	135

Ferteeo	250	100%	250
Total	1865		1630

(Source: www.mysteel.com)

MBR is the second largest mining company in Brazil, ranked 6th in the world, producing 25 million tons of iron ore a year, now 50% of its stocks are held by CVRD. The main mines are located at Brocuto, Fabria Nova,Fazendo, Itabia. MBR owns 5 billion tons of iron ore reserve and the iron content is more than 64%, which is high quality.

Ferteeo is originally held by German Consortium Thyssen, CVRD only shares a small part of stock, but now 50% of the stocks are held by CVRD. Ferteeo owns 1.3 billon tons of iron ore reserves and the annual output volume are around 17 million tons.

3.2 Brazil-China iron ore shipping demand

3.2.1 Global iron ore shipping demand

Since 2001, with the world economy entering into a new growing period, and the global steel industry developed so quickly. A huge demand derived from the process of urbanization and industrialization of the developing countries like China as well as the developed countries like Japan, Germany, and America greatly stimulates the global steel consumption and thus turns into a driving force that leads to a rapid growth of global iron ore output. The global steel production volume increased from 889 million tons in 2000 to 1.32 billion tons in 2008, with an annual growth rate about 6%. In 2008, the steel production volume of China, Japan, Korea and Germany these four major steel production countries is 502 million tons, 119 million tons, 53.49 million tons and 45.83 million tons, respectively.

The rapid development the world steel industry has hauled the iron ore demand of the

major steel production countries. In recent times, the iron ore resources are mainly concentrated in Australia, Brazil, India, China, and Russia. Australia and Brazil have many large-scale high quality iron ore reserves, and their iron ore output is far beyond their iron ore consumption. Therefore, most of their iron ore resources are exported. In 2008, the iron ore export volume of Australia, Brazil, and India is 308.9 million tons, 281.7 million tons, and 100.7 million tons, respectively, accounting for 90.6%, 68.9% and 50.4% of their total annual output. And the total iron ore export volume of these three countries accounts for 77% of the world total, which is 2% higher than the year in 2007. The following tables will show the world iron ore export and import conditions.

Table 3-4 World iron ore import volume by region

	EU-15	Japan	China	USA	Total Major	Others	World Total
2004	160.4	134.9	208.1	11.8	515.2	128.7	643.9
2005	156.6	132.3	275.2	13.0	577.1	138.3	715.4
2006	160.2	134.4	326.0	11.5	632.1	129.6	761.7
2007	160.7	138.9	383.7	9.4	692.7	129.7	822.4
2008	161.6	140.5	441.1	9.5	752.7	135.8	888.5
Unit: million tons							

(Source: Drewry dry bulk forecaster 1Q09)

Table 3-5 World iron ore export volume by region

	Australia	Brazil	India	Total Major	Others	World Total
2004	221.2	200.9	62.7	484.8	159.1	643.9
2005	239	223.4	80.9	543.3	172.1	715.4
2006	247.3	246.6	89.3	583.2	178.5	761.7
2007	266.8	269.4	93.7	629.9	192.5	822.4
2008	308.9	281.7	100.7	691.3	197.2	888.5

	Unit: million tons

(Source: Drewry dry bulk forecaster 1Q09)

3.2.2 Brazil-China iron ore shipping demand

As one of the largest iron ore producer, China is also the largest consumer of iron ore products. In 2008, China consumed more than 856 million tons of iron ore. Though the iron ore resources in China are relatively abundant, the iron content is relatively low. The domestic iron ore resources are far from enough to meet the current demand of steel production in China, which force China to import, to a large extent, iron ore from foreign countries. The import volume is listed in the following Table.

Table 3-6 China's iron ore import volume

Year	2004	2005	2006	2007	2008
Import volume	207.5	275.2	326.3	383	443.6
Growth rate		32.6%	18.6%	17.4%	15.8%
					Unit: million tons

(Source: Drewry dry bulk forecaster 1Q09)

Brazil is one of the biggest iron ore trading country to China, and the iron ore trading volume between the two countries has increased continuously for many years. To meet the high demand of iron ore transport between Brazil and China, in 2006, CVRD began to use the world largest ore carrier "Berge Stahl" to undertake the transport mission from Brazil to China, which greatly reduced the unit transport cost due to the economies of scale. The Brazil-China iron ore trade volume is show as follow.

