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WORLD MARITIME UNIVERSITY



Shanghai, China

**The trend analysis and short-term forecasting of
CCBFI**

By

Lulu Cao

China

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

2014

DECLARATION

I certify that all the material in this research paper 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 research paper reflect my own personal views, and are not necessarily endorsed by the University.

Signature: Cao Lulu

Date: 25th Jun 2014

Supervised by:

Professor Meifen Hu

Shanghai Maritime University

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ABSTRACT

Title of research paper:**The Trend Analysis and Short-Term Forecasting of CCBFI**

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

As the barometer of coastal transport market, China Coastal Bulk Freight Index (CCBFI) reflects the change trend of the freight of China coastal shipping market. It is the tool of government to control the market, also a way to obtain the shipping market information for the shipping company, shipowner, trading company, port, agency and related departures.

This dissertation is aimed at studying China coastal shipping market, analysis and forecast of China Coastal Bulk Freight Index. The dissertation summarized the influence factors of CCBFI based on the introduction of CCBFI and analysis of various bulk cargo markets, especially the current situation of supply and demand of China coastal coal and iron ore shipping market. Based on that, in order to provide some useful information for the shipping company, shippower and any other related departments, the EViews soft used in this dissertation to built ARIMA model to make a CCBFI short-time forecast.

Keywords: CCBFI, China coastal dry bulk shipping market, Supply and demand, ARIMA model, Forecast

Table of Contents

DECLARATION	I
ACKNOWLEDGEMENT	II
ABSTRACT.....	III
LIST OF TABLES.....	V
LIST OF FIGURES	VI
LIST OF ABBREVIATIONS.....	VII
1. Introduction	1
1.1 Backgrounds of dissertation	1
1.2 Literature Review	3
1.3 The Framework and Content.....	4
2. Analysis of International Dry Bulk Shipping Market	5
2.1 Review of Global Economic	5
2.2 Review of Chinese Economic	6
2.3 Recent International Market of Dry Bulk Shipping Market	7
3. Introduction of China Coastal (Bulk) Freight Index	9
3.1 Definition and Method of CCBFI.....	9
3.2 The Functions of CCBFI.....	11
4. Analysis of Influencing Factors of CCBFI.....	13
4.1 Review 2013 China Coastal Dry Bulk Freight	13
4.2 Volume Analysis of Chinese Coastal Dry Bulk in 2013.....	16
4.3 Capacity Analysis of Chinese Coastal Dry Bulk in 2013	19
4.4 Review Chinese 2014Coastal Dry Bulk Shipping Market.....	20
4.5 Analysis of Factors Influencing the Fluctuation of CCBFI	23
4.6 Comparison of Relationship between CCBFI and BDI.....	30
5. Validation of ARIMA Model	31
5.1 The Establishment of ARIMA Mode.....	31
5.2 Specific Application of CCBFI ARIMA (p,d,q) Model	34
6. CCBFI Short-term Forecast by using ARIMA.....	41
6.1 Extrapolation Forecast for ARIMA model – Static Prediction	41
6.2 Extrapolation forecast for ARIMA model – Dynamic Prediction	42
6.3 ARIMA Model’s Extrapolation Predicted and True Value Comparison....	44
6.4 Disadvantages of ARIMA model’s extrapolation forecast	44
7. Shipping Companies’ Business Decisions based on CCBFI.....	45
7.1 China Shipping Company Case	45
7.2 Major Shipping Enterprise Operating Conditions Overview	46
8. Conclusion	48
References.....	50

LIST OF TABLES

Table1	IMF reports about growth rate of global economic and trade	05
Table2	Growth rate of Chinese main economic indicator	06
Table3	2012 and 2013 International dry bulk shipping market	08
Table4	Example routes with various ships of CCBFI	10
Table5	Results of ADF test	35
Table6	Test d index	36
Table7	Estimation of ARIMA (2,1,2)	38
Table8	Values of five future predictions	43
Table9	Static predictive value and dynamic predictive value	44
Table10	The profit of coastal dry bulk shipping companies in 2013	47

LIST OF FIGURES

Figure1	Three years trend comparison of BDI	08
Figure2	Three years trend comparison of CCBFI	13
Figure3	China coastal coal freight index in recent years	14
Figure4	China coastal metal ore freight index in recent years	15
Figure5	China coastal food freight index in recent years	16
Figure6	Volume of coal of domestic transportation in Chinese major ports	17
Figure7	Throughput of ore in Chinese coastal ports	18
Figure8	Throughput of food in Chinese coastal ports	19
Figure9	Capacity of domestic coastal dry bulk ship	20
Figure10	Growth rate of GDP in each industry	21
Figure11	Internal trade throughput of main coastal ports	22
Figure12	Trends of CCBFI	23
Figure13	Flow chart of ARIMA model	33
Figure14	Sequence diagram of CCBFI	34
Figure15	New sequence diagram	36
Figure16	Index's autocorrelation and partial correlation function diagram	37
Figure17	ARIMA (2,1,2) model	40
Figure18	ARIMA (2,1,2) model static prediction results	41
Figure19	Scatterplot of comparative between static and actual predictions	42
Figure20	Results of ARIMA (2,1,2) dynamic prediction	42
Figure21	Comparison between dynamic value and predicted value	43

LIST OF ABBREVIATIONS

BCI	Baltic Capsize Index	01
BPI	Baltic Panama Index	01
BHMI	Baltic Handy-size Index	01
CCBFI	China Coastal Bulk Freight Index	02
BIFFEX	Baltic International Freight Futures Exchange	03
GDP	Gross Domestic Product	06
BDI	Baltic Dry Index	07
BSI	Baltic Exchange Supramax Index	08
BFI	Baltic Freight Index	09
IRF	Impulse Response Function	30

1. Introduction

1.1 Backgrounds of dissertation

As is known to all, dry bulk is commonly raw materials of industrial production, which is the basis of world economic development; its transportation relies mainly on the sea. Dry bulk market, therefore, has become an important part of the shipping market, is a service market that between ship owners and traders in service object for carriage of goods by sea.

In the world trade, 85%-90% of goods are transported by sea, what's more, the international dry bulk shipping market is an important part of international shipping market, and its shipping demands accounted for about a third of the world's total shipping. The dry bulk demand of international shipping market is composed of iron ore, coal, grain and some other small dry bulk, among them, iron ore, coal, grain, those three types of dry bulk is the main part of the international dry bulk shipping market demand, accounting for about 60% of the international dry bulk shipping weight. The development of the international dry bulk shipping market is closely related with the development of world economy and trade change, therefore, iron ore, coal, grain of three large dry bulk trade, in the world economy and trade and the international shipping market occupies very important position.

Depending on the type of dry bulk, shipping market is divided into capsized, panama and handy-size. The Baltic exchange's, according to the above classification method also issued a different type of dry bulk freight index, respectively capsized ships dry bulk freight index (BCI), panama ship dry bulk freight index (BPI), handy-size ships dry bulk freight index (BHMI). These three kinds of freight index are "Barometer" reflecting the dry bulk shipping market.

In recent years, the coastal bulk cargo transport market in China has developed rapidly both in terms of deadweight tonnage of ship investment, or freight and relevant professionals have reached the highest level in history. Accompanied by the rise of a large and specialized crude oil, ore, coal terminal, large-scale younger trend of fleet size, and the appearance of private shipping enterprise, etc., the contradiction between supply and demand of capacity of the China coastal bulk cargo transport market has become more competitive. At the same time, bulk cargo transportation, is a special risk industry, which will be influenced by the national policy, economic fluctuation and natural factors. These characteristics are the same as the international dry bulk market.

