8-4-2007

Analysis of the China factor effect on the international dry bulk shipping market

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ANALYSIS OF THE CHINA FACTOR EFFECT ON THE INTERNATIONAL DRY BULK SHIPPING MARKET

By

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China

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

MASTER OF SCIENCE

(INTERNATIONAL TRANSPORT AND LOGISTICS)

2007

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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ACKNOWLEDGEMENT

I am very thankful to World Maritime University and Shanghai Maritime University provide us the course international logistics and transportation to study, and especially to all the professors taught me, I have learnt much from them, not only the latest knowledge, but ways or ideas to solve problems.

My sincere thankfulness and respect will be expressed to my supervisor Professor Qu Linchi. With his invaluable instructions and help I finished my dissertation. And I am deeply touched by his wide knowledge, precise teaching attitude which benefit me a lot.

I am also very thankful to my relatives and friends who encourage me on the completion of this dissertation, and give me help and instructions

ABSTRACT

Title of Research paper: **Analysis of the China Factor Effect on the International Dry Bulk Shipping Market**

Degree: **MSc**

In recent years, shipping industry has achieved some of the best records with the boom of China, especially in the dry bulk market, with China accounts for much of the growth of the dry bulk trade and enjoys sharp increase in the dry bulk import volume. So the increase of China's status and influence in the areas of the world and the increase trend of China's export volume of iron ore and other industrial raw materials and energy supplies such as oil imports, major impact on the shipping industry known as the "China factor" has been widely attention.

This paper aims to find the causes of such China factor, qualitative analysis the effects in dry bulk market of which China factor is one important driving force, quantitative analysis the correlation of China iron ore and coal seaborne volumes with the world total, and outlook for the China factor effect so as to present a clear picture of the causes of such an effect, the great role China play in the dry bulk market for better judgment of the future trend.

Casual relationship and grey correlation analysis are applied in this paper, and an overall China effect chart are drawn at the end of the paper.

KEY WORDS: China factor, dry bulk shipping, qualitative and quantitative Analysis

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LIST OF ABBREVIATIONS

BDI	Baltic Dry Bulk Index
DWT	Dead Weight tons
EU	European Union
GDP	Gross Domestic Product
IISI	International Iron and Steel Institute
IMF	International Monetary Fund
m.dwt	Million tons deadweight
mt	Million tons
OECD	Organization for Economic Cooperation and Development
TDC	Trade Development Cycle
UNCTAD	United Nations Conference On trade And Development
WTO	World Trade Organization

Chapter 1 Introduction

1.1 Background of the research

With the rapid and sustain development of China economy and increasingly close tie with other countries in economic and trade, the effect of China on the international economic and trade is growing and has attracted the attention of the scholars from home and abroad extensively. China factor, as a topic of international significance, was first proposed in economic circles a few years ago, and now the effect of China factor on the shipping market, especially on the dry bulk market has become an important issue that the international shipping industry concerns about because of the close tie of the shipping industry with international economy, and the international trade in particular.

In the international shipping industry, "China factor" has now become the main driving force of overall rise in the three major international maritime transport market, that is container liner, dry bulk and tanker market, and also changes the global economy and trade, raw materials, energy supply and the structure of the international shipping market that services to the global seaborne trade.

In the first "World Shipping (China) Annual Summit" held in 2004 in Beijing and the second "World Shipping (China) Annual Summit" held in 2005, China factor has became the theme of the conference and drew the attention of the world shipping industry. The first world shipping annual summit create the concept of "China factor"

and rewritten the three Baltic Freight Index operation framework and obviously tilt to East Asia with China as the center.

Many people in the industry believe that China has become one of the internationally recognized shipping clubs and China factor will play long-term role in the global maritime market. In the dry bulk market, with its outstanding performance, China has a special impact on the market.

Since 1999, the China shipping market increase rapidly with an annual growth rate of 20 percent, accounting for 50 percent of the growth of the global maritime market. In 2001, the volume of the dry bulk trade volume increased by 51.9 million tons, while the global dry bulk trade growth is only 29 million tons. It means that the global dry bulk market would see a negative growth of about 20 million tons without the strong pull of the China dry bulk market.[1]

From 2002, the economic mode change from quantitative to qualitative, China is gradually becoming the new world processing center, the consumption of raw materials, energy and the import and export demand is growing substantially and rapidly.

And iron ore is one of the main cargos that generate such a boom. Take the year 2003 for example, China imported 148.13 million tons of iron ore in 2003, accounting for 28.54% of the global ore trade volume, increased by 36.63 million tons compare with 2002, while in this year, the volume of global seaborne iron ore increase was only 43 million tons, it means that China accounts for 75% increase of the global market, and being the main growth point of the market. The increase of the global seaborne trade

[1] Clarkson database

volume in 2003 was 92 million tons, China alone accounted for 80 % of the total, which was 74 million tons.[2]

In the subsequent two years, the China dry bulk market, iron ore in particular, maintain high speed growth, the iron ore imports in 2005 surpass 275 million tons, accounting for 40 percent of the share. The demand from China is changing the global economic and trade structure and the pattern of raw material and energy supply so as to change the pattern of global dry bulk market.[3]

In such circumstance, China factor has become the thermometer of the international shipping market, and the BDI index, which reflects the main conditions of the market, was fluctuated with the China economy. Take 2004 for example, affected by the Chinese macro control, the BDI index fluctuated from the peak to the bottom, and then rebounded again in half years, the sensitivity of BDI index with China's economic and policy changes reached unprecedented heights.

It is not hard to foresee that China factor is not only the important factor pushes the growth of the current market, and such a trend will continue for quite a long time, instead of just a short-term cyclical phenomenon. China’s industrial process will provide strong market demand for the market.

So how to fully understand and utilize the China factor would be an important issue for the parties concerned. The development of the status and influence of China on the international trade has become one of the issues the current international economic and trade circles, raw material suppliers and traders, as well as the

[2] Clarkson database
[3] Clarkson database

international shipping industry most concerned about.

1.2 Literature review

With the deepening of China reform and opening up and the improving of China status, China factor has become one of the important factor affect international economy. In respect of the research on international trade and industry structure, Lan Qingxin and Tian Haifeng (2002) study the relationship between the trade structural change and economic growth in transition by doing regression analysis of the economic growth mode transformation indicators with the data of China foreign trade and industrial structure.

There are many studies on the dry bulk market and factors affect the market both at home and abroad, including various publications from the well known research institutions, but not many researches specifically study the China factor effect on the shipping market.

China factor was first proposed on the first "World Shipping (China) Annual Summit" in 2004 and China factor, as the theme of the summit, was been widely discussed, such as the China effect on the global trade and shipping market structure, China's future demand and the development trend of international maritime market was also analyzed and forecasted.

By the end of 2004, the British shipping consulting company Drewry made a report of China factor, "Global Shipping Insight-Forward Thinking on the China Factor", qualitative analysis the effect of China factor on the international shipping market in

recent years.

The director of Clarkson research, Dr Martin Stopford study China factor and its development trend from the perspective of the effect of industrialization process on the development of trade.

Domestically, Yang Peiju(2004) in the article “ China factor, a new proposition in international shipping industry” briefly analysis the changes in the shipping industry caused by China factor, qualitative analysis the China factor effect on the international shipping market, including dry bulk market, and point that beyond promoting the growth of demand in the international shipping market, China factor effect can also be seen on the impact of the national policies on international shipping market.

Also in this year, Cui Liande(2004) in the article “ rethinking of the China factor in the shipping market” point out the substantial increase in the raw materials export and import volume driven by the China economy development, qualitative analysis the effect of China to the international shipping market.

In 2005, on the 24th session of the World Ports Conference and the second "World Shipping (China) Annual Summit", the CEO of the China Merchants Dr. Fu Yuning and the president of COSCO Wei Jiafu address respectively the China factor effect on the international port industry and shipping related industry.

Generally speaking, these researches and studies on the analysis of the China factor in the international market are reasonable, but such analysis focus only on the shipping market, or regional shipping market, or just one aspect of the shipping

market, but not precisely on how China factor affect the international dry bulk market. Most of the studies only focus on qualitative analysis, lack quantitative analysis of the China factor effect.

1.3 Paper structure

This paper is conducted from three perspectives.

First is the cause of China factor on the international dry bulk market. It is analyzed from the China regional development cycle, China economic and trade development, and the great role China played on the international dry bulk market.

Second is the effect China factor on the dry bulk market. Qualitative and quantitative analysis are conducted. Casual relationship analysis is adopted to analysis the China factor effect on the freight rate, new building market, second hand market, scrap market. Grey correlation analysis is adopted to analysis the extent of correlation China with the dry bulk market.

Third is the outlook of the China factor effect on the dry bulk market. The world economy, the China trade development, and the development of the China iron ore and steel is analyzed so as to get a clear picture for related parties for further judgment.

Chapter 2 The causes of the China factor effect on the dry bulk market

2.1 The regional development cycle

With the transfer of industry division, the change of global trade structure and volume, and the rise of new economic powers, the world maritime centre are gradually diversified, and the westline circumnavigate the globe. By its accelerated economic and industrial development and sudden seaborne expansion, China now is again leading the world maritime trade growth and triggers the fourth wave of regional development in world shipping industry.

There are four regional trade development cycles in the last fifty years. The first wave is in Europe in the 1950s, then came after Japan in the 1960s, the import of Japan reached 600 million tones in the early 1970s. Then South Korea and the Asian Tigers follows, the imports of which grew from just 300 million tones in 1975 to over 1.2 billion tons in 1995, while the growth of Europe and Japan became halted. And then China follows, the imports of China reached 500 million tones in 2005.[4]

The figure above shows that these waves one stepped along the same path after another had a similar pattern, which can be referred as trade development cycles. Analysis of the earlier regional development cycles will then be useful for reviewing China trade development.

Driven by different stages of economy growth, such a seaborne trade growth wave

[4] Clarkson database

normally first trigger rapid trade growth as the industrial infrastructure built up, demand for raw materials such as iron ore, coal etc. increases, for resource intensive industry such as steel, energy and construction. And then the seaborne trade growth lowered and trade stabilized while the economy become mature as service oriented industry are been focused on then.