Table 3-7 Brazil-China iron ore trade volume

Year	2004	2005	2006	2007	2008
Trade Volume	46	54	81	105	106

Growth rate		17.4%	50%	29.63%	0.95%
					Unit: million tons

(Source: www.mysteel.com)

3.3 Brazil-China iron ore shipping supply

The main ship type used in Brazil-China iron ore shipping market is Capesize vessel. Therefore, we need to conduct an analysis of the Capesize fleet development in recent years.

Table 3-8 World Capesize Fleet

	size		Size		Total	
Year	110-200		200+			
	No	mdwt	No	mdwt	No	mdwt
2004	545	87.8	59	13.6	604	101.4
2005	583	94.6	68	15.5	651	110.1
2006	629	102.8	77	17.3	706	120.1
2007	661	108.5	99	22	760	130.5
2008	676	111.3	128	29.3	804	140.6
2009 March	701	115	144	33	845	148

(Source: Drewry dry bulk forecaster 1Q09)

After a long time practice and optimization, different types of ship have been selected to serve different dry bulk market. In the iron ore shipping market, Capesize vessel has its own advantage due to the long distance of transport and huge quantity of the cargo. Therefore, almost all the international iron ore transport are done by Capesize vessel.

From the above Table, we can see that the Capesize Fleet grows continuously during the last 5 years. This is, to a large extent, caused by China’s strong demand of iron ore;

in 2005 the Capesize vessel was even in short supply, while the transport demand is so high. Therefore many shipping company decide to purchase new Capesize vessel to meet the high demand and increase their profit. But the market is changing all the time; and no one can expect the financial crisis in 2008. The growth rate of the vessel supply is same as the previous year while the growth rate of the maritime demand didn't grow as expected. This will finally lead to the Capesize oversupply, and a sharp drop in BCI index.

3.4 Analysis on Brazil-China iron ore shipping market based on supply-demand balanced model

Now we have just conduct an analysis on both demand and supply side of the Brazil-China iron ore shipping market, but it is far from enough. We need to unify the demand and supply to one flat by a certain method to reflect the impact of the change of the gap between demand and supply on the market. Here we use supply-demand balanced model to closely connect the demand and supply in order to accurately describe the real market situation. Supply-demand balanced model is aim to analyze the dry bulk market by building a bridge between the supply and demand and calculation the gap between the supply and demand. From the result of calculation, we can easily get a general idea of the recent market condition. Through this method, the shipping manager can get a brief idea of the market situation and make some new adjustment and strategy in time according to different market condition.

Since iron ore shipping market is a tramp market, it is hard to identify a certain fleet of Capesize ship that only sail from Brazil to China, Therefore, we choose the total supply and demand of the Capesize vessel as the input data to calculate the gap between the demand and supply of the Capesize vessel to reflect Capesize market condition. When calculate the maritime demand by ship sector, we use the ship operational efficiency as an intermediate to unify the supply and demand to one plat. And we use maritime turnover to represent the maritime demand which takes the

voyage distance into consideration.

Capesize annual operational efficiency

$$M = \frac{Q}{D} \qquad (1)$$

M： Operational efficiency

Q: Annual turnover

D: Deadweight

In order to calculate the operational efficiency, we need to know the annual turnover carried by Capesize vessel.

Table 3-9 Global dry bulk turnover by Capesize carrier

Year	Capesize
2004	4052
2005	4386
2006	4622
2007	4997
2008	5253
	Unit: Billion Tonne Miles

(Source: The Dry Bulk Shipping 4Q 2008)

Table 3-10 Total Capesize fleet

Year	Capesize
2004	101.4
2005	110.1
2006	120.1
2007	130.5
2008	140.6
	Unit: million Dwt

(Source: The Dry Bulk Shipping 4Q 2008)

From Table 3-9 and Table 3-10, we can calculate M

Table 3-11 Capesize operational efficiency

Year	Capesize
2004	40.0
2005	39.8
2006	38.5
2007	38.3
2008	37.4

From the calculation, we can see the Capesize operational efficiency in each year is different, and we assume that the power of each year is equal, and calculate the five-year average Capesize operational efficiency

$$\overline{M} = \frac{1}{n}\sum_{i=1}^{5} M_i \qquad (2)$$

(i=1, 2, 3, 4, 5)

M_i： Operational efficiency in year i

$\overline{M}$： Average Capesize operational efficiency

Table 3-12 Average Capesize operational efficiency

Ship-type	Capesize
Average Capesize operational efficiency $\overline{M}$	38.8

According to the operational efficiency and the annual turnover, we can calculate the maritime demand by ship sector, and then combine the real ship supply; we can further confirm the gap between supply and demand.