To reflect comprehensively the coastal change of the freight transport market in our country, to adapt to the water price system reform needs new tools to depict objective of the development and change of market demand, in order to be conducive to the healthy and orderly development of coastal transportation market, the Ministry of Communications in November 2001 in Shanghai launched China Coastal Bulk Freight Index (CCBFI). Five years later, in order to adapt to the new changes of domestic coastal bulk cargo transportation market, as of May 18, 2007, China Coastal Bulk Freight Index opened a new plan. Up to now, China Coastal Bulk Freight Index has been running for nearly 13 years. In the past 13 years, China Coastal Bulk Freight Index has influenced increasingly inside and outside as the role of market “Barometer”. How to correctly use China Coastal Bulk Freight Index can help shipping companies to grasp market pulse, formulate and adjust the management decision-making, judgment enterprise development direction and development space, to enhance their competitive ability, to ensure that the operating earnings, to guard against operational risks effectively? Many scholars at home and abroad pay more attention to the international dry bulk shipping market; a lot of people have researched the Baltic dry index, analysis and prediction. For China

Coastal (Bulk) Freight Index prediction research is less, mainly in coastal bulk cargo transport market week, month ratings and reports.

1.2 Literature Review

Dry bulk shipping market research is quite widespread, in the 1930s, the Dutch economist Tinbergen and Koopmans has studied the econometric model of shipping market, Tinbergen studied demand and impact on freight shipping supply, Koopmans studied the rate change rule, found that when the low level of freight, shipping supply price elasticity is very good, and when the freights is very high, the elasticity of supply became very insufficient.

Cullinane in 1992, one of the method of time series analysis is first B-J for BFI forecast, in order to obtain the BIFFEX freight index futures operation advantages, the forecast model of ARIMA (3,1,0). 1995 Veenstra and Franses using higher time series econometrics with process and the method of unit root test, published by henriette van niekerk different dry bulk ship type, the different routes of the freight index time series, first-order vector autoregressive model VAR (1) is used to predict. In 2001, the British scholar MAnolis G Kavussanos and Amir h. Alizadeh-m to create a single variable integral Seasonal autoregressive moving average model (Seasonal ARIMA-SARIMA)/multivariate Seasonal product and season cointegration (Seasonal) Cointegrating vector autoregressive (VAR) model to study of index, and Seasonal fluctuation in the dry bulk shipping market characteristics are obtained.

2001 Zhang Lingong, Chen Guyuan concept introducing market comprehensive factors, quantitative research and prediction index of international shipping market, from the perspective of the supply of freight, comprehensive analysis of shipping freight and market factors and the function relationship between transformation trend. 2002 Zhang Lingong various prediction models are discussed, and the various

prediction models for the applicability of the shipping market forecasting are discussed, respectively, of the international dry bulk shipping market supply, demand and freight forecast, integrated the three forecast conclusion, it is concluded that the dry bulk shipping market forecast conclusion as a whole. He Yingjie (2002) established a time series T*S*C*I and ARIAM model, analyzed the freight index, points out the index of the long-term growth trend, cycle fluctuations and the characteristics of seasonal fluctuations. Zhu jian and Li Meilong analyzed the data of the Baltic dry bulk freight index from the year of 2003 to the year of 2005 using the methods of residual test to select the most models. Zhang Lanfang in 2005 on the elements of the international dry bulk shipping market theory research, analyzes the elements of the markets is the link between each other, using virtual variable regression model to solve the capacity demand and world economic development, the quantitative relationship of change, the ARCH model is established for fitting index variation rule, it is concluded that the index variation rule.

1.3 The Framework and Content

The main goal of this paper is to introduce the CCBFI and forecast the CCBFI. The discussion started with a brief introduction of current international dry bulk shipping market, followed by an introduction of CCBFI's background, method of establishment and functions, then a discussion about the influencing factors of CCBFI's fluctuation. Next chapter is an introduction of the ARIMA model, which is used to forecast the CCBFI, and in the chapter 6, using the ARIMA model to forecast CCBFI. In chapter 7, taking some examples to illustration the decision making of shipping company based on the CCBFI. In the end, a conclusion and recommendation would be given.

2. Analysis of International Dry Bulk Shipping Market

2.1 Review of Global Economic

Throughout the world, the increase of global major economics shows slow down in 2013. IMF released a report that in 2013 global economic growth rate was 2.9%, which decreased 0.4% comparing to last year's rate 3.3%. In 2012, developed economic growth rate was 1.2% only, which was lower than the last year's rate 1.3%. As for emerging economies, under obsession of overall external demand weakness and internal structural problems, the economic growth also fell significantly in 2013, which was 4.5% only, decreased 0.8% comparing to previous year's growth rate. Among those data, Chinese economic growth rate was 7.6% in 2013. It was the most stunning performance in major economies even though growth rate was 0.2% lower than the rate of last year. The main risks of global economy including Asian geopolitical security risks and substantial shock of international financial market, which is caused by the United States exit the quantitative easing policy.

Table1 IMF Reports about Growth Rate of Global Economic and Trade

Fiscal Year	2009	2010	2011	2012	2013	2014(F)
Global Output	-0.6	5.1	3.9	3.2	2.9	3.6
Advanced Economies	-3.2	3.0	1.7	1.5	1.2	2.0
US	-2.4	2.4	1.8	2.8	1.6	2.6
Euro Zone	-4.1	2.0	1.5	-0.6	-0.4	1.0
Emerging Markets and Developing Economies	-0.9	7.4	6.2	4.9	4.5	5.1
China	9.1	10.4	9.3	7.7	7.6	7.3
India	5.7	10.1	6.3	3.2	3.8	5.1
Global Trade Volume	-11.9	12.6	6.1	2.7	2.9	4.9
Import						
Advanced Economies	-13.7	11.4	4.7	1.0	1.5	4.0
Emerging and Developing Economies	-9.5	14.9	8.8	5.5	5.0	5.9
Export						
Advanced Economies	-13.6	12.0	5.7	2.0	2.7	4.7
Emerging and Developing Economies	-7.2	13.7	6.8	4.2	3.5	5.8

(F): Predicted Value

2.2 Review of Chinese Economic

In 2013, in the slow recovery of international economy, Chinese macro-economic made remarkable perfect results. Chinese macro-economic policies developed base on two main approaches, which are scientific development and transformation acceleration, and also base on improving the quality and efficiency of economic. According to the data, which was published by the National Bureau of Statistics Jan 20, 2014, annual GDP was RMB 56.8845 trillion, calculated at comparable prices, increased 7.7% comparing with last year's GDP, increased 7.5% in the second quarter, 7.8% in the third quarter and 7.7% growth in the fourth quarter. Chinese economic "troika" of export demand rebounded. The annual growth rate of import and export trade was 7.6% this year and 6.2% last year, which was speed up by 1.4%. Export growth rate was 7.9% this year, which was boost by 3.6% than previous'. Fixed assets investment growth rate was 19.6%, decreased 1% comparing previous same periods. Social consumption growth rate was 13.1%, decreased 1.2%. The main risks of Chinese economy are excessive growth of bank credit, expansion of debt and local bubble house prices will burst.