China now is in the raw material intensive stage and especially in steel which is the most significant feature in the China industrialization process. The Figure 2-1 shows that the percentage of China in the world is increasing rapidly since the year 2000 and China now account for one third of the world steel output. And Figure2-2 shows the large increase of pig iron which is for ore-based production in recent years

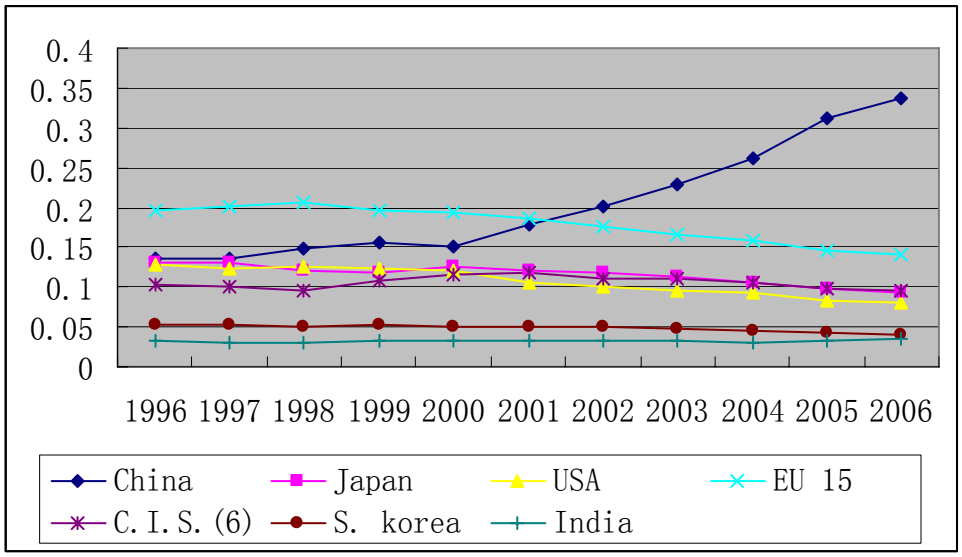

Figure 2-1 Percentage of share in world crude steel output (world main region, 1996-2006)

Source: IISI

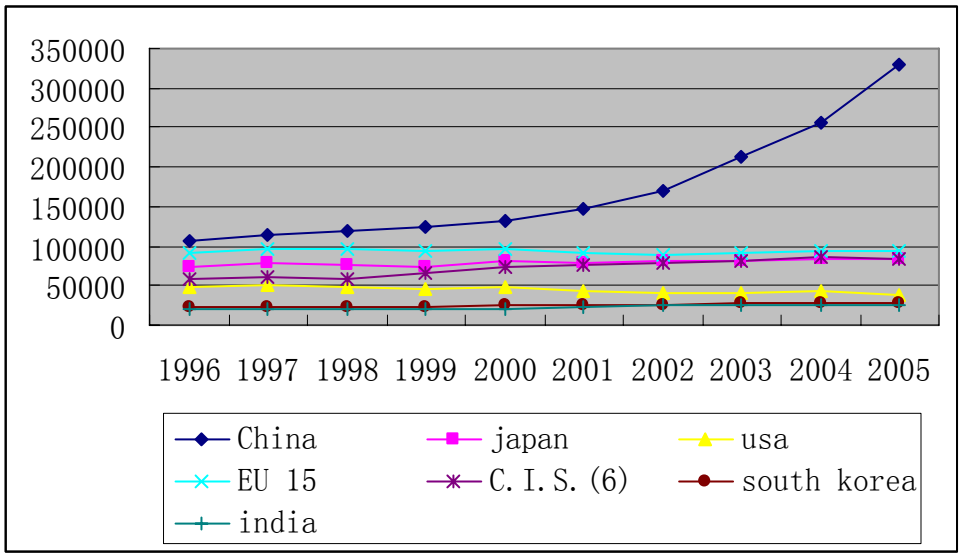

Figure2-2 the production of pig iron in main regions of the world (1996-2005, tonne)

Source: IISI

The above figures show the rapid development of steel industry. The steel output of China has ranked the first in the world for 10 consecutive years after it surpassed Japan and its share of world crude steel output is increasing rapidly. The big domestic demands cause the boom of China steel industry. In respect of the consumption of steel, related studies show that the real estate, machinery, and auto industry account for 50%, 20% and 4% respectively, the real estate contribute most to the steel industry boom as a result of the continuous growth in fixed assets investment, the rapid development of infrastructure construction and real estate industry.

One thing worth mentioning is that the huge demand in steel not only benefit iron ore seaborne trade, but also generate the increase of other related raw materials like coking coal, scrap, coke, steel and other raw materials and products for making steel.

For example, about one quarter of the domestic steelmaking raw materials is scrap steel, and the import of scrap steel grow rapidly with the rapid development of China steel production.

So while China is in the raw material intensive development stage, the prominent development in the mental, consumer durable, construction, shipbuilding and motor vehicle industries has triggered rapid growth in demands for raw materials and the prosperity of shipping industry and especially in the dry bulk market which will be discuss later.

2.2 The China economic growth and trade

From the 1950s up to now, the development of China economy has experienced three periods, that is the planned economy period(1956-1978), the early economic reforms period(1978-1990) and the deepening economy reform period(1990-now). The first two periods is not such stable and swings volatile, but from the deepening economy period China economy has developed rapidly, especially since 1999 China’s accession into WTO, the GDP growth rate is much higher than the world's average level and can be seen in Figure 2-3

Figure 2-3 shows the GDP growth of the China, advanced economics and the world in recent years. And Figure 2-4 shows the productivity performance of China. As see from the figure, the sustain performance of China is very impressive and the productivity growth has been strong since 1990s.

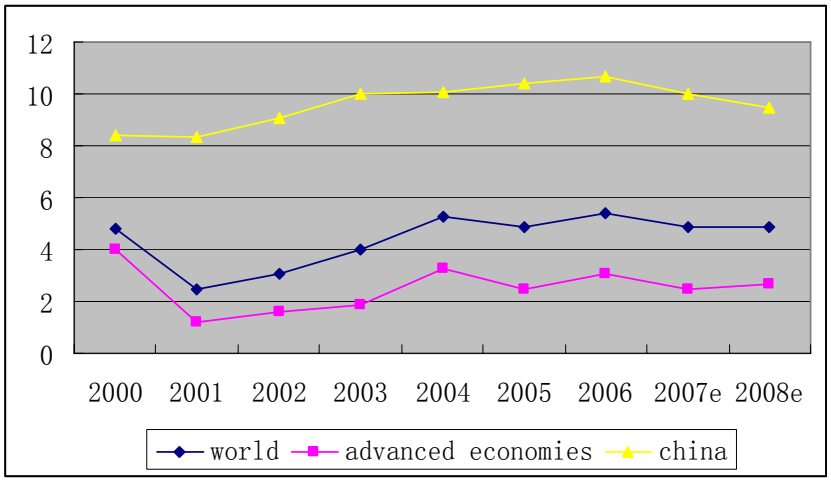

Figure 2-3 the annual percentage change of real GDP of the world, advanced economics, and China (2000-2008e)

Source: International Monetary Fund, World Economic Outlook Database, April 2007

Sources: World Bank, *World Development Indicators* (2006); and IMF staff calculations.
[1]Measured as real GDP divided by working-age population.

Figure 2-4 China global productivity performance

(Annual percent increase; three-year moving average 1990-2006)

Source: April 2007 world economic outlook page 20 IMF

For 1976 to 2006, China maintains an average annual GDP growth rate of about 10.9

percent and the upgrading of China's comprehensive national strength has also greatly boosted China's foreign trade growth, the share of China in the international trade is growing and the growth in the import and export of China much higher than the international trade growth rate.

According to IMF statistics, from 2000 to 2006, the annual growth rate of China in export and import is 25% and 23% respectively, ranking the third in the world, and account for 8% of the world merchandise trade in value. Then in the second half of 2006,the export volume of China for the first time even surpass that of USA, which share of 8.6% value of the total, while the largest trader Germany share 9.2% of the value in 2006. While The UNCTAD in maritime review 2006 show that China ranges the third in the share of world seaborne trade that is 6.7% in value, while Germany and USA 8.3% and 12.5% respectively.

China has maintained rapid economic growth in recent years and such a trend is to continue and the growth of China economy will continue to bring major impact on the world economy, the increase of the aggregate national strength and the high speed growth of international trade.

Beyond the China trade value growth, the China seaborne trade volume shows a clearer picture of the China growth in recent years. In the early 1990s, the Chinese import trade is only 100 million tones, that are 2% of the world seaborne imports, but in 2000, the imports doubled to 296 million tones, and then it increased sharply to 534 million tones in 2003 and even 633 million tones in 2004 that is about 10% of the world seaborne imports. [5]

[5] Clarkson database

.Such a rapid import growth may be result by the domestic reform like financial system liberalization, the national infrastructure program, or the open of the country's foreign investment. And such a speed of growth has made an enormous impact on the shipping industry, especially on the dry bulk sector, since iron ore accounts for much of the growth, which will be discussed later.

With its huge domestic demand and low production costs China has become the most active areas for domestic and foreign investment. Following the eastern coastal western region development, China has began implementing the strategy of revitalize old industrial bases in northeast China and the central China development strategy so as to enter a new round of infrastructure construction period.

The large scale optimization of the economic structure and pattern, technical transformation, large number upgrade of technology and equipment, and new major project construction has triggered huge demand in the construction and production of raw materials and has become the main driven forces for the shipping market development.

The development of China economy and foreign trade brings much opportunity for China and world industry. Since China is in the process of industrialization, demands for oil, coal and ore will continue to grow for a longer period. And China is playing a much important role in the global maritime trade with rapid increase of international trade and foreign trade dependence. Since shipping market follow a similar cycle of economy and trade, the Chinese trade pick up is most important cause of the extreme of the dry bulk market

2.3 The role of China dry bulk trade on the dry bulk market

For the last forty years, dry bulk trade has grown by about 300% in the last forty years. The development of the major bulk trades and there has a remarkable growth in total dry bulk shipment and such a growth is backed by the growth in the shipment of coal and iron ore in particular.

According to the Fearnleys dry bulk market October 2006, the average total dry bulk growth from 1999 to 2006 is 5.0%, with the annual growth of grain 3.1%, coal 4.8% and iron ore 8.6% respectively. The annual growth of iron ore from 2002 to 2005 is particularly noticeable, that is 13% per year, and the main cause of such a change of trend is China.

The impact of China on the dry bulk market is obvious and has generated structural change in the shipping word. Since 1995 the China import grow significantly and China has entered the sustain rapid growth of industrial raw material stage, and the annual growth rate of the China in the major dry bulk seaborne trade is much higher than those of Japan, European union and USA. In fact, since 1999 China has contributed to about half of the world dry bulk shipping net demand increase.[6]

As mentioned before, China's trade development is in the footstep of Europe and Japan. And the growth cycle of China shows what had happened in the previous trade development cycles. And one characteristic is that the process is dominated by steel and energy, there has been a remarkable increase in the imports of iron ore and oil which contributed to about over 60 percent of the growth from in the market in

[6] Clarkson database

the last four years and has been main growth of China seaborne trade.

Undoubtedly, the boom of China steel industry which drives the significant rise of steel related dry bulk cargo volume is one of the driving forces that push the increase in shipment of the whole dry bulk market and is the main causes of the sharp increase in China iron ore imports.

Though the imports of major dry bulk cargo like soybean and coal also have noticeable growth, the largest increase of imports in recent years is iron ore. Figure 2-5 shows respectively the share of the net China iron import increase in the net world iron ore shipment increase and the world dry bulk cargo shipment increase.