When we calculate the supply side of the market, we should take the inactive vessel and combis vessel into consideration. From Table 3-10 we know the total number and

deadweight of the fleet which contains inactive vessel that stop doing business, and also combis vessel should be calculated as additional supply.

Table 3-13 Capesize fleet total supply

	Capesize			
Year	fleet	Inactive	Combis	Supply
2004	97.2	0.4	4.1	100.9
2005	105.7	0.4	4.1	109.4
2006	115.1	0.1	4	119
2007	125.3	0.2	3.8	128.9
2008	135.6	1.4	3.6	137.8
Unit: million Dwt				

(Source: The Dry Bulk Shipping 4Q 2008)

Table 3-14 Average annual Capesize fleets

Year	Capesize
2004	97.2
2005	105.7
2006	115.1
2007	125.3
2008	135.6
Unit: million Dwt	

(Source: The Dry Bulk Shipping 4Q 2008)

Table 3-15 Average annual Capesize Supply

Year	Capesize
2004	100.9
2005	109.4
2006	119

2007	128.9
2008	137.8
	Unit: million Dwt

(Source: The Dry Bulk Shipping 4Q 2008)

According Table 3-9 and Table 3-12, we can calculate the maritime demand by ship sectors

$$\hat{D} = \frac{Q}{\overline{M}} \quad (3)$$

$\hat{D}$： Maritime demand by ship sectors

Table 3-16 Maritime demand by ship sectors

Year	2004	2005	2006	2007	2008
Demand	88.7	97.2	107	123.2	120.2
					Unit: million Dwt

According to Table 3-15 and Table 3-16, we can get the supply-demand balanced condition.

Table 3-17 Supply-demand balances

Year	2004	2005	2006	2007	2008
Supply	100.9	109.4	119	128.9	137.8
Demand	88.7	97.2	107	123.2	120.2
Balance	12.2	12.2	12.0	5.7	17.6

From the calculation, we find out that the gap between the supply and demand enlarged sharply in 2008, and the supply seriously exceeds demand, which is the main reason lead to a tremendous drop in BCI index.

After calculating the gap between the supply and demand, we need to further analyze the increment of the supply and demand to know the market trend.

According to Table 3-9 we can calculate the increment in turnover.

Table 3-18 Increment in maritime turnover by Capesize carrier

Year	Capesize
2005	334
2006	236
2007	375
2008	256
	Unit: Billion Tonne Miles

According to Table 3-15, we can calculate the increment in Capesize supply.

Table 3-19 Increment in Capesize supply

Year	Capesize
2005	8.5
2006	9.6
2007	9.9
2008	8.9
	Unit: million Dwt

The increment in demand by ship sector is the maritime turnover by Capesize carrier divided by the operational efficiency.

Table 3-20 Supply-demand increment balances

Year	2005	2006	2007	2008
Increment in supply	8.5	9.6	9.9	8.9
Increment in demand	8.5	9.8	16.2	-3
Balances	0	-0.2	-6.3	11.9
				Unit: million Dwt

From the analysis, we can see that during the year 2005 to year 2007, the increment of supply is a little lower than that of demand. While the market condition is that supply exceeds demand, the lower supply increment just eased up the degree of oversupply. In 2008, the supply still increased due to a large number of vessel delivered in that year while the demand turn to decrease due to the financial crisis. All these reasons lead to a sharp decline in the Capesize shipping market.

A serious Capesize fleet oversupply leads to a crazy drop of the freight rate, some small company with a higher RFR (required freight rate) will have problem to run their business. A long period in such market condition is fatal to some small company; they cannot earn profit through running their vessel, and will end up with bankruptcy. And some larger company that share the economics of scale should adjust their fleet structure to survive in a bad market, they may stop running some of the vessel and berth them at the port, or they can scrap the old vessel to have a emergent cash flow that will help the company get over the tough period. All these measures and strategies carried out will, to some extent, reduce the fleet supply to balance the demand decrease. For some companies, they will have an assessment of their fleet to see whether all the vessels are economic reasonable to sail in the target line, such problem will not be concerned when the market is booming and the freight rate is high enough to keep the vessel earning profit.