Table2 Growth Rate of Chinese Main Economic Indicator

Items	2009	2010	2011	2012	2013	2014(F)
GDP Growth	8.7	10.3	9.2	7.8	7.7	7.5
The Growth of Investment in Fixed Assets	30.1	23.8	16.1	20.6	19.6	20
Investment in Real Estate Development	16.1	33.2	20.0	14.9	19.8	—
Import and Export Growth	-13.9	34.7	22.5	6.2	7.6	—
Import	-11.2	38.7	24.9	7.9	7.3	—
Export	-16	31.3	20.3	4.3	7.9	—

(F) Predicted Value

2.3 Recent International Market of Dry Bulk Shipping Market

In 2013, the international dry bulk shipping market continuing dominated by excess capacity, showing the bottom of swings upward trends. The volatility of BDI was mainly affected by Cape Ship market. Two strong rebound waves, which started at September, made the majority of people believe that the worst period of shipping market is over. BDI fluctuated between 698 and 2337 points. 698 point at opening year Jan 2 became the lowest point of the whole fiscal year and 2247 point at ending period, which close to the highest point in the whole year. Annual average point is 1204, increased 282 points (30.6%) comparing to last year's index.

International dry bulk market showed a float trend in the first quarter 2014. Under the support of Cape Ship market, this year first quarter performance of international dry bulk market was better than the performance of last year same period. Market activity also significantly improved over the previous three years, which beyond the traditional off season expectations. In support of optimistic outlook forecast, time charter market transactions active and prices rise continually became important factors, which support and lead the spot market.

Meanwhile, the market showed the feature that different ships and different parts were comparatively differentiation. Capesize market was the most active market, and also, foreign mine expansion contributed to the increase of import transactions. However, because the insufficient domestic demand of coal trade, internal and external prices upside down and sluggish performance, and also due to lack of anchoring in South American as well, food trade support the market becomes weakness, the boat market is relatively weak. The first quarter mean BDI closing at 1371 points, 574 points higher than the same period last year's increased by 72%. It was the highest point since the same period in 2011. But since late March, BDI started to adjust after the market demand overdraft. Iron ore, coal and soybean

inventories increased and hoarded, which caused by early concentrate imports. Coupled with downward pressure on macroeconomic, market confidence was under attack. There was a significant market correction trend, BDI points was fell from 1621 points Mar 20 to 930 points on Apr 17, decreased 42.6%.

BDI Three Year Trend Comparison

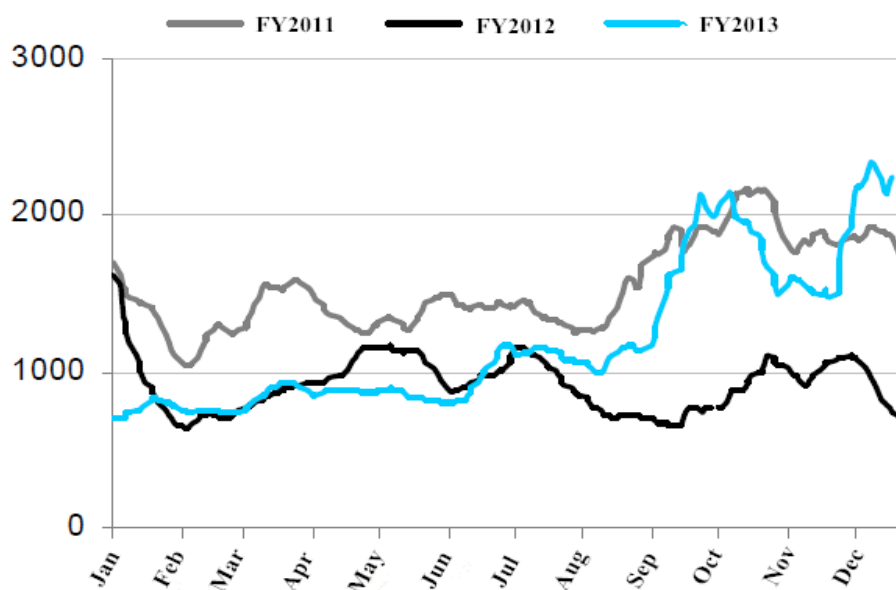


Figure1 Three Years Trend Comparison of BDI

Table3 2012 and 2013 International Dry Bulk Shipping Market

Items mean	BDI	BCI	BPI	BSI	Average rent of Capesize ship routes	Average rent of Panamax ship routes	Average rent of Supramax ship routes
2013	1024	2019	1184	981	14562	9467	10280
2012	922	1567	965	904	7718	7689	9454
Comparison (%)	11.1	33.8	22.7	8.5	88.7	The change is same as the Index	

3. Introduction of China Coastal (Bulk) Freight Index

3.1 Definition and Method of CCBFI Establishment

Freight index is defined by the ratio of shipping market price in a period and the freight in the baseline period. It is used to reflect the dynamic changes of the level of shipping freight.

In order to reflect the dynamic changes level of China coastal bulk freight, China Coastal (Bulk) Freight Index (CCBFI) was officially launched in Shanghai Shipping Exchange in November 2001. CCBFI in January 2000 as the base, the base index was 1000 points. According to the importance of the principle, choose the types of goods which listed the top of five of bulk cargo throughput in China port as type sample of coastal cargo freight index, including coal, crude oil, refined oil, metal ores and grain. Based on the volume size, taking into account the regional coverage and considering the future development of the route, it selected 18 sample routes for CCBFI. There are 17 shipping companies to provide freight information. Every Friday, Shanghai Shipping Exchange estimates and releases the integrated freight index and 18 routes index.

For purpose of adapting to the major change in coastal bulk cargo transport of domestic market, in May 18, 2007 the Shanghai Shipping Exchange was officially opened a new scheme to prepare freight index. The new compilation scheme was adjusted in aspect of the type of ship, the shipping route, the sample firms, the weight, the form of releasing and the time and other aspects, making the new index reflects the market more accurate and more objective, and highlighting the timeliness, characterization and practicability of the index. After adjustment, the sample routes increased from 18 to 21, more shipping companies (27) provide freight information. Shanghai Shipping Exchange publishes the information in ever Wednesday. In July 12, 2011, the eighth plenary meeting of China Coastal (Bulk) Freight Index

Committee examined and adopted the second reform scheme for China Coastal (Bulk) Freight Index. CCBFI adjusted and optimized the routes, the type of ship, and the expansion of sample firms. Since December 7, 2011, China Coastal Coal Freight Index was published in daily. The integrated index was issued in each Friday. The new plan with specific content as follows:

1. Base period

Along China Coast (Bulk) Freight Index in January 2000 as the base, the base period index at 1000 points.