Figure 2-6 show that China iron ore import contribute a lot to the world iron ore and dry bulk cargo net increase and its import volume has become an important force pull the market trend. With China iron ore import has become the barometer of the dry bulk market trend, it may not base entirely on the trends of global economy to determine the international dry bulk market development trend.

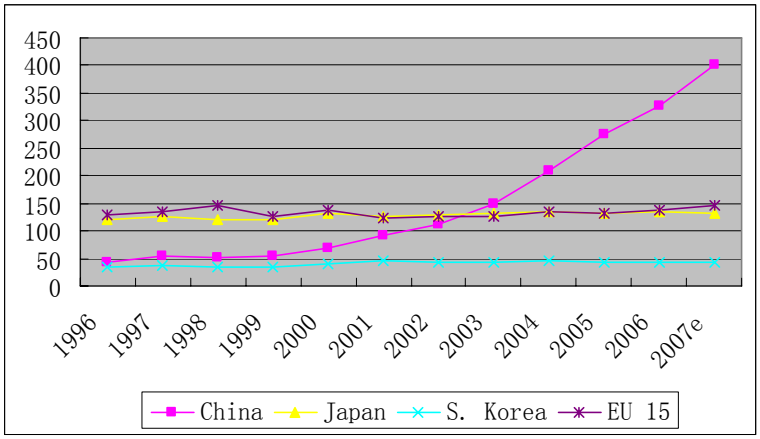

Figure 2-5 World major iron ore imports (1996-2007, in million tones)

Source SSY Monthly shipping review IISI Steel Statistical Yearbook 2006

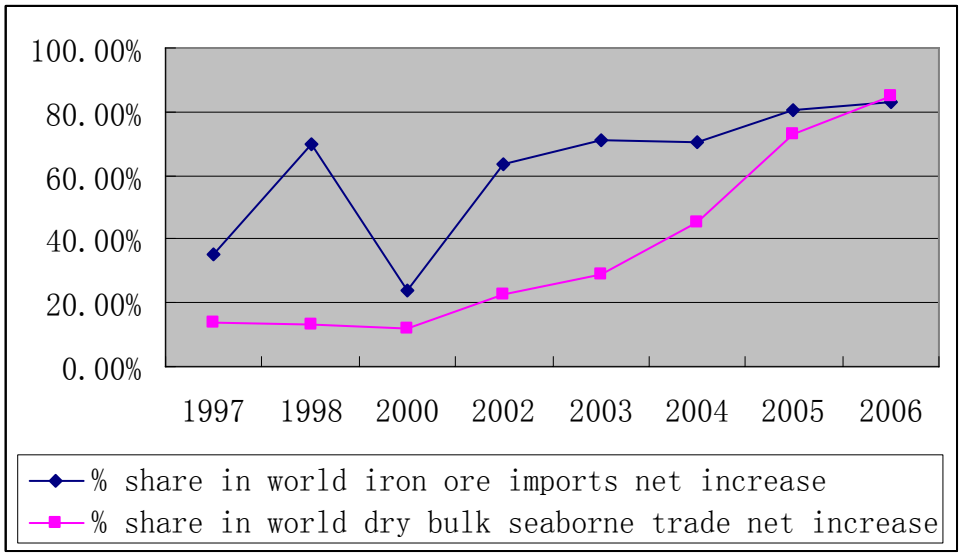

Figure2-6 the percentage share of China iron ore imports net increase in the net increase of world iron ore imports and world dry bulk seaborne trade.

Source SSY Monthly shipping review

IISI Steel Statistical Yearbook 2006

Note: Year 1999, 2001, the world iron ore import decrease though the China iron ore import increase, so it is not shown in the figure.

2.4 Summary

The rapid development of Chinese economy is one of the main factors that stimulate the rapid growth of international shipping industry. Since the 21st century, with the accelerate of industrialization and urbanization, the continuous upgrade of the national consumption structure, and the transfer of the global manufacture, the huge demand in the China dry bulk market has contribute a lot to the international shipping market development.

It is the surge demand increase of iron ore and large imports and exports of other major bulk cargo like coal, oil, soybean that promote the prosperity of the international shipping market. In respect of the correlation of international dry bulk market and China economic development, 70 percent of the dry bulk market growth was from China.

All these will make the world dry bulk market change with the variable of China factor, so China factor and the import of iron ore is attracting more world attention.

Chapter 3 the China factor effect on the dry bulk market

One thing worth noting before the starting of this chapter is that, since dry bulk market is affected by many factors, it is hard to say the causing of some phenomenon in this chapter is only triggered by China factor. Just as chapter 2 mentioned, China factor contributes a lot to the boom dry bulk shipping market, so China factor may be one of the main driving force, but not the only one force that trigger such effect analyzed below.

3.1 The China factor effect on dry bulk freight

3.1.1 BDI

The Baltic dry bulk index (BDI) is such an index track the performance of the dry bulk market and it closely related with the world economy, the demand and supply of the dry bulk market. Take the year 2000 and 2001 for example, the recovery of the world economy and the increase in the dry bulk trade volume leads to the increase of BDI in 2000, the soften of dry bulk trade in 2001 and the rapid growth of fleet cause the decrease of BDI by 50%. Then since 2002, the China boom leads to the all time high of BDI which is then fluctuated with the China trade. Figure 3-1 shows the fluctuation of BDI in recent years.

Before the surge of BDI from 2002 to 2004, there are several peaks in history. For example, the BFI once peak to point 2352 in history during the 1995 to 1996 period, the sustain growth of demand in the Japan market in 1995.

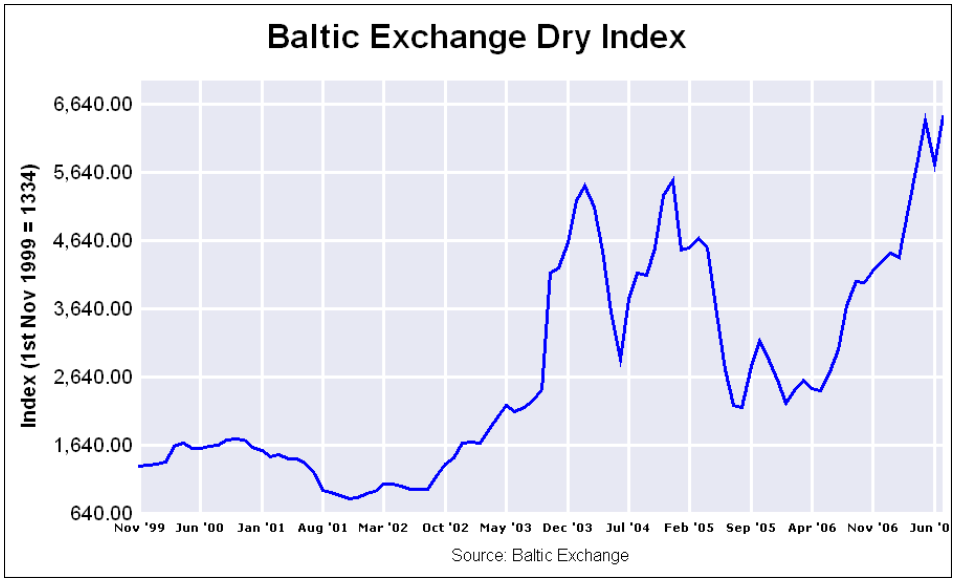

Figure 3-1 The BDI index (1999-2007)

Source: Clarkson Research Services Limited 2007

With the structural change in the dry bulk market, the situation may be different compare with the peaks in history, the surge demand from China is changing the structure of the global trade, the demand and supply of raw material and energy and also the dry bulk market and trigger a new round of cycle in the dry bulk market which can be seen from the peaks in BDI.

In order to reflect the clearer picture of the dry bulk market situation, the BFI add two China ore transportation sailings and changed to BDI. And the percentage of the China sailing in the BDI will increase with the boom of China economy and its increasing impact on the dry bulk market.

As shown in the figure, the fluctuation of BDI since Sep 2002 is more obvious than the previous years and has attracted the attention the global dry bulk cargo owners and carriers. What worth mentioning is that, since Chinese dry bulk trade plays an

important role on demand and supply in the dry bulk market, correlating with the fluctuation in China trade, there are sharp rises and falls of the BDI index in the dry bulk market.

Take the year 2004 for example, with the surge in the China iron ore imports, BDI reach rocket high of 5681 points in Feb. 4, 2004, and when China then economic restriction policy to ease down over investment, the BDI drop1000 point in a month in April China stop a Tieben 8million tons steel plant project on the Yangtze river delta, and knocked down to 3286 points in May 31, with a fluctuation of 2395 points in just three months, and that is 17 percent. And the BDI then rose when China start import soybean, export grain and increase iron ore import from Australia.

Then Along with the slowdown of China economy, the cool of China real estate heat, which directly lead to significant drop in the demand for major dry bulk, the BDI bottom to the lowest point 1732 in July 2005. And later the rapid increase in the China iron ore, steel volume leads to pick up of BDI since then.

Though BDI fluctuated with the China market fluctuation, for a long period perspective, with the steady growth of economic in China, the market will be more stable. Since the net increase of world iron ore volume to a large extent is from China, the development of the China steel industry will still have an important impact on the BDI.

3.1.2 Charter Rates

The balance of demand and supply has a direct impact on the freight rate. Since Demand is affected by world economy, while supply is affected by size and

availability of the global fleet, the orderbook or investment, the unbalance in demand and supply may lead to the fluctuation of the market which will then reflect in the freight rate. Figure 3-2 shows 12 months time charter rates in dry bulk shipping market.

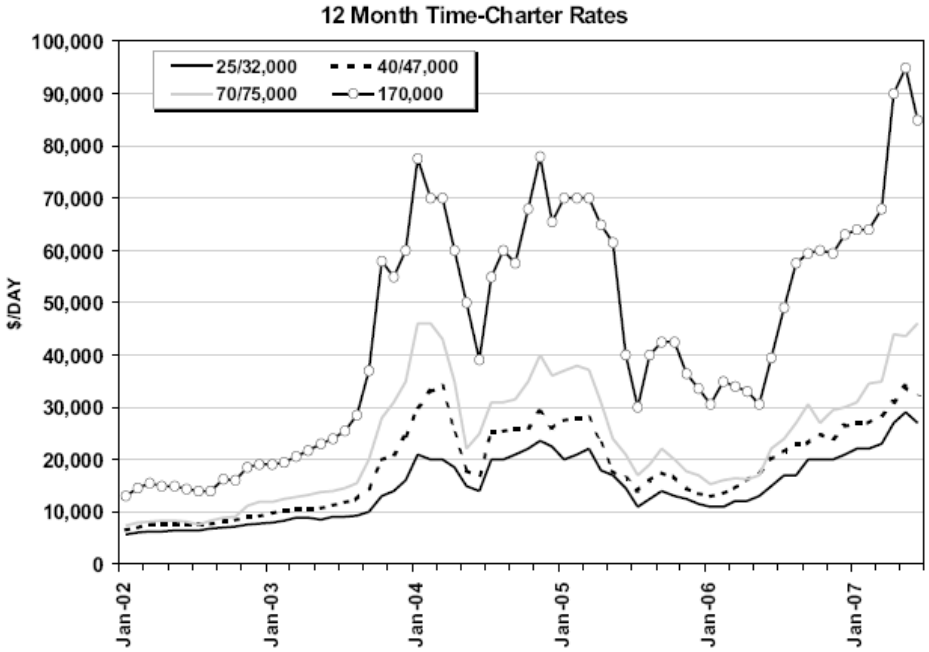

Figure 3-2 12 Month Time-charter Rates (2002-2007)

Source: SSY Monthly Shipping Review 6 July 2007

The figure above shows the 12 months time charter rates of four major type of vessel in dry bulk shipping, that is capesize(170,000 DWT), panamax(70/75,000 DWT),handymax(40/47,000 DWT) and handysize(25/32,000). Capesize, panamax, are mainly transport the major bulk cargo like iron ore, coal and grain which account for 67% of the dry bulk trade while handysize, handymax are mainly transport minor bulks like steel fertilizer, sugar, cement which account for 33% of the dry bulk trade. And there are several major trade routes, 70% of the iron ore is transported from Australia & brazil to China, Japan and Europe, coal is mainly transported from

Australia and Canada to far east , Europe while Grain are mainly transported from US Gulf, Brazil or Argentina to Europe and to the Far East.