CHARPTER 4 THE CURRENT STATUS OF THE FLEET OF XYZ SHIPPING COMPANY

4.1 Introduction to XYZ shipping company

XYZ shipping company is a Chinese private shipping company providing special Iron ore seaborne transportation service from Tubarao in Brazil to Ningbo in China for Chinese Steel companies. The company was incorporated in Shanghai on December 15, 2001 and is headquartered in Ningbo. Currently, XYZ shipping company owns a fleet of six ore carriers and their sizes are ranged from 130,000 dwt to 200,000 dwt, with an average age of approximately 15years and the total carrying capacity is more than 1 million deadweight tons.

4.2 Analysis of the structure of the fleet

The fleet of XYZ shipping company consists of six Capesize vessels. The main parameters of six vessels are listed in the following Table.

Table 4-1 Fleet of XYZ shipping company

Vessel	Dwt (tons)	Draft (m)	Ballast speed (knot)	Laden speed (knot)
A	134980	16.52	14.6	14.5
B	151380	16.98	14.9	14.8
C	164469	17.23	14.4	14.3
D	172980	17.67	14.8	14.7

E	194200	19.82	16.3	14.2
F	208630	18.02	14.3	14.2

From the above Table, we can see the company owns different types of vessel range from 130,000 Dwt to 200,000 Dwt, since the company is always adjusting its fleet structures through purchasing or chartering in new vessels. Such fleet contains some good condition vessels and also some old bad condition vessels. Since the shipping market is so good during the last few years, the company didn't decide to further upgrade its fleet, some old vessel are still running their business due to the luck of vessel supply in the market.

4.3 The current problems the company facing with

From the analysis by supply-demand balance model of Capesize market, we can find out that, the Capesize fleet is serious oversupplied. This is lead to a continuous decrease of the Capesize freight rate. During the declining period, many small shipping companies that cannot bear the high operational cost and without sufficient cash flow will end up bankruptcy. Some shipping companies that in good financial conditional will adjust their fleet structure to reduce the loss to the minimum extent. The effective measure that most company will carry out is to seal some of their vessels to reduce the variable cost when operating a vessel and focus on some vessels that have a low RFR.

During the booming period, if you own vessel you can earn money, and no one will consider the whether this vessel is economic reasonable to sail on this line. When it comes to depression, all the problems occurred; and the ever dropping freight rate force the shipping company to choose their most economic types of vessel to run the business, or the company will lose money. Now the manager of XYZ shipping company found that some types of vessel are out of date. Their low condition meet the

customer’s requirement and the high operating cost cannot make up of the ever lowering freight rate.

Therefore, we have to make some practical strategies to help the company safely get over this tough moment.

CHARPTER 5 THE DEVELOPMENT STRATEGY OF XYZ SHIPPING COMPANY

5.1 The principle and content of the development strategy

The development strategy of a company is to help the company grow up in a sustainable and healthy manner. When the market is in depression, the most important thing is to keep the company survive in the market. Therefore, the principle of the strategy is to maintain a stable income and reduce the running cost.

The company can take some measures in two different ways.
The first way is to adjust the fleet it owns we defined it as the fleet adjustment strategy; it is the internal adjustment within the company, aiming at reduce the operational cost. The fleet adjustment strategy is done by assessing each vessel's economic index and compare them with each other, then the manage will conduct different measures to each vessel according to the result of the assessment, the measurement can be stop running the vessel, charter the vessel out or keep running the vessel with more attention and keep the operational cost as low as possible through an efficient ship management

The second way is to adjust the operational method. An improvement on the management of a vessel can also reduce the running cost to some extent. And some alliance strategy and market freight strategy are so effective when the company faced with some problems. These strategies are external compare with the fleet adjustment

strategy, and the effect of the strategy may be influenced by the outside factors. But some time it will be more efficient than the internal adjustment which depends on the ability and leadership of the manager.

5.2 Fleet adjustment strategy

5.2.1 Model chose for ship type selection

Ship type selection project is often conducted by many shipping company to select the optimum ship type for a specific line. The paper will use the economic assessment model to conduct a comprehensive assessment on the different index of six vessels

There are many economic indexes to assess a certain type of vessel, different index will reflect the differences of each type of vessel from different aspect. Consider the current situation of XYZ shipping company, the most important matter the company concern is to lower the transport cost to secure their profit. Therefore, we choose required freight rate (RFR), NPV, and PBP (payback period) as the index to assess the advantage and disadvantage of each vessel.