2. Cargo, route and the ship

Five kinds of goods are included in the CCBFI, which is coal, ore, grain, refined oil and crude oil. The routes and the ships include:

Table4 Example Routes with Various Ships of CCBFI

Coal	From Qinhuangdao to Guangzhou (50,000-60,000DWT)
	From Qinhuangdao to Fuzhou (30,000-40,000DWT)
	From Qinhuangdao to Ningbo (15,000-20,000DWT)
	From Qinhuangdao to Shanghai (40,000-50,000DWT)
	From Qinhuangdao to Zhangjiagang (20,000-30,000DWT)
	From Tianjin to Shanghai (20,000-30,000DWT)
	From Tianjin to Zhenjiang (10,000-15,000DWT)
	From Huanghua to Shanghai (30,000-40,000DWT)
	From Jingtang/Caofeidian to Ningbo (40,000-50,000DWT)
Grain	From Dalian/Jinzhou to Guangzhou (20,000-30,000DWT)
	From Yingkou to Shenzhen (40,000-50,000DWT)
Iron Ore	From Qingdao/Rizhao to Zhangjiagang (20,000-30,000DWT)
	From Beilun to Zhenjiang (30,000-40,000DWT)
	From Zhoushan to Zhangjiagang (5,000-10,000DWT)
Refined Oil	From Dalian to Guangzhou (30,000-40,000DWT)
	From Dalian to Nanjing (5,000-10,000DWT)
	From Tianjin to Wenzhou/Taizhou (2,000-5,000DWT)
Crude Oil	From Ningbo/Zhoushan to Nanjing (30,000-40,000DWT)
	From Ningbo to Shanghai (30,000-40,000DWT)
	From Guangzhou to Nanjing (30,000-40,000DWT)

3. Freight information collection

There are 38 companies to provide freight information, such as Changhang Phoenix CO.Ltd., Dalian Wantong Logistics CO. LTD., Dalian Haidakuize Trade CO. LTD., and Dalian Yuanchang Shipping CO. LTD.

4. A method of publishing

Shanghai Shipping Exchange released China Costal (Bulk) Freight Index, commodity index, routes index and the freight of main routes.

3.2 The Functions of CCBFI

Since the reform and opening up in 1978, sustained and the rapid development of Chinese economy formed a strong demand for iron ore, coal and grain and other resources, and build a solid foundation for the dry bulk shipping demand growth. China costal bulk shipping market is developing rapidly. The pattern of the monopoly that few medium-sized coastal bulk shipping companies was broken, a lot of local shipping companies and private shipping companies have to participate in the competition in coastal bulk cargo market. Facing the increasingly fierce market competition of coastal transportation, the freight is the most direct and sensitive benchmark to reflect the changes of supply, demand and price trend in the market.

For the government, CCBFI is an important basis for judging the trend of industry development, grasping the supply and demand situation of the whole shipping market even the related markets from the volatility of in the freight of shipping market trend, making scientific planning and macroeconomic regulation and control policy, standardizing the order of the shipping market.

For shipping companies, through CCBFI can capture market information timely, grasp the domestic coastal transportation market trends and the changes in the price level, and adjust their freight level and the management strategies to adapt to the changing market with the freight fluctuation. Based on the CCBFI, the charterers can

understand the trends of shipping market. Trying to put themselves in a favorable position in the future trades, they reduce the costs so that promote the deals and get more profits. Shipowners are based on market analysis and forecasting to develop practical freight and avoid blind bargain. In accordance with the market trends and with the purpose of acting an active position and obtaining the better economic benefits, shipowners adjust the distribution of routes and develop new business strategies and ship purchasing plans.

For the foreign trading, energy, finance and other related industry, CCBFI is an important indicator of the degree of prosperity of shipping market, and it also is one of tools to making trade negotiations and bidding projects. The shipper can know the information of shipping market freight fluctuation according to the value of CCBFI and calculate a proper and correct cost of the imported and exported goods when they having trade negotiations. It will avoid and reduce the economic loss brought by the incorrect judgment of freight.

4. Analysis of Influencing Factors of CCBFI

4.1 Review 2013 China Coastal Dry Bulk Freight

4.1.1 2013 Coastal Dry Bulk Freight Roses Rapidly

In 2013 coastal dry bulk freight continued downturn during the first half of the year, there was a rapid rise after six months. The early stage of the overall volatility is relatively flat, late volatile. The excess capacity decreased and the demand in the peak months raise sharply is the most important factor of the rise of the freight.

As of December 2013, an average of China Coastal (Bulk) Freight Index issued by Shanghai Shipping Exchange is 1100.26 points, with basically the same as in 2012, down narrows 10.92 percentage points. The minimum value in 2013 is 963.3 points in July 26th, the highest value of 1444.46 points in December 6th, a difference of 481.16 points, overall volatility is comparatively huge in 2013.

CCBFI Three Year Trend Comparison

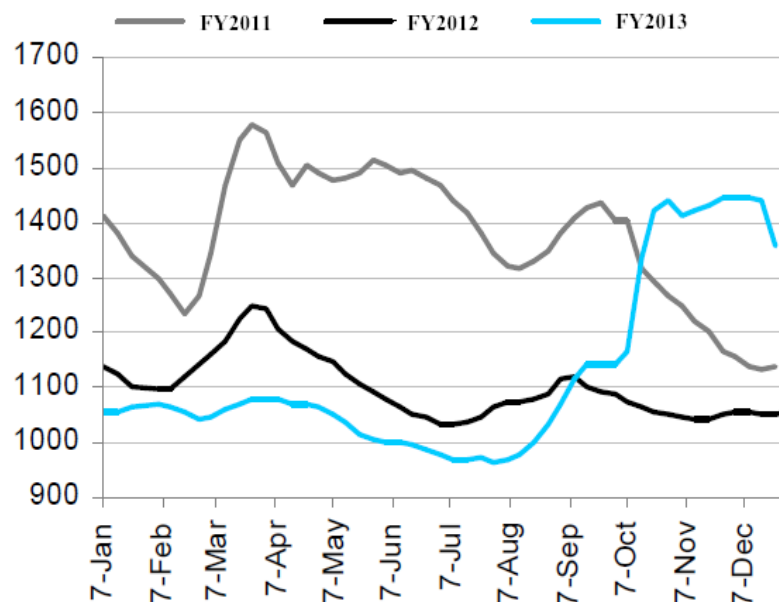


Figure2 Three Years Trends Comparison of CCBFI

4.1.2 Significant Seasonal Characteristics of Coastal Coal Freight

Influenced by the Daqin line maintenance in spring and autumn, the high storage of coal in summer and winter, bad price of coal price at home and abroad, and the weather, the far ocean freight of coal in 2013 stopped falling and started rising, it showed a low in prior and high trend in later, and the late two rounds of rise were bigger. The annual freight has gone up compared to 2012, expanding volatility, seasonal characteristics significantly, the normal situation of unobvious in peak months was broken. By the end of 2013 compared to the same period in 2012, the freight of coal raised 67%-111%, almost doubled. The coal freight index in the annual average is 824.83 points, up 16.29% from 2012. The highest and lowest differs very big. The freight of the route from Qinhuangdao to Guangzhou raised 33.2 Yuan per ton and the route from Qinhuangdao to Shanghai raised 42.8 Yuan per ton. Two peaks appeared in different period, one was 935.57 point in September 13th, the other one was 1423.94 point in October 25th. The lowest point occurred in July 12th, which is 586.35 point.