The significant in the increase of growth rate of dry bulk trade demand driven by the strong industrial economic development in China Southeast Asia and India has lead to the all time high of freight rate. What worth mentioning is that the sustain and rapid growth of the China iron ore import cause the short supply of fleet, result in the unprecedented high in dry bulk freight market, especially in the capesize market. Figure 3-3 shows the capesize rate for Brazil to China, and West Australia-China.

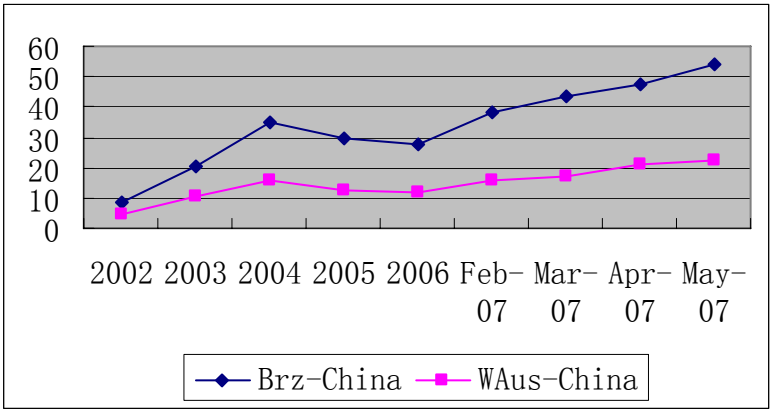

Figure 3-3 capesize rate for Brazil to China, and WAus-China (2002-2007, $/mt)

Source: Drewry Dry Bulk Forecaster 1Q07; Drewry Dry Bulk Insight 07.3-07.6

The figure shows that the rate is on the rise in recent years. And in respect of the monthly market situation in recent two years, if the China iron ore import increase, then the market especially the capsize market will on the rise , if the China iron ore import volume relatively stable or on the stage of temporary adjustment, then the market will be stable or on the downward trend. So the trend of capsize shipping market is in line with the trend of Chinese import of iron ore. For example, the

excess demand in 2004 lead to the all time high to BDI, while the BDI decline with the supply surplus in 2005 and the first half of 2006 and then rebound in the second of 2006 when the demand increase.

To ship owners the surge in freight rates means big fortune, which can be see in table. Table 3-1 shows the percentage of the actual one year time charter rate in the required one year time charter rate.

Table 3-1 the actual and required rate 1 year T/C for dry bulk carrier (End of May 07, USD/Day)

	Actual	Required	Actual in % of req.
NEWBULIDING			
Handymax 53,000	41500	16100	258.00%
Panamax 75,000	43000	17400	246.80%
Capesize 170,000	97000	30500	318.20%
5 YEARS SECOND-HAND			
Handymax 53,000	40000	21100	190.00%
Panamax 70,000	42000	23700	177.20%
Capesize 170,000	96000	38800	247.20%
10 YEARS SECOND-HAND			
Handymax 45,000	39000	19600	198.70%
Panamax 70,000	40000	23100	172.90%
Capesize 170,000	82000	34500	237.30%

Source: Fearnleys Monthly Report May 2007

Assumptions: 25 years lifetime. Interest: 10% on total investment, and normal operating/docking expenses. Based on end of current month values and demoliton prices. Operating days: 355 for NB, 5 Years S-H. 350 for 10 Years S-H

The table above shows that compared with the required daily operational cost, the shipowner makes a big fortune in operating the dry bulk fleet in recent years, especially in capesize vessel. Such a big profit leads to the increase of new orders, deliveries, the rise of ship prices etc., which will be discussed later.

3.2 The China factor effect on the dry bulk shipping

3.2.1 Increase demand for dry bulk carriers

It is worth noting that China is related with global shipping capacity shortage, because the increase of ships coming to China and the decrease of ships to other countries leads to the rise of freight rate and supply shortage.

Just take the China iron ore as the base for analysis, as the rapid growth of China iron ore imports became a decisive factor for the market. According to the statistics of IISI, from 2001 to 2003, the import of China iron ore increased by more than 100%, which is 73.8 million tons in volume.

In consideration of the average transportation distance of China iron ore import, it means that 12 million tons DWT are needed, equal to the annual operating of six voyages of 72 capesize vessels.In respect of the fleet supply, from 2001 there are 14 million tons of new capsize deliveries, and 3.4 million scarps, so the actual market fleet supply is 10 million DWT, which can not even meet the demand of China.Take the year 2004 for example, the number of new capsize deliveries is expected to be 35, that is 5.8 million tons, the dismantling is 1.3 million DWT, so the net market fleet growth is 4.5 million DWT, the growth of China iron ore import is 20 million tons, the fleet demand is 3.3 million tons, in such circumstance, there only left 1 million

DWT for other growth of demand.[7]

And expert predict that by 2010 the demand for the dry bulk fleet will be over 68.5 million DWT, accounting for 22% of the world fleet demand, and China iron ore fleet demand will rise to the third in the world. Undoubtedly, large amounts of new dry bulk vessels are needed with the strong growth in the demand of dry bulk fleet so as to meet the rapid growth demand in the imports of mineral resources, which means a good opportunity for the world shipping industry.[8]

And the large demand for raw materials in the industrialization of China, the surge imports lead to serious port congestions of specialized terminal for iron ore, coal and grain. High China iron ore import leads to the port delays in Australia which can be seen in Figure 3-4

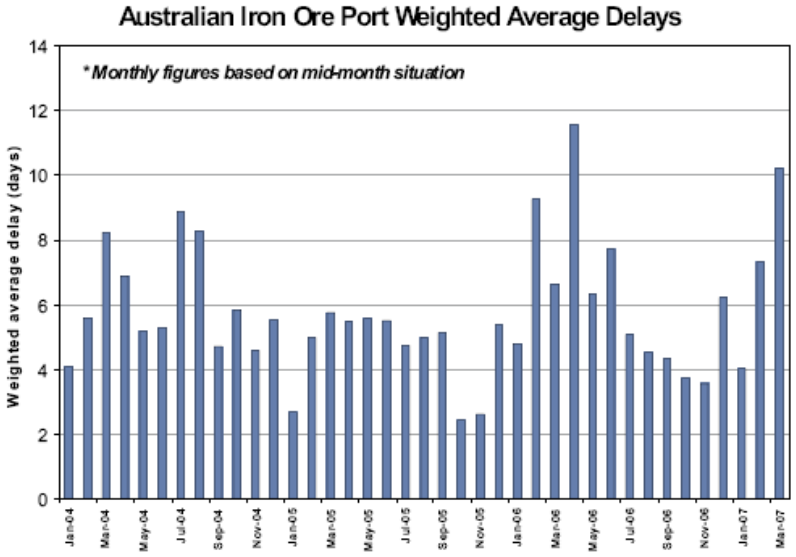

Figure 3-4 Australian Iron Ore Port Weighted Average Delays

Source: SSY Monthly Shipping Review 14 March 2007

[7] Fearnleys Monthly Report Mar. 2007
[8] Fearnleys Monthly Report Mar. 2007

With such a situation of port congestions and delays, there is a trend of longer distance in the import of iron ore. China mainly imported iron ore from Australia and India, but now China also import cargo from Brazil and South Africa which also means the increase demand of bulk carriers. One thing to mention is that with the sustain growth of China iron ore imports, and the decrease of grain in the percentage of the dry bulk market, the dry bulk market is less affected by seasonal factors cause by grain.

3.2.2 Boom shipping building and low scrapping

With the boom of dry bulk market, the increase in dry bulk trade volume means demand for additional dry bulk carriers, the big profits in freight rates make shipowner what more ships to operating, all of which leads to increase in new orders and deliveries, which can be seen in table 3-2

Table3-2: dry bulk new orders, total order book and deliveries (2002-2006,mdwt)

		2002	2003	2004	2005	2006
Handysize	New orders	0.8	0.5	0.4	0.3	2.2
	total orderbook	0.9	1.2	1.2	1.7	1.9
	deliveries	1.0	0.5	0.7	0.7	0.6
Handymax	New orders	3.5	3.3	2.0	1.5	9.1
	total orderbook	9.0	10.6	13.5	15.7	21.9
	deliveries	4.7	3.4	5.2	6.5	5.8
Panamax	New orders	4.4	9.2	4.8	2.2	6.4
	total orderbook	7.1	20.2	24.8	21.7	19.6
	deliveries	4.6	2.1	6.3	7.1	8.8
Capesize	New orders	8.4	5.3	6.6	4.3	17.5
	total orderbook	13.4	15.5	24.3	25.4	36.7
	deliveries	3.5	4.4	7.4	8.8	10.9

Source: Drewry

The table shows the sharply increase of new orders in recent years. Though new

order increase, the capacity of the ship yard is limited, this leads to the surge of new building prices.

And it also lead to the quick developing of ship building industry, take China for example, the share of China in the world ship building increase from 5% to 10%.

China economy is becoming the strong momentum of the world shipbuilding industry, which is benefiting a lot from the sustain economic growth in China. In the first six months in 2006, a total of 139 new vessels of capesize, panamax and handymax launch into the market, with a fleet increase of 12.7 million DWT. But it may cause excessive supply with such a trend.

It can be seen from the table that the orders increase significantly from 2003. This is because the prosperity of the dry bulk market, the all way long climb of the BDI and the high rate of investment return attract the rapid capital flows to the bulk carrier ship building market.