The calculate of the annual total running cost

1. Crew salary S_1

2. Annual depreciation cost S_2

We choose liner depreciation and depreciation life is 20 years with a residual value of 5% of the purchasing value.

$$S_2 = \frac{P - 0.05P}{N} \quad (1)$$

P：Purchasing price

N：Depreciation life

3. Annual maintenance cost S_3

The annual maintenance cost is around 1.5% of the purchasing price

4. Annual insurance cost S_4

The annual insurance cost is around 0.7% of the purchasing price

5. Annual bunker cost S_5

Since iron ore transport is a single flow transport, a round trip contains one laden voyage and one ballast voyage. And the ballast speed is 1.05 times the laden speed.

$$T = \frac{L}{24 \times V_s} + \frac{L}{1.05 \times 24 \times V_s} \quad (2)$$

T : Round trip time

Voyage time = Round trip time + port time

The bunker is consisted of fuel oil and diesel oil that should be calculate separately in the formula.

$$S5 = N_w \times \left[(T_1 + T_2) \times G_1 \times P_1 + (T_1 + T_2 + T_3 + T_4) \times G_2 \times P_2 \right] \quad (3)$$

G_1 G_2 : Consuming rate of fuel oil and diesel oil

T_1 T_2 : Time at laden voyage and ballast voyage

T_3 T_4 : Time at loading and discharging port

P_1 P_2 : Price of fuel oil and diesel oil

N_w : The number of trips a year

6. Lubrication cost S_6

The lubrication cost is around 8% of the bunker cost

7. Material cost S_7

The material cost is around 10% of the bunker cost

8. Port charges S_8

9. Management cost S_9

Management cost is around 20% of the total running cost

$$S_9 = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6 + S_7 + S_8) \times 20\% \quad (4)$$

Therefore, Total running cost Yc = S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9

Calculation of the taxation

Turnover tax:

$$Turnover\ tax = freight\ income \times 3.3\% \quad (5)$$

Income tax:

$$Income\ tax = \left(freight\ income \times 3.3\% - total\ running\ \cos t - depreciation\ \cos t\right) \times 33\% \quad (6)$$

Assessment index calculation

1. RFR

$$RFR = \frac{Yc - S_2 + P \cdot (A/P, i, n) - RL \cdot (A/F, i, n)}{\sum Q} \quad (7)$$

RL: residual value, 5% of the purchasing value

Q: annual transport volume

$$Q = Wc \times Nw \times 10^{-4} \quad (8)$$

Wc: single transport volume

2. NPV

Annual total income: F

$$F = trip\ volume \times freight\ rate \times number\ of\ trips \quad (9)$$

$$NPV = (F - Yc + S_2) \cdot (P/A, i, n) + RL(P/F, i, n) - P \quad (10)$$

3. PBP

$$PBP = \frac{\lg\left(1 - \frac{i \cdot P}{F - Yc + S_2}\right)}{\lg(1+i)} \text{ Year} \quad (11)$$

5.2.2 The index calculation and sensitivity analysis

We take vessel D as an example to explain the process of calculation.

1. The purchasing price of vessel D is 65 million dollars

2. The crew salary is different according to different types of vessel, and we take COSCO as reference, the crew salary of the same size of the vessel as vessel D in COSOC is around 250,000 $

3. The depreciation cost:

$$S_2 = \frac{P - 0.05P}{N} = 3.0875\ million\ \$$$

4. Annual maintenance cost S_3

$$S_3 = P \times 1.5\% = 975000\$$$

5. Annual insurance cost S_4

$$S_4 = P \times 0.7\% = 455000\$$$

6. Annual bunker cost S_5

$$S_5 = N_w \times \left[(T_1 + T_2) \times G_1 \times P_1 + (T_1 + T_2 + T_3 + T_4) \times G_2 \times P_2 \right] = 4086100\$$$

The current price of fuel oil and diesel oil is 270.53 $/ton and 424.83$/ton

7. Lubrication cost S_6

$$S_6 = S_5 \times 8\% = 326800\$$$

7. Material cost S_7

$$S_7 = (S_5 + S_6) \times 10\% = 441300\$$$

8. Port charges S_8

A 170,000 Dwt ore carrier will generate around 80000$ port charge when calling at the port of Tubarao