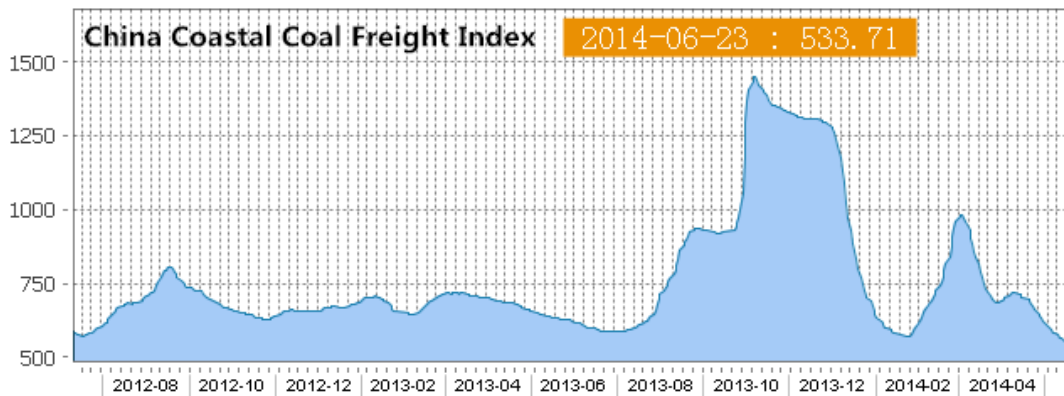


Figure3 China Coastal Coal Freight Index in Recent Years

4.1.3 The freight of Coastal Metal Ore and Grain

In 2013, due to the development of economy, the production and export of iron and steel is better than before. From January to June, the freight of coastal iron ore keeps slight fluctuation, while till the second half of 2013, it rise rapidly. The annual average of the freight is 942.51 points, a 2.2% rise in 2012. The peak appears in the 6th, December (1368.64 points), the lowest point is 858.59 points. The fluctuation is nearly 60%.

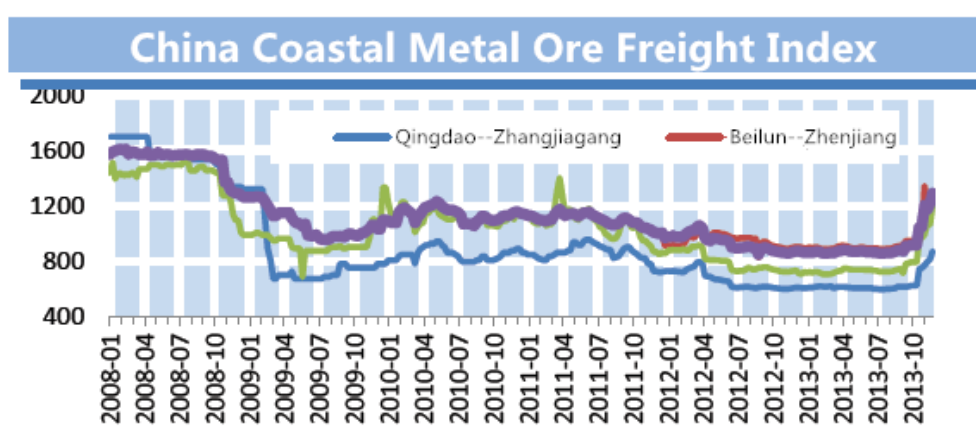


Figure4 China Coastal Metal Ore Freight Index in Recent Years

As of 2013 December, coastal grain freight index published by Shanghai Shipping Exchange stopped falling and started rising. The annual average is 1050.21 points, increase by 41.52%, the overall rose of grain and coal is similar situation. Two peaks appear in the September 17th at 974.7 points and November 8th at 1303.12 points, the lowest in July 26th which is 658.51 points.

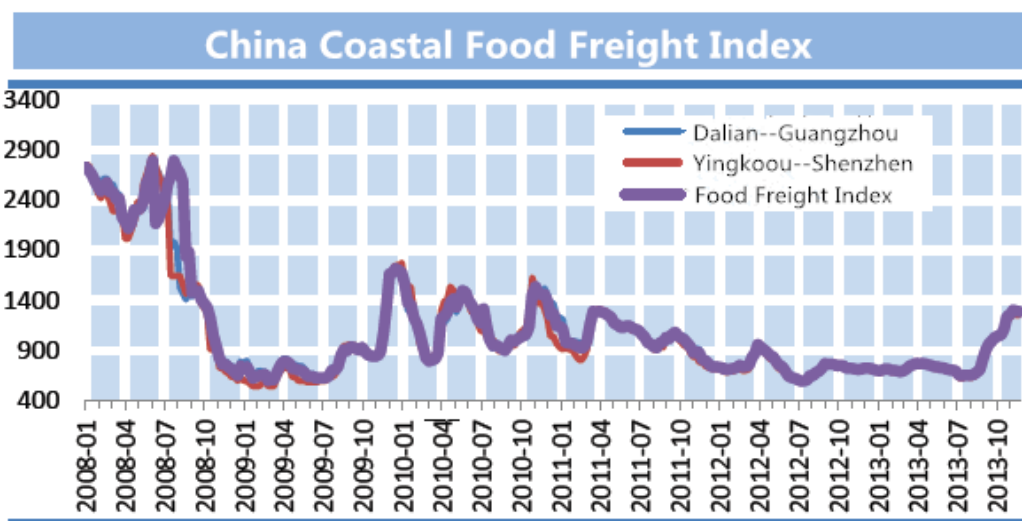


Figure 5 China Coastal Food Freight Index in Recent Years

4.2 Volume Analysis of Chinese Coastal Dry Bulk in 2013

4.2.1 The volume of China coastal dry bulk increased in 2013

In 2013, the world economy appears weak growth pattern in a smooth. Although global trade growth is still insufficient, the economy of developed countries sent a recovery signal. In this context, the overall economy of China shows a stable growth. The specific performance in: the export trade situation has improved, the profitability of industrial processing enterprises is better than before, an increase in demand for raw materials and dry bulk. On the whole, coastal dry bulk transportation needs rose up in 2013. From throughout the year, 2013 coastal dry cargo is lower in front and in the rear it is higher, and the seasonal characteristics and the fluctuation are obvious.

4.2.2 Increased coastal coal transportation

Thermal power rapid growth year on year, the increase of coal imports narrowed significantly, the demand of electricity consumption and coal consumption in steel industry are increased, they make coastal coal transportation demand increased, which increase the demand for coal is a major factor. From January to September in 2013, the volume of coal for domestic trade in the main coastal ports of China attains

467 million tons, an increase of 7.16%, which improve the growth rate 12.93 percentage points. The volume of national main coal transport by train increased significantly. To more specific, first, the amount of thermal power generation with relatively fast growth, electricity demand increased. Second, coal as power imports year-on-year decline, the domestic coal sales fell below 600 Yuan per ton. Third, the domestic economic growth keeps stability basically, the stocks of coal is decline.