The rapid development of the China dry bulk market also leads to the domestic dry bulk fleet expansion. As UNCTAD maritime transportation review 2006 and 2005 reported, the China bulk carrier by flag of registration is 13340 million DWT in dec31,2004 and increase to 14353 million DWT in jan1 2006, while the world bulk carrier is 320584 million DWT and 345924 million DWT during the same period. What worth mentioning is that COSCO operating dry bulk vessel of 321, 18372675 total DWT in 2005, ranking the first in the world bulk carrier companies.

Compare with being passive in line with market change, China bulk carriers can to some extent dominate and control the market and the influence of China bulk carrier

on the global market has been enhanced markedly. And China shipyard show significant growth momentum in dry bulk carrier building.

In respect of demolition, with the rise in freight rate, many ship owners put the ships which are mean to be scrap into operation so as to make profit. If the price of the scrap market is high, then ship owners will choose to old ship into operation. So the number of demolitions vessel is decreasing by the year, just as table 3-3 shows

Table 3-3: dry bulk demolitions (2002-2006 ’000 dwt)

	Handysize	Handymax	Panamax	Capesize
2002	1556	938	1200	997
2003	597	1103	465	248
2004	113	0	95	123
2005	109	165	202	247
2006	475	380	539	296

Source: Drewry

One thing worth noting is that the increasing delivery of new ships and the decreasing demoliton leads to the increase in dry bulk supply capacity, and to some extent it just causes overtonnage which will then cause a negative effect on the market.

3.2.3 Active second hand transaction

Beyond the increase in the increase of new orders, deliveries, the all time high of freight rate in dry bulk market which trigger by China factor also leads to the active

in second hand market. The second hand activity is increasing, and changes with the fluctuation of the dry bulk market, just as Figure 3-5 shows.

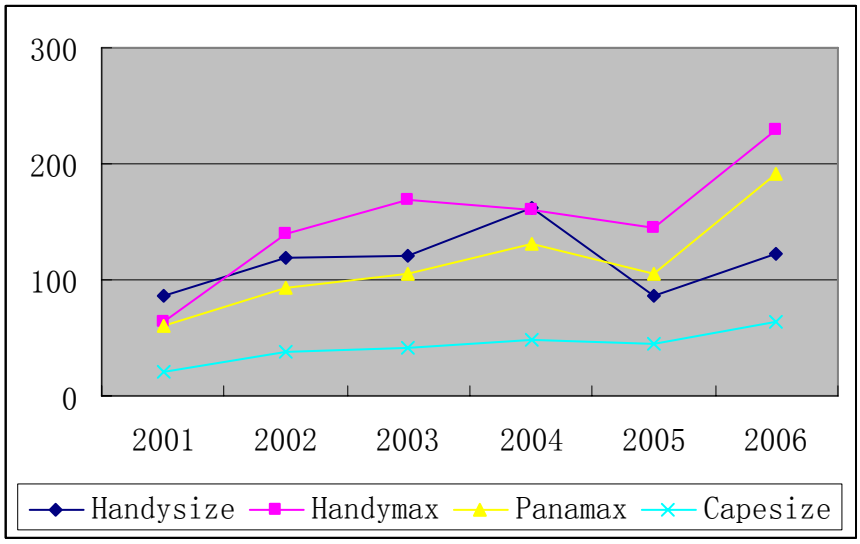

Figure 3-5 second hand sales activity in number (2001-2006)

Source: Drewry

There are several reasons. On one hand, because building new ships takes time, ship owners rush to the second hand ship market. It is the demand of quick delivery that leads to the increase of second hand prices. One thing worth mention is some of second hand ships price are even higher than new building prices, which can be seen in Figure 3-6

Another reason for the boom of second hand ship market is that dry bulk shipping market is a highly competitive market with low entry threshold. In such a business diversification market, operators from other industry may involve in the ship purchase when the market is boom, for example many real estate companies in China involved in the dry bulk shipping market.

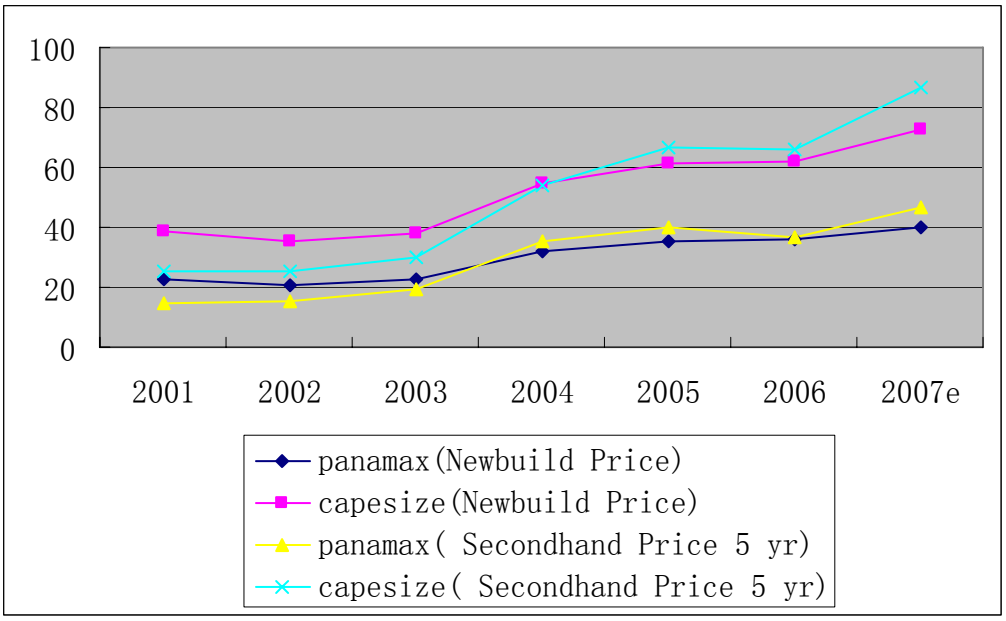

Figure 3-6: new building and second hand price for capsize and panamax (2001-2007e $ million)

Source: Drewry

One more reason is that large ship operators may expand the size of the enterprises by mergers or acquisitions which also lead to the boom of second hand shipping market.

What's more, some ship owners may sale their ships to make a profit when the market is boom.

3.3 The China factor effect on shipowner and cargo owner

Dry bulk shipping is a capital intensive industry, though ship owners gain good profit when the market is boom. But when the market is down, since the supply of the dry bulk carrier is relatively inelastic the ship owners are unable to adjust the market supply capacity with such a change. In particular, the larger trend of ships more

easily leads to excessive capacity and increase the management risk and possibility of loss. The freight owned in depression may not even compensate for the large of cost.

And the rise in the new building market means larger investment cost. To some extent, with the effect of China factor, the relevant market players have started to adjust there business strategies:

Two thirds of the world iron ore transport is controlled by steel giants who have global marketing network, specialized terminals and a logistic system. In order to ensure the transportation of raw materials and control costs, the purchase or charter in some dry bulk fleet so as to be initiative in dealing with shipowners and control the market.

In order to adapt to changing situation and improve the bargaining power, shipowner alliances which normally focus on one certain type as the core component so as to control one specific market have been gradually increasing.

As the product of dry bulk market development, such a joint venture which can control the supply capacity of the market and may lead to the wide fluctuation in the market will be a trend of the dry bulk market development.

There also a trend of bilateral cooperation between shipowners and big cargo owners. For the cargo owner, such cooperation can ensure the stability of cargo flow and avoid market risks to some extent, while for shipowners, sign long term COA contract and forge strategic partnership with cargo owners will make sure the stability of cargo demand.

3.4 casual relationship analysis of the China factor effect

The dry bulk shipping market, composed of demand, supply and other related factors as a system, the change of one element in the system will affect the change of the whole system. Casual relationship analysis in this section so as to analysis the effect of China factor.

As mentioned before, the China economy growth lead to the increase in China international trade volume, especially demand for raw materials like iron ore, coal and grain which support the economic development of China.

The surge demand for dry bulk cargo, then generate the prosperity and new rising cycle in dry bulk market and the rise in freight rate. When such a rise trend is relatively certain, then vessels which sealed because of market pressure will again put into operation, shipowners may invest in the second hand ship market, which then drive up the price of the second hand ships, when the price rise to some extent, then shipowner may found it is more economic to build ships and divert cash to the new shipbuilding market. And vessels to be dismantled resume production if possible.

So when the demand in the market present long term growth trend, first seal idle vessels come to the market, next the second hand ship market, then the shipbuilding market, finally the scrap market will all be affected .But with the seal, idle or new vessels put into operation and the reduction in the scrap vessels, the supply capacity increase rapidly which may lead to an oversupply situation. Following such a trend, maybe a long period later , then the spot market would decline, and then spread to the second-hand vessels, shipbuilding, demolition market

Chapter 4 The quantitative analysis of China factor effect on the dry bulk market

4.1 model selection

4.1.1 Grey system theory and grey correlation analysis

Grey system theory was first raised by domestic professor Ding Julong in 1982. The theory is widely applied in agriculture, transportation, meteorology, engineering, transport, economic, medical care, etc., and now further widely applied to related fields like information, electronics, electrical, aviation, and commercial.

In general, grey system theory mainly use systematic correlation analysis and model building, effectively addressing with "uncertainty"," variables input ", "discrete" and "data incomplete " to forecast and understand the system when the system is not clear or the information is incomplete.

With its simple calculation and the capability to solve problems in management areas when the information is incomplete or uncertain, the grey system theory is widely applied in studies of management decision-making areas.

Grey correlation analysis is one of the most important methods adopted in grey system theory. It is a calculation method that analysis the correlation of discrete sequence in the grey system. Since it base on the change of various factors to analysis the trend, grey correlation analysis do not requires large amount of data as samples or the samples require good distribution. Though it required small amount of computation, the results of the grey correlation analysis is usually the consistent with that of the qualitative analysis.

The relevant of the factors which change with time or other objects in two systems is know as correlation. In the development process of such a grey system, higher degree in the consistency of the change of the two factors means higher degree of correlation. Therefore, grey correlation analysis method, is based on the similarity or difference in the development trend so as to measure the extent of correlation of the factors analyzed.

4.1.2 Traditional grey correlation model

Suppose a sequence set $X_i(n) = \{ x_i(1), \ldots x_i(n) \}$ And i=0, 1, 2…m $\in$ N meet the following three conditions:

Firstly, all the factors measured must be normalized

Secondly, the factors in the sequence must belong to the same class or order, or the difference must on be greater than two grades.

Thirdly, the factors in the sequence have the same direction

The sequence are comparable suppose meet the three conditions. Since the inconsistent of the direction of the factors may lead to the incorrect of results and the not entirely linear conversion of the sequence may cause the distortion of the sequence, so it is necessary to standardize the data before calculation. Suppose there are one original sequence and several comparison sequences, then a matrix called grey correlation matrix can be constructed, holistic analysis and contrast the relationship of the various factors. And we can also sort the result so as to see the correlations of the comparison sequences with the original.