9. Management cost S_9

$$S_9 = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6 + S_7 + S_8) \times 0.20 = 2004100\$$$

10. Total income

$$F = trip\ volume \times\ freight\ rate \times number\ of\ trips = 1327.36 million\$$$

The current Tubarao-Ningbo Iron ore freight rate is 17.5$/ton

Calculation of the taxation

11. Turnover tax

$$Turnover\ tax =\ freight\ income \times 3.3\% = 438000\$$$

12. Income tax

$$Income\ tax = \left(freight\ income \times 3.3\% - total\ running\ \cos t - depreciation\ \cos t\right) \times 33\%$$
$$= (1327.26 - 1202.48 - 43.80) \times 33\%$$
$$= 268800\$$$

13. $$RFR = \left[Yc - S_2 + P \times \left(A/P, i_o, N\right) - RL \times \left(A/F, i_0, N\right)\right]/Q = 17.78\$/ton$$

14. $$NPV = P + \left(P/A, i_o, N\right) \times \left(Q \times R_r - Yc + S\right) + \left(1 + i_0\right)^{-N} \times RV = 8123.76\ m\$$$

15 $$PBP = -Lg\left[1 - i_0 \times P/\left(Q \times P_r - Yc + S_2\right)\right]/Lg\left(1 + i_0\right) = 11.97\ Year$$

The economic assessment of the other five vessels is calculated as the process above. Then we can get the result of the assessment of six vessels.

Table 5-1 The economic assessment of six vessels

vessel name	A	B	C	D	E	F
deadweight	134980	151380	164469	172980	194200	208630
building price	5530	6000	6350	6500	7100	7300
the number of trips a year	5.14	5.13	4.91	5.02	4.78	4.73
crew salary S_1	23	24	25	25	27	29.5
depreciation cost S_2	267	284	298.65	308.75	334.5	345.75
annual maintenance cost S_3	83	90	95.6	97.5	106	109.5
annual insurance cost S_4	38.2	42	44.5	45.4	49.7	51.1
bunker cost S_5	378.65	409.01	394.41	408.62	425.76	449.77
lubrication oil cost S_6	30.39	32.52	30.35	32.69	33.06	36.28
annual material cost S_7	40.59	44.37	42.70	44.33	46.58	48.78

annual port charges S_8	33.55	36.22	36.88	39.98	43.09	44.87
management cost S_9	179.12	192.82	193.66	200.41	212.68	223.01
annual total cost	1074.70	1156.95	1161.94	1202.48	1276.08	1338.06
annual total income	1137.64	1298.65	1294.18	1327.77	1562.37	1525.04
turnover tax	37.54	42.86	42.71	43.82	51.56	50.33
income tax	8.38	32.62	29.54	26.89	77.46	45.09
profit after tax	17.01	66.23	59.98	54.59	157.27	91.55
RFR	18.54	17.57	17.97	18.12	16.43	17.58
NPV	7003.44	8222.12	8451.34	8123.76	9986.40	9834.18
PBP	12.87	11.08	11.79	12.12	9.76	11.35

*All the Unit of the money is million $

The economic assessment is conducted under the current market situation, but the future market is unexpected. So when the market changes, the index will change. In order to observe the impact of the uncertain variable parameters on the economic index, we need to do a sensitivity analysis on the freight rate, bunker price and loading rate. The following table is the sensitivity analysis (NPV) of vessel D.

Table 5-2 Sensitivity analysis (NPV)

	-10%	-5%	0	5%	10%
building price	8168.95	8142.21	8123.76	7938.75	79302.01
loading rate	6933.40	7524.44	8123.76	8936.52	9457.56
bunker price	8386.43	8210.95	8123.76	8040.00	7924.53
freight rate	6853.40	7534.44	8123.76	8716.52	9447.56

From the sensitivity analysis, we find out that the freight rate and loading rate have a

great impact on the NPV. Therefore, it is essential for XYZ shipping company to well control the cargo flow and the freight rate.

From the economic assessment model we can see that, in Tubarao-Ningbo line, vessel E is the optimum type since its RFR, NPV, and BPB is better than the other five vessels.

As to NPV, vessel E is 47% higher than vessel A, 33.6% higher than vessel B, 27.5% higher than vessel C, 26.3% higher than vessel D, 4.8% higher than vessel F. It is concluded that vessel E can achieve the economics of scale in Tubarao-Ningbo line.