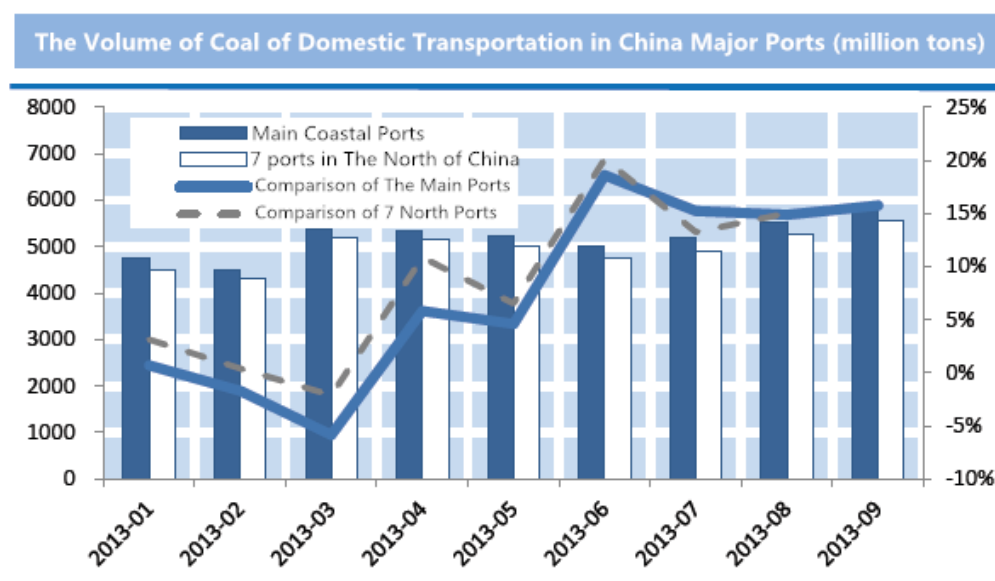


Figure6 Volume of Coal of Domestic Transportation in Chinese Major Ports

4.2.3 Coastal Ore Shipments Improved Significantly

In 2013, the world economic recovery and the domestic economic tend to be better than before. The drop of the domestic steel price reduced so that the demand of it has increased. Therefore, the crude steel production remains high level, the overall demand of coastal iron ore growth rose. From January to October in 2013, the main port of domestic iron ore import volume totaled 243 million tons, an increase of 10.17% compared to 2012 shows significant improvement. The trend of domestic inbound and outbound volume for the year is subject to fluctuations. The specific reasons are as follows: the drop of the steel price declines, resulting in improved coastal ore transportation needs. Second, the production of steel increased

significantly becoming the main reason of increasing for the transportation demand of coastal iron ore. Third, the growth rate of iron ore supply has increased, the iron ore import volume growth maintains the level of last year. Fourth, port and steel mills continue with the special strategy to maintain low inventory.

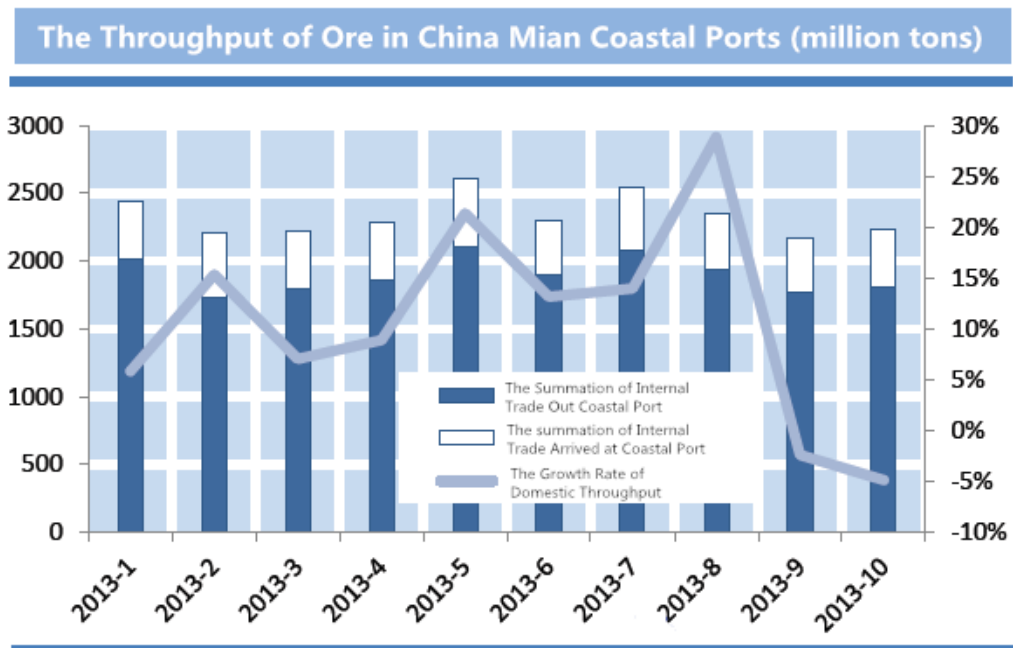


Figure7 the Throughput of Ore in Chinese Coastal Ports

4.2.4 Coastal Grain Capacity

The throughput of domestic food in the major ports accumulated 74,068,900 tons, an increase of 14.86%, which in January and October is the highest, respectively 8,245,200 tons and 8,151,600 tons. The lowest throughput for domestic trade is February, only 6,101,300 tons. Seasonal fluctuations in demand for grain coastal transportation weakened over the last year, the overall performance is better than coal and ore. There are several reasons can explain it: firstly, with the lifting of H7N9 bird flu, the stock of pigs rose steadily. It becomes the main factor to support the coastal food transportation demand. Secondly, the overall supply of food in north

is adequate. Thirdly, corn processing industry is losing money. Fourth, port inventory fluctuates obviously.

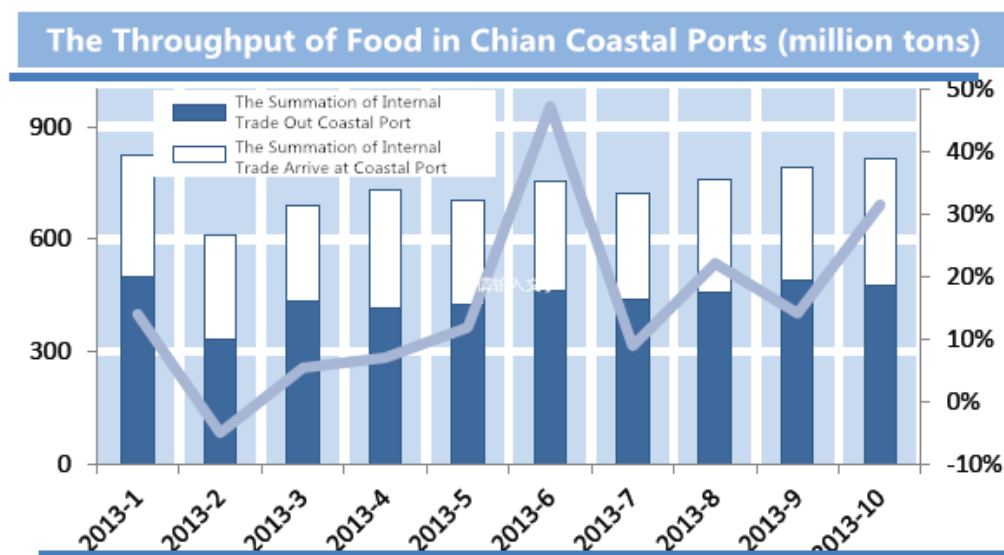


Figure8 Throughput of Food in Chinese Coastal Ports

4.3 Capacity Analysis of Chinese Coastal Dry Bulk in 2013

4.3.1 The Capacity of Coastal Dry Bulk Rise up in 2013

First of all, the coastal dry bulk capacity continued to rise up, but the speed of growth slows down. Shipping companies have generally realized that overcapacity leads dilemma to shipping industry. In order to control the scale of losses, shipping companies using the way of delivery delay and early retirement of old ships. Hence, the capacity of China coastal dry bulk ship continued to slow down. Secondly, a large number of ships have scrapped in recent years, and the numbers of new ships are greatly reduced. The average age of vessels which are bigger than 1 million tons remains stable compared to the last year. In addition, some large coastal bulk shipping companies slowed the speed of ship delivery.