The basis calculation method can be stated as follows:

Suppose the original sequence is $X_0 = \{ x_0(t)$, t =1, 2… n$\}$,

and the comparative sequence $X_i = \{ x_i(t)$,t=1.2,…,n, i=1,2,…,m $\}$,

Then the grey correlation coefficient of X_i with X_0 at point t can be defined as:

$$\zeta_i(t) = \frac{\min\limits_i \min\limits_t \Delta_i(t) + \rho \min\limits_i \min\limits_t \Delta_i(t)}{\Delta_i(t) + \rho \min\limits_i \min\limits_t \Delta_i(t)},$$

In this formula, $\Delta_i(t) = | x_0(t) - x_i(t) |$ is the absolute margin

$\rho \in$ (0, 1) is the distinguish coefficient which is used to enhance the correlation difference between the coefficient was significant, and it is normally valued at 0.5.

When the grey correlation coefficient is calculated, then the grey correlation is the average of the grey correlation coefficients, namely,

$$r_i = \frac{1}{n} \sum_{t=1}^{n} \zeta(t)$$

But the traditional grey correlation has many drawbacks:

Firstly, since relevant factors like the standardization of the original sequence, the sequence length, the value of the distinguish coefficient will have effect of the result of the grey correlation, then the may change with the change of the relevant factors. Secondly, as mentioned different distinguish coefficient may produce different grey correlations. Thirdly, the traditional method only reflects the positive correlation, but not the negative ones. Fourthly, if the distinguish coefficient is equal to 0.5, then the grey correlation will always more than 0.333, but the fact is that the grey correlation of the relevant sequence may be negative or less than 0.333.

4.1.3 Improved grey correlation model

The improved grey correlation model is actually base on the relative change of the factors so as to get the correlation between the indicators and the objectives. It effectively covers the lack of the traditional grey correlation model and analysis the correlation more effectively.

The method can be stated as follows:

Suppose the original sequence is $X_0 = \{ x_0(t)$, t =1, 2, …, n},

and the comparative sequence $X_i = \{ x_i(t)$,t=1.2,…,n, i=1,2,…,m },

Step 1, cumulated minus the X_0 with X_i in the two sequences

$$y_i(t+1) = x_i(t+1) - x_i(t)$$

$$y_0(t+1) = x_0(t+1) - x_0(t) \qquad (t = 1, 2, \ldots, n-1) \qquad 4\text{-}1$$

Step 2; calculate the relative of change rate k

$$k_i(t+1) = \frac{y_i(t+1)}{\overline{x_i}} \qquad \overline{x_i} = \frac{\sum_{t=1}^{n} x_i(t)}{n}$$

$$k_0(t+1) = \frac{y_0(t+1)}{\overline{x_0}} \qquad \overline{x_0} = \frac{\sum_{t=1}^{n} x_0(t)}{n} \qquad 4\text{-}2$$

Step3, calculate the correlation $\zeta_i(t)$ and r_i of X_i with X_0

$$\zeta_i(t) = \pm \frac{1}{(1+ \| k_i(t) | - | k_0(t) \|)} \qquad 4\text{-}3$$

If $y_i(t)$ and $y_0(t)$ is both negative or positive, then set $\pm$ as "+", if not ,set $\pm$ as"—",if $y_i(t)$ or $y_0(t)$ is zero, then treat it as positive.

$$r_i = \frac{\sum_{t=2}^{n} \zeta_i(t)}{n-1} \qquad 4\text{-}4$$

So the negative or positive of r_i shows the relationship of the two variables. If r_i >0, then X_0 and X_i is positive correlation, the increase or decrease of X_0 will lead directly to the increase or decrease of X_i, if r_i <0, then X_0 and X_i is negative correlation, the increase or decrease of X_0 will lead directly to the decrease or increase of X_i. In this way, r_i is no longer a relative value, but an absolute one, such improvement lead to a more widely application in related industry.

4.2 The grey correlation analysis of the world three major dry bulk cargos

4.2.1 Data selection

Since the three major dry bulk account for majority of dry bulk cargo and show the main trend and development in dry bulk shipping. so the analysis in this section focus on the analysis of the dry bulk volume of the three major dry bulk cargoes in recent years so as to find the evolution of their correlation with the total major dry bulk cargo shipment volume.

Table 4-1 shows the volumes of the three major dry bulk cargoes in recent years.

X_0 is the world total major dry bulk seaborne trade volume

X_1 is the world iron ore seaborne trade volume

X_2 is the world coal seaborne trade volume

X_3 is the world grain seaborne trade volume.

Here the world total major dry bulk seaborne trade volume, iron ore, coal and grain seaborne trade volume are treated as a grey system, X_0 is the original sequence,

X_1, X_2, X_3 are three compare sequences. Then the analysis can be done as follows.

Table 4-1 three major dry bulk seaborne trade volumes (1988-2011e, in million tonnes)

Year	Major Bulk	Iron Ore	Coal	Grain
1988	842.2	342.4	303.8	196
1989	870.8	362	313.8	195
1990	867	347	328.0	192
1991	908.1	358	350.1	200
1992	903.49	337	358.5	208
1993	894.67	352	349.7	193
1994	931.7	380	367.7	184
1995	995.4	402	397.4	196
1996	1016.6	392	431.6	193
1997	1082.8	428	451.8	203
1998	1090.1	427	467.1	196
1999	1088.7	402	466.7	220
2000	1189.9	448	516.9	225
2001	1237	451	552.0	234
2002	1298.9	484.3	570.0	244.6
2003	1383	524	619.0	240
2004	1485.3	586.9	650.0	248.4
2005	1588.1	660.1	675.0	253
2006	1684.6	721.6	701.0	262
2007e	1744.2	756.2	724.8	263.2
2008e	1801.7	787.7	739.0	275
2009e	1860.2	813.2	765.0	282
2010e	1927.3	848.3	790.0	289
2011e	1991.5	886.5	808.0	297

Source: 1988-2004 Clarkson Research Studies 2005

2005-2011 Drewry Dry Bulk Forecast 4Q06

4.2.2 Model applied

Firstly, set the data of the world major dry bulk seaborne trade volume from year 1988 to 2011 as the original sequence X_0, and the data during these period in X_1, X_2, X_3 as compare sequences, calculate the correlation of the three major dry bulk with the total volume during the same period.

Step 1, use formula 4-1 $y_i(t+1) = x_i(t+1) - x_i(t)$ (t =1,2, …,n-1) i=0,1,2,3, cumulated minus the original data in Excel, the result of cumulated margin is show in table 4-2.

Table 4-2 cumulated margin for annual major dry bulk trade volumes (1989-2011e)

Year	X_0	X_1	X_2	X_3
1989	28.6	19.6	10	-1
1990	-3.8	-15	14.2	-3
1991	41.1	11	22.1	8
1992	-4.61	-21	8.39	8
1993	-8.82	15	-8.82	-15
1994	37.03	28	18.03	-9
1995	63.7	22	29.7	12
1996	21.2	-10	34.2	-3
1997	66.2	36	20.2	10
1998	7.3	-1	15.3	-7
1999	-1.4	-25	-0.4	24
2000	101.2	46	50.2	5
2001	47.1	3	35.1	9
2002	61.9	33.3	18	10.6
2003	84.1	39.7	49	-4.6
2004	102.3	62.9	31	8.4
2005	102.8	73.2	25	4.6

2006	96.5	61.5	26	9
2007e	59.6	34.6	23.8	1.2
2008e	57.5	31.5	14.2	11.8
2009e	58.5	25.5	26	7
2010e	67.1	35.1	25	7
2011e	64.2	38.2	18	8

Step 2, calculate the relative change rate. For sequence X_i ={ $x_i(t)$,t=1.2,…,n}, just as stated in 4.1.3 use formula $\overline{x_i} = \frac{\sum_{t=1}^{n} x_i(t)}{n}$ to calculate its average and use the formula $k_i(t+1) = \frac{y_i(t+1)}{\overline{x_i}}$ to calculate the relative change ,follow the formula 4-2 in 4.1.3 and calculate it in Excel, the result is show in table 4-3.

Table 4-3 the relative change rate of major dry bulk volumes (1989-2011e)

Year	X_0	X_1	X_2	X_3
1989	0.022371	0.03764	0.018902	-0.00437
1990	-0.00297	-0.02881	0.026841	-0.01312
1991	0.032148	0.021125	0.041774	0.034978
1992	-0.00361	-0.04033	0.015859	0.034978
1993	-0.0069	0.028806	-0.01667	-0.06558
1994	0.028964	0.053772	0.034081	-0.03935
1995	0.049825	0.042249	0.05614	0.052467
1996	0.016582	-0.0192	0.064646	-0.01312
1997	0.051781	0.069135	0.038183	0.043722
1998	0.00571	-0.00192	0.028921	-0.03061
1999	-0.0011	-0.04801	-0.00076	0.104933
2000	0.079157	0.08834	0.09489	0.021861
2001	0.036841	0.005761	0.066347	0.03935
2002	0.048417	0.06395	0.034024	0.046346
2003	0.065782	0.076241	0.092621	-0.02011

2004	0.080018	0.120795	0.058597	0.036727
2005	0.080409	0.140575	0.047256	0.020112
2006	0.075481	0.118106	0.049146	0.03935
2007e	0.046618	0.066447	0.044988	0.005247
2008e	0.044976	0.060494	0.026841	0.051592
2009e	0.045758	0.048971	0.049146	0.030606
2010e	0.052485	0.067407	0.047256	0.030606
2011e	0.050216	0.07336	0.034024	0.034978

Step 3, use the formula 4-3 $\zeta_i(t) = \pm \frac{1}{(1+\| k_i(t) - \| k_0(t) \|)}$ in 4.1.3, calculate the grey correlation in Excel, the result is shown in table 4-4

Table 4-4 the grey correlation rate of the three major dry bulk volumes (1989-2011e)

Year	X_1	X_2	X_3
1989	0.98496	0.996544	-0.98232
1990	0.974816	-0.97669	0.989958
1991	0.989097	0.990465	0.997178
1992	0.964578	-0.9879	-0.96958
1993	-0.97856	0.990322	0.944569
1994	0.975793	0.99491	-0.98972
1995	0.992481	0.993725	0.997366
1996	-0.99738	0.954141	-0.99655
1997	0.982941	0.986584	0.992006
1998	-0.99622	0.977316	-0.97571
1999	0.955187	0.999661	-0.90593
2000	0.990901	0.984511	0.945809
2001	0.969857	0.971339	0.997497
2002	0.984705	0.985811	0.997933
2003	0.989649	0.973862	-0.95633
2004	0.96082	0.979029	0.958505
2005	0.943248	0.967911	0.943132
2006	0.959117	0.974341	0.965129
2007e	0.980557	0.998372	0.960272

2008e	0.984719	0.982189	0.993427
2009e	0.996797	0.996623	0.985074
2010e	0.985297	0.994798	0.978589
2011e	0.977379	0.984066	0.98499

Step 4; use the formula 4-4 $r_i = \frac{\sum_{t=2}^{n} \zeta_i(t)}{n-1}$ in 4.1.3 to get the grey correlation of the three major dry bulk world seaborne trade volumes with the world major dry bulk seaborne trade volume from the year 1988 to 2011.