5.2.3 The analysis of the result of the assessment

Though the analysis of each vessel's economic index, we have some advices to the company for their reference.

First, we suggest that the company should inactive the vessel A and D, since their RFR is too high and in the current market condition, we cannot earn profit when operating these two vessel, and moreover, the age of these two vessel is old, the ship condition is not as good as the other vessels, and the low condition will charge more maintenance cost and management cost.

Secondly, try to well control the loading rate of vessel E and vessel F, these two vessels are comparatively in good condition and share the economics of scale. So we should take more care about them, and try to well control the loading rate through better arrangement of cargo flow and good coordination with the client as possible as we can.

Third, the company can charter vessel B and vessel C out when the cargo is not sufficient. On the one hand, the company can spare more efforts on the management of the other vessels; on the other hand, the renting income can be a stable support for the security of the company's cash flow.

Table 5-3 The measurement of each vessel

Vessel	Operate	Inactive	Charter out
A		●	
B			●
C			●
D		●	
E	●		
F	●		

5.3 Operational adjustment strategy

5.3.1 Shipping pool strategy

Shipping pool is one of the effective strategies that commonly carried out by many shipping company especially dry bulking shipping company, because dry bulk shipping market is a competitive market. The market is so turbulent that changing every minute according to the increase or decrease of the market. And the majority of dry bulk shipping companies are small-scale and powerless to stabilize the freight rate to secure their profit. Therefore, many small shipping companies cooperate with each other and build XYZ shipping pool to share their fleet capacities and have the advantage of the economics of scale.

Generally speaking, there are two types of shipping pool, one is ship owner cooperation, and other is to cooperate with big cargo owner. As XYZ shipping company that specialized in iron ore transport, the latter one is recommended. Through the friendly relationship with the iron ore importer or exporter, the shipping company can better control the cargo resource, and have sufficient cargo to transport. It can not only ensure the business of the company, but also avoid the market risk. NYK is a good example; it takes the advantage of the fact that the majority of the raw materials in Japan are imported from the international market, associating with the big

cargo owners in their country to build a pool which greatly increased NYK's market strategy and competitive strength.

As to XYZ shipping company, we suggest that the company can try to negotiate the steel production company by quoting attractive freight rate to them to build a pool which can allow the company better control the cargo resources and avoid the market risk.

Therefore, we suggest that the first step of the company is to negotiate with steel production company. And the second step is to sign a long-term contract with them to secure a stable income flow, although the freight rate may not be satisfied by the shipping company. The most important thing is to hold the market share rather than maximize the profit, So the association with the steel production company may be a good decision to make under such market condition.

5.3.2 Freight market strategy

If pool strategy seem to be more active that sometimes the condition is beyond our control and some measures hard to be executed, the freight market strategy seem to be more protective and easy to carried out. The shipping company can make use of the freight rate futures to hedging against the profit loss due to the market fluctuation.

We suggest that the shipping should buy some freight rate future contract when the market is down. For example, the XYZ shipping company has brought the future contracts, and the market is not so good, the company wants to secure their freight rate, they can sell out their future contracts and buy it again if the freight rate goes down. Through such operation, though the company suffered a loss in freight income, it earns profit in the future contract. It is an effective measure to hedge against the market risk and is easier to conduct.

CONCLUSION

After the reform and open up, China's iron ore shipping market has achieved a rapid development. Under the over-heated iron ore import demand of China, the manager of the shipping company should have a clear mind to uncover the potential crisis. The financial crisis is unexpected and disastrous, but we still can find some measures through a deep analysis of the target market to solve the existing problem. The manager of XYZ shipping company should closely focus on the change of the market in order to adjust their management strategy in time.

For XYZ shipping company, the drop of the iron ore market is not a bad thing, since it reveals the existing problem of the company. The paper has put forward several strategies through the analysis of the company's fleet and the current market situation and its trend. In conclude, there are three main feasible strategies for reference.

First is to readjust the fleet structure. After assessing six Capesize fleet of the company, we made a conclusion that vessel A and vessel D are unsuitable to sail Tubarao-Ningbo line. Second is to build a pool with China's steel company that enable the company to access to more reliable cargo resources. Third is to buy freight rate futures to hedge against the market risk and, to some extent, reduce the loss caused by the market changing of the company

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