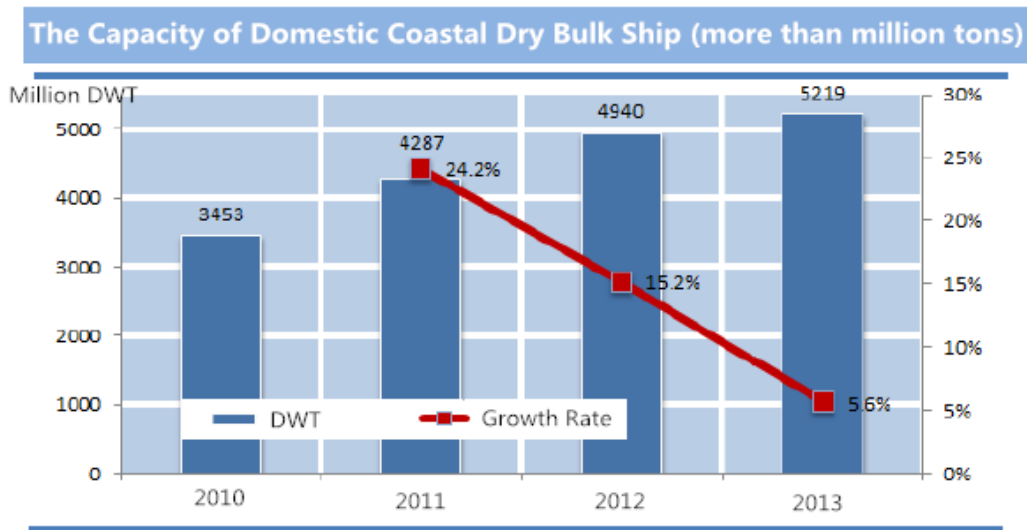


Figure9 the Capacity of Domestic Coastal Dry Bulk Ship

4.4 Review Chinese 2014Coastal Dry Bulk Shipping Market

From the data of China macro economy in the first quarter of 2014, we can see that domestic economy is not optimistic, and downward trend is obvious. Mainly due to the series connected factors and the high base in the last year. From January to February, export situation suffers a downturn, demand of domestic consumption is weak, and investment grows slowly. Chinese economy is in a weak state. China statistics bureau issued a report that the growth rate of GDP in the first quarter in China is 7.4%, a decline 0.3 percentage.

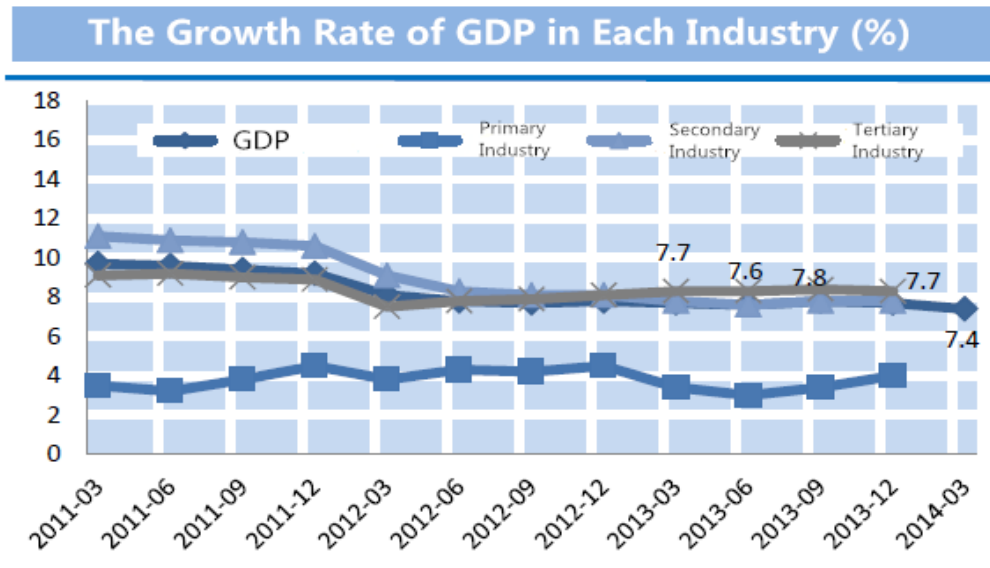


Figure10 the Growth Rate of GDP in Each Industry

4.4.1 The Shipping Market of Coastal Dry Bulk Rise Slowly

In the first quarter of 2014, the transportation volume of China coastal dry bulk and the capacity grow up at the same time. The increase of the transportation volume is lower than that of the capacity so that the supply is greater than the demand. In general, the performance of this quarter's China coastal dry bulk shipping market is not as good as the performance of last quarter. From January to February in 2014, the domestic throughput of China coastal port rose 4.49 percent to 674.682 million tons, a decrease of 6.24 percentage points of the growth rate.

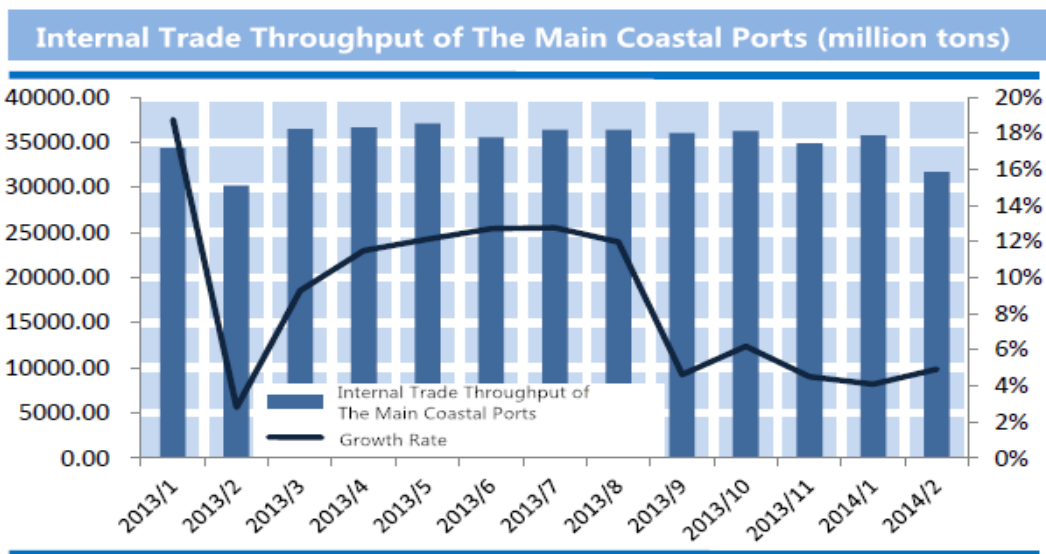


Figure11 Internal Trade Throughput of Main Coastal Ports

As dividing line, Chinese traditional Spring Festival divided the freight of the first quarter of China coastal dry bulk into two parts. Before the Spring Festival, the freight decreased greatly while another trend is showed out after the Spring Festival that increased obviously, showing the trend like a V shape. About a month before the Spring Festival, the downstream power plants and steel mills basically completed replenishment, and thus before the holiday and about two weeks after the holiday, coastal transportation took a downturn. After the Lantern Festival, the freight rises up gradually. The highest value of China coastal bulk index in this quarter is 1238.94 on January 3, the lowest value is 1031.14 points on February 14.