The result is that r_1=0.720466, r_2=0.813562, r_3=0.385013

Since the above grey correlation shows the overall trend from since the year 1988, in order to further analysis the grey correlation in recent years, select the grey correlation from the year 2000 to the year 2006, the result of the grey correlation of the three major dry bulk world seaborne trade volume with the world major dry bulk seaborne trade volume of this period is: r_1=0.971185, r_2=0.976686 r_3=0.693097

4.2.3 Result analysis

The grey correlation of the three major dry bulk seaborne trade volume with the world total major dry bulk volume shows that during the period of 1988 to 2011 shows that iron ore and coal are the most two important dry bulk cargoes, the effect of which surpass that of the grain.

And the grey correlation of the period 2000 to 2006 shows that the correlation of iron ore is increasing, which means that the impact of iron ore on the dry bulk market is more obvious in recent years, such an effect may be triggered by the surge in the imports of China.

Just as mentioned in the chapter2, China account for majority of the annual net increase of world iron ore and dry bulk trade in recent years. And driven by the demand from China, the boom in the dry bulk market also leads to the steady increase of grain seaborne trade, the grey correlation of which is also increase in recent years.

4.3 grey correlation analysis of China main dry bulk trade

4.3.1 China iron ore imports grey correlation analysis

Since iron ore is the main factor that contributed to the growth of dry bulk shipping, and China's import of iron ore have a decisive impact on the international dry bulk shipping market, in this section, improved grey correlation model is applied to quantitative analysis the correlation of China with the world iron ore imports.

Table 4-5 is the annual iron ore imports volume of the world main iron ore importers from 1996 to 2007.The import volumes of the year 1980,1985,1990,1995 is also selected.

Table 4-5 the iron ore import volume of world main iron importers (in million tones)

Year	World	China	Japan	South Korea	EU 15
1980	387.3	5.8	133.7	9.1	134.2
1985	377.5	10	124.5	13.2	133.9
1990	399.3	14.3	125.3	22.6	140.4
1995	439.2	41.2	120.4	35.1	143.3

1996	444.2	43.9	119.2	34.5	129.3
1997	476.3	55.1	126.6	38.6	134.7
1998	471.5	51.8	120.8	33.6	145.9
1999	443.6	55.3	120.1	35.4	127
2000	485.5	70	131.7	39	138.7
2001	501.5	92.4	126.3	45.9	123.1
2002	531.3	111.4	129.1	43.3	127
2003	559.9	148.2	131.4	43.1	126.7
2004	635.5	208	133.7	44.5	135.5
2005	700.6	275.2	132.3	43.5	131.9
2006	762.1	326.3	134.3	43.9	138.1
2007	840.3	400.8	131	43.9	145.1

Source: SSY Monthly shipping review

IISI Steel Statistical Yearbook 2006

In order to detail analysis the correlation of China iron ore imports volume with the world total iron ore import volumes, the period is selected into two parts, one is from the year 1980 to 1999, and the other is from the year 2000 to 2007.

Following the same steps just as show in 4.1.3 in Excel, the grey correlation rates of the four regions is shown in table 4-6

Table 4-6 grey correlation rates of the main importers (1985-1999)

Year	China	Japan	South Korea	EU 15
1985	-0.91048	0.951022	-0.88898	0.979822
1990	0.931711	0.957622	0.776474	0.997058
1995	0.594193	-0.94944	0.736688	0.933262
1996	0.93788	-0.99806	-0.99012	-0.91639
1997	0.801074	0.985306	0.931961	0.966189
1998	0.922507	0.965555	0.855481	-0.93359
1999	-0.96522	0.944063	-0.99993	0.931119

And then the grey correlation of the four region iron ore import volumes with the world total iron import volume from 1980 to 1999 is: China: 0.330238, Japan: 0.408009, South Korea 0.060225, EU 15:0.422496

Following the same step, the grey correlation of the four region iron ore import volumes with the world total iron import volume from 2000 to 2007 is: China: 0.871814, Japan: 0.138345, South Korea 0.104995, EU 15: 0.144397

The above grey correlations show that during the period 1980 to 1999, Japan and EU15 play a major role on the world iron ore market, while the correlation of China with the world in the iron ore import during this period is not so obvious. Then from the period 2000 to 2007, China has a close correlation with the world iron ore market, and the correlation of the other three regions is relatively small.

This result consistent with the qualitative study done in the previous chapters, China has been the driving force of the world iron ore import market and has a close correlation with the world iron ore market.

4.3.2 China coal imports grey correlation analysis

Coal is a major cargo in the dry bulk transportation and China is a large coal producing and exporting country. Since China exports more steam coal than coking coal every year, so the grey correlation analysis focus on the analysis of grey correlation of the China steam coal exports volume with the world total steam coal exports. Table 4-7 is the main countries of steam coal annual export volume from the year 1988 to 2007.

Table 4-7 main steam coal export country annual export volumes (1988-2007 in million tones)

Year	world	USA	Australia	South Africa	Colombia	Indonesia	China
1988	150	19.2	43.7	39.2	10.1	1	12.4
1989	160	23.3	43.1	42.8	12.5	2.5	12.4
1990	179.4	28.3	49.5	46	13.7	4.4	13.7
1991	191	33.7	54.5	43.8	16.4	7.6	16.2
1992	204	29.8	58.3	47	14.6	16.1	19.7
1993	194	18.7	57.6	51.7	17.8	18.2	15.5
1994	211	17.1	59.4	54.8	18.4	21.9	19.3
1995	249.7	28.2	62.1	55.6	18.7	31.3	18.9
1996	267	28.6	63.6	59.7	24.8	36.4	20.1
1997	282	19.3	73.6	64.2	27.6	41.7	22.3
1998	298	15.1	83	60.6	30.1	47.2	24.6
1999	305	9.8	79.2	62.8	29.9	55.3	29
2000	344.2	9.6	87.1	68.1	34	57.1	48.6
2001	389.9	8.6	88.1	68	37.1	66.5	78.6
2002	403.8	5.3	99.9	68.2	35.3	73.2	70.6
2003	442.3	3.3	105.2	70	44.4	88.7	80.6
2004	484	6.3	108.3	66.7	51	105.1	80.8
2005	508.2	5.4	111.7	70	54.6	128.7	66.4
2006	569.1	5.9	113.2	67.8	58.3	182.5	58.9
2007	592.8	9.1	116.9	61.9	66	198.4	41.6

Source: Clarkson Research Studies 2005 SSY Monthly shipping review

In order to detail analysis the correlation of the China steam coal exports with the world, the analysis is separated into three parts, first is the year from 1988 to 1993, second is from the year 1994 to 1999, and the third is from the year 2000 to 2007.

Following the same steps of the methods just use in the previous in Excel, the results is shown in table 4-8

Table 4-8 grey correlations of the major steam export countries (1988-2007)

Year	USA	Australia	South Africa	Colombia	Indonesia	China
88-93	0.498988	0.590123	0.200245	0.192097	0.443019	0.902284
94-99	-0.14297	0.548318	0.577508	0.531104	0.909088	0.574652
00-07	-0.14233	0.945329	-0.11868	0.665411	0.910546	-0.14138

The above figures in the table show that the ranking of the grey correlations of the major steam export countries with the world from the year 1988 to 1993 is China > Australia > USA > Indonesia > South Africa > Colombia, from the year 1994 to 1999 is Indonesia > South Africa > China > Australia > Colombia> USA and from the year 2000 to 2007 is Australia > Indonesia > Colombia > China > USA > South Africa. One thing worth mentioning is that USA have a really negative correlation with the world, the grey correlation during the period 2000 to 2005 is -0.5288

The ranking show that the grey correlation of China steam coal with the world show a downward trend. This shows that steam coal, as one of the main dry cargo export of China, the export volume of which has declined with the increase domestic demand in the industrialization process.

4.4 Conclusion

This chapter use improved grey correlation method to quantitative analysis and confirm the extent of the impact and changes China factor on the international dry bulk market. And the results of the grey correlation analysis are co insistent with the analysis done in the previous chapter. It shows that grey correlation analysis is an effective method of analysis the impact of China on the dry bulk shipping market, further studies can be done to analysis the future trend of the correlation of China with the world by forecasting volumes.

Chapter 5 The outlook of the China factor effect on the future dry bulk market

5.1 China future trade development

5.1.1 Economy development

With the relatively stable growth of global economy and the industrialization of developing countries, especially China and India, dry bulk market is present a trend of stable growth. Economy is a main factor affects the dry bulk volume change. Sustain rapid economic growth of China means increased demand for raw materials and then the tremendous demand in dry bulk shipping and the capacity expansion of iron and steel industry are stimulated by the growth of world economy

In general, the world economy develop stable in recent years. According to the IMF forecast in April 2007 World Economic Outlook, the global growth will moderate to 4.9%,that is 0.5% less than 2006, and the growth of China will ease moderately but keep the pace in 2007 and 2008.

Since the dry bulk cargoes are mainly industrial raw materials in international trade, the growth of demands is mainly from the world's industrial production growth. Therefore, the world overall economic environment and national industrial development can to some extent determine the future dry bulk demand trend. The composite lead indicator, which accurately forecast the short-term industrial production change, can be considered as one of the main factor to predict short dry bulk trade volume. The indicators published by OECD are on the historical high

level, the general trend of the current economy development is optimistic and the international dry bulk market is on the stage of favorable development.

What worth mentioning is that, instead of grow in a straight line, there may some volatility in the Chinese economy. Since now China's economy development is in transition which may last about 5 to 10 years, then when the economy of China moves toward maturity, then the demand growth trend will change and the speed of economy growth will slow down and get moderated and step into long term steady growth. So China will maintain its important position on the dry bulk market for a long time period.

5.1.2 Dry bulk trade development

China has contributed enormously to the rising of dry bulk market in recent years and will continue to be so, the reasons can be stated as follows:

Firstly, as the general rule in trade development cycle, the trend of the increase in the import of industrial raw material will remain until the completion of the industrialization process and will stabilize or lower afterwards. So as one of the largest developing country, China will still maintain large potential of long term development.

Large amount of infrastructure construction in China's process of modernization, industrialization and urbanization will continue for a long period, which means huge demand for productions like steel and imports of iron ore and other major bulk cargo. The China government is strive to make the long term stable and healthy

development of economy and important industry like steel by implementing scientific economic and industrial development policy.

Secondly, it is infrastructure development, national projects such as high way system, electricity grid be the direct demand fro iron ore, and other core commodities, but not driven by consumers. What's more, the urbanization process evolution, the 2008 Olympic game, the 2010 world expo will create huge potential demand for dry bulk shipping.

Thirdly, though in consideration of the heated economic growth, China follow steps to soft land it and have implement policies to cool down industries like real state, steel, cement, and aluminous so as to keep the economy on the right track.

In short term such restriction policies may have slow the heating sentiment in dry bulk freight market, on the long term it will help maintain a healthy demand level in the market and the industry will benefit from China's continuous strong growth.

What's more, the ministry of commerce would foresee an average annual trade growth rate of about 10% in the following five years. And as forecasted by the state information center, the investment growth rate of China will decline slightly and stably. But the economy will remain in a high growth and low inflation trend under the marco control of central government. So instead of the repetition of the irregular fluctuations from 2003 to 2005, the market will grow in a stable and sustainable trend which also means great opportunities. In the long run, the China dry bulk seaborne trade will volume will on the trend of rise and China will play a sustainable important role on the dry bulk market.

5.2 China iron ore and steel development

Since iron ore and coking coal, which account for more than half of dry bulk trade volume, have direct relationship with steel industry, so the development of steel industry is crucial to the dry bulk market development.

As The International Iron and Steel Institute(IISI) in the short range outlook 2007 shows, though the growth rate will be lower than 2006, the world steel output is 5.9% and 6.1% respectively in 2007 and 2008. IISI foresee that China will still be the world largest market with the strongest growth, and its output will account for 35% of the world in 2008. So the demand for steel will continue to grow with the acceleration of the China industrialization process.

And according to the estimate of the State Development and Reform Commission and the Chinese Academy of engineering, the demand for steel in 2010 will be 340 million, and peaked in 2015 with 350 million tons, then the demand will be stabilized or lower slightly, and it may decrease slightly to 320 million tons in 2020. As a result, the import of iron ore will increase significantly due to the shortage of domestic raw materials, it also means sustain increase in the demand of dry bulk cargo shipment.

But most of the iron ports have port congestions, if the potential pressure can not be alleviated, then China would consider import steel directly instead of iron ore, which will change the current iron ore demand driven pattern. The reform pace of the China steel industry would change China’s future demand for raw material imports.

And there exists some problems in the rapid development of China steel industry in recent years. How to settle these problems are key to the healthy, stable and rapid

development of the China steel industry and also vital to the development of dry bulk market.

China is now in a period of heavy industry with continuous development and the shortage of raw materials and serious shortage of energy like electricity has restricted China economic development for a long time, how China solve the bottleneck problem would affect the development of the global shipping industry. Whether China and the world economy and trade would sustain the high raw material and freight rate prices is still a problem. And China seems do not willing to be too dependent on imported energy and alternative energy which may not need sea transport such gas and oil pipeline may be considered. With its cheap price coal may be alternative energy and be promising for volume growth.

Whether China will keep or limit it iron ore import growth rate and correct its fast expansion in steel industry is a problem. But some experts predict that demands for demand for necessities like oil, coal, steel ,ore and grain will grow significantly in the next 20 years. By 2020, China's demand for energy will reach 3.1 billion tons of coal, accounting for 13.2% of the global total, which means 60% of the volume of America, 3.29 times than that of India, seven times than that of England. With the process of China's electrification, the generating capacity of China in 2020 will be expected to the total of west Europe.[9]

In general, China raw material imports for steel industry is expect to stabilize but still play an important role on the dry bulk shipping market and the trade will increase though the growth rate will slow down

[9] Yang Peiju (2004) "China Factor" offers a new proposition for the international shipping industry. *China Ship Survey,* 2004.V.08 P 20-23

One thing worth mentioning is that Indian may have the potential to be new driving force in the dry bulk market with its coal import grow annual 15% toward 2013 and the expansion of steel production capacity in the industrialization process

5.3 Risks

The supply of fleet in the international dry bulk market was mainly affected by the seaborne trade volume, the freight rate, the shipbuilding and scrap market. Excessive new orders in recent years leads to the excessive of deliveries and the fast growth of fleet supply, which lead to the imbalance of fleet demand and supply, such a balance will still exist in review of the new orders in the two years and the sustain growth of dry bulk supply. Table 5-1 shows the supply and demand of dry bulk fleet in recent years.

Table5-1: the supply and demand of dry bulk fleet capacity (2002-2011e, mdwt)

Period Averages	Average Supply	Total Demand	Surplus/ (Deficit)
2002	293.4	249.3	44.1
2003	307.3	269.1	38.2
2004	327.4	297.5	29.9
2005	351	317.2	33.8
2006	372	334.9	37.1
2007e	393.3	351.2	42.1
2008e	410.3	362.7	47.6
2009e	424.9	377.2	47.7
2010e	438.6	394.9	43.7
2011e	450.8	406.7	44.1

Source: Drewry

The soaring in demand for coal, iron ore from China simulate the investment in new

ships. Since the change of fleet supply is the result of the change of new deliveries, scraps, and idle ship volume change and the speed of new ships add to the market. The fleet growth is faster than the growth of the demand will cause short term volatility. And excessive supply may destroy the balance of shipping demand and supply

Since dry bulk is event driven and has the nature of cyclicality and volatility. In retrospect, the Short term prosperity in 1970s, many shipowners around the world rush to build panamax, leading to the growth of supply is two times than that of demand. And the decrease in demand leads to the bottom down of the market and accelerate fleet scrapping

Right now, just as the table above shows, with large bulk carrier into the market the serious short supply situation has been eased and increase in the investment of new ships may just lead to over tonnage. But large numbers of new ship orders, and the yards are in full capacity and there are contracts even signed for the year 2011 shows that the players in the market are expected a positive outlook, there still exists uncertainty and investment risk as in such a transitional economy no one knows when the demand will fall. What’s more, there are also risks like the slow down of global economic in an economic cycle, environment concern .or the change of government policy.

So we should be mindful while the economy is in a transitional change and have a well thought of the market as the lesson of the previous shipping market cycle shows that oversupply is pain. In general, the outlook of China factor on the international dry bulk market is positive and though may be with vitality, but the trend of impact is sustained.

Chapter 6 Summary & Conclusion

So the overall China factor effect can be show from the follow figure6-1

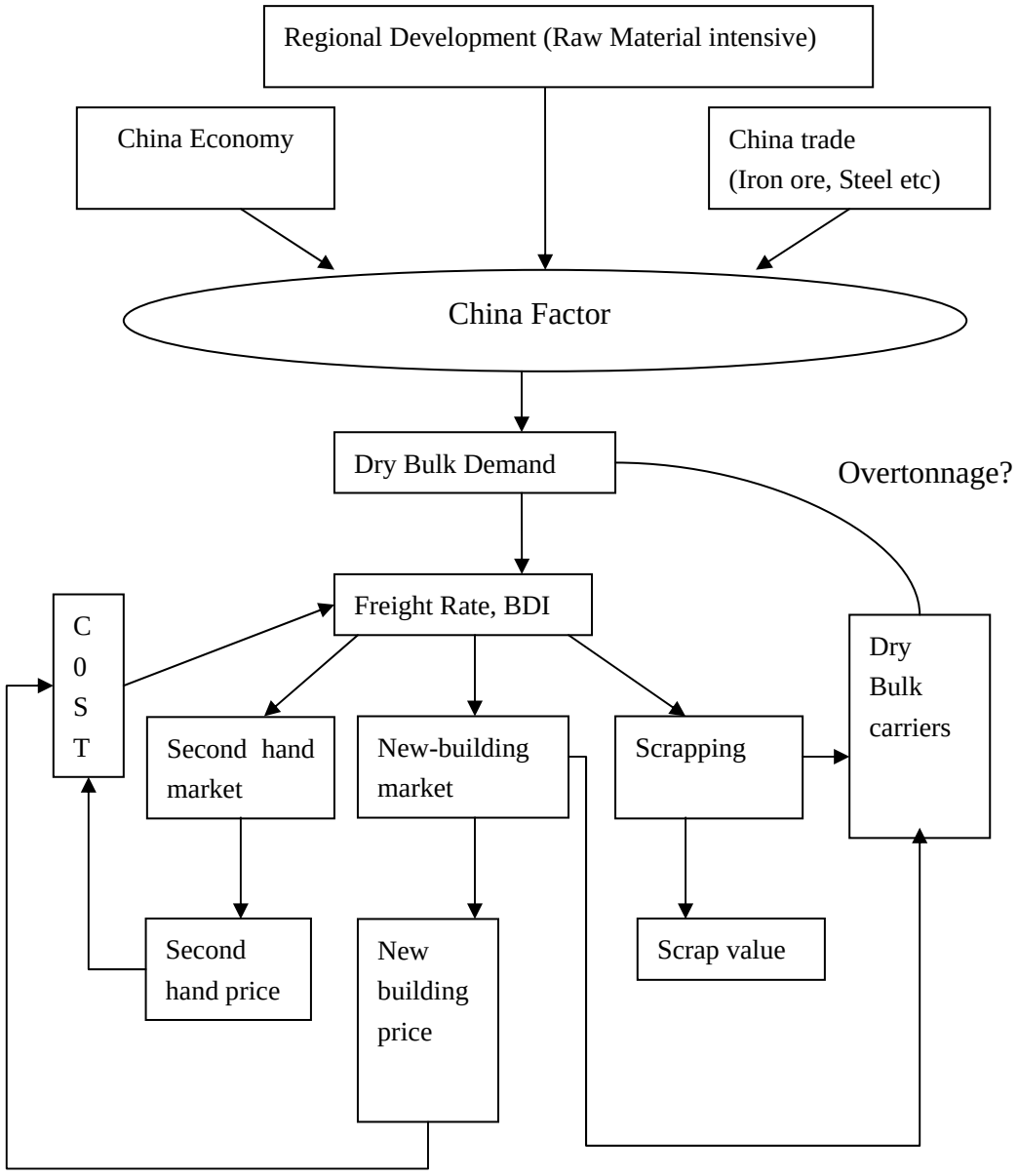

Figure 6-1 China factor effect

With such an important role China factor play on the international dry bulk market, it is better for related parties to fully understand the industrialization process of China

and its rule of development pay close attention to the development of China economy. How to fully utilize China factor so as to increase its international competitiveness is an important issue for domestic dry bulk related party to study.

For the domestic dry bulk carrier operators, pay attention to the effect China factor on the dry bulk market, make full use of the location advantage and good relationship with government and domestic cargo owners so as to expand the scale of the company, upgrade management level, increase its share in the international dry bulk market, and increase its core competitiveness.

For domestic cargo enterprises, fully aware of the tremendous effect China factor on the market, avoid market risks participate in port or shipping operation and cooperation, stabilize supply chain and low operational cost.

Since International dry bulk market is a large and complex system, the development of which is affected and constrained by many factors, such as natural environment, technological development, world economy, politics etc. In this paper, the study is mainly base on the analysis of the China and world dry bulk trade volume, the demand and supply of the market without the consideration of the above factors in the quantitative analysis.

It is worth mentioning that China factor brings not only great opportunities, but also risks, how to effectively avoid and control the risks becomes a major concern for the market. As part of the international shipping industry, the dry bulk market in short term is very uncertain which may be affected by any sudden politic, economic and natural disasters. So risks and risk control and prevention analysis may be more practical for further study.

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