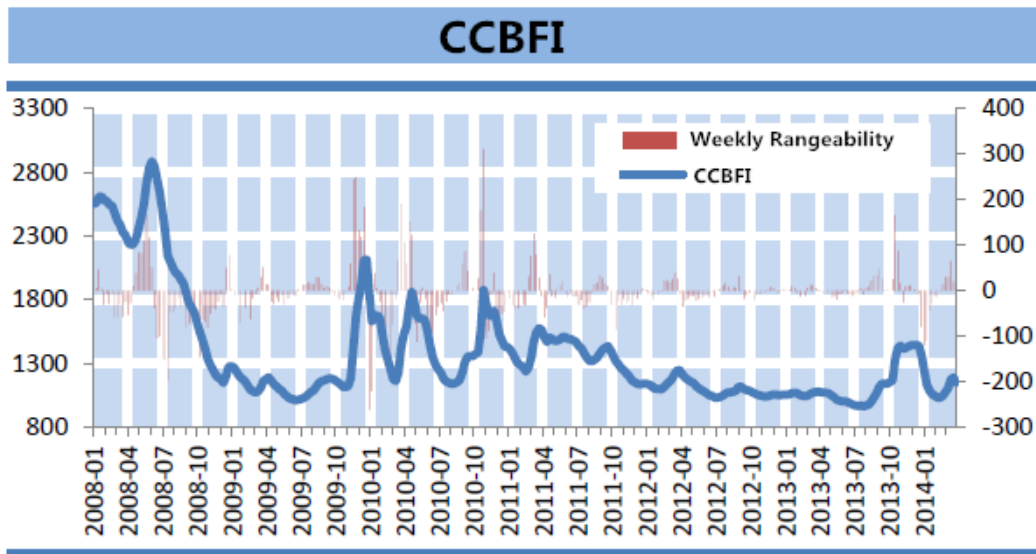


Figure12 Trends of CCBFI

4.5 Analysis of Factors Influencing the Fluctuation of CCBFI

The fluctuation of CCBFI describes the change of different species of China coastal shipping market. The current situation of the whole shipping market and the factors effected coastal shipping freight are basic to analysis the affective reasons of CCBFI. As all we know, there are many factors affecting the fluctuation of the freight, such as the shipping cost, the relationship of supply and demand in the market, the framework of shipping market, the policy if country and the competence of all kinds of transportation way. Meanwhile, we cannot ignore emergencies that are important reasons to affecting freight shortly.

The freight means the price of shipping service provided by shipping company to the goods or the customers. China coastal bulk freight is influenced by the relationship of supply and demand in shipping market as same as the price of products.

The freight means the price of shipping service provided by shipping company to the goods or the customers. China coastal bulk freight is influenced by the relationship of supply and demand in shipping market as same as the price of

products. Under the market mechanism, when the power of supply and demand of the dry bulk shipping market changes, the original equilibrium price will be broken and new market equilibrium will be built forming a new market price. Therefore, as the intrinsic factors for the freight fluctuation, the shipping market supply-demand relationship leads the trend of freight.

4.5.1 Influencing Factors of Coastal Coal freight

Coal is the first big cargo of coastal bulk cargo transport in China. Coastal coal freight index account for the largest proportion of China coastal bulk freight index, therefore, the coastal coal freight directly influenced the trend of China coastal bulk freight index. So let's make a further analysis of market supply and demand with an example of the coastal coal transportation market.

The main factors affecting the supply of coastal coal transportation market are: first, the national policy. Chinese coal is mainly composed of state-owned coal mines, the local state-owned coal mines and township coal mines. The production capacity of the coal enterprises determines the absolutely fixed coal quantity of supply. The planning of national macroeconomic regulation for control of electric power construction, and the National Development and Reform Commission limit to import and export coal every year, which both influence importantly the domestic coastal coal transportation. National policy will undoubtedly restrain the growth of gross coal production. The second factor is the climate factors. The statistical data shows that, in 2013, the rise of coastal coal freight is due to the factors that maintenance of the Line of from Datong to Qinhuangdao in spring and autumn, storage of coal in summer and winter, the difference of the coal price in domestic and overseas and the poor weather, etc.

The real impact of coastal bulk cargo transport capacity is the effective supply of coal. In the sample line of coal of CCBFI, coal's loading ports include Qinhuangdao port, Tianjin port, Jintang port and Huanghua port. These four ports are close to

Shanxi, Shannxi, Western Inner Mongolia, Hebei and other important coal production base, and the railway transportation is convenient, the geographical position is superior, the number of coal transportation is high. The four northern ports have superior natural conditions, such as Qinhuangdao port has a reputation of natural ice free port, however, when the extreme weather conditions come, harbors will be locked. Such as high winds and foggy weather, a large area of sea ice could cause the overstock of a harbor, so that the effective capacity declines and prices go up. At the same time, extreme weather conditions might cause broke of stability of some equipment so that the working performance of the port will be influenced, and that could reduce the effective capacity of the supply. The third factor is the influence of international dry bulk market. The transport demand of international bulk cargo increases. Part of the coastal bulk cargo is split for the sake of profit driven, resulting in the capacity of coastal coal transportation market is tight and price rise up.

There are several factors to influence the demand of coastal coal in the shipping market. First of all, it would be influenced by macroeconomic. The second half of 2008, influenced by the world economic downturn, foreign trade situation is grim, productivity reduction of the southern area of some high energy consumption enterprise and closed down of parts of small and medium enterprises, which cause the electricity consumption reduced, the coal demand fell significantly, thus further suppression of the coastal coal transport demand and the freight. With the continued to improve, the electric power, iron and steel, cement, and coal industry warmer gradually. The demand of coal transportation will steadily rise. Secondly, the seasonal factors cannot be ignored. Coal consumption is affected by seasonal factors obviously. The summer and the winter in each year is the vigorous period for the coal demand. July and August is the summer peak season, personal and industrial electricity consumption has increased dramatically, especially in the continuous hot

weather. In order to do a good job in the coal reserves to ensure normal operation of the coastal power plants and electricity enterprises, they scramble for coal resources, so the demand of coastal coal transportation is strong, and the freight goes up at the same time. Till the winter, warm demand increases, the power plants will increase the intensity of coal using level, and so the coastal coal transportation is in a great demand. In addition, the hydroelectric power also has obvious seasonal characteristic. When hydropower capacity in a great demand, it also can affect the demand of the coal in some extent. The third factor is the expectation for the rising coal price. The coal industry conference, holding on the end of each year, will discuss the coal price of the next year by the coal department and electricity department. If the coal price is expected to rise, the power plants will speed up progress of coal storage, which could result in short prosperity of coal transportation market. So the freight will be rise. On the opposite side, if the price of coal is expected to a trend of steadily falling, traders will be cautiously wait-and-see, which result in low coal transportation demand. So the freight declines again

4.5.2 Influencing Factors of Coastal Iron Ore Freight

The reasons for the rapid rise of the freight of iron ore and coal are similar during the second half 2013. Intermittent winds and foggy weather is the main reason. In addition, the low port inventory and the active supply of foreign mines played an big role in the rising of the coastal ore price.

Generally speaking, different from the coal transport market, seasonal characteristics of the iron ore transport demand is not very obvious, changes of the transportation price more depend on the demand of domestic iron ore industry. Besides of a small number of Hainan ore, China coastal metal ore mainly imported iron ore from other countries. It is because the number of current ports which could load and discharge the iron ore is very limited. A considerable part cargo needs to be transited at the Beilun port and the Qingdao port. Therefore, in that situation, the

number of imported iron ore will directly affect the demand of amount of coastal two-way iron ore transportation. While the number of imported iron ore is affected by the rigid demand of the domestic economy, it also affected by the international iron ore prices. That is to say, the international iron ore prices will affect the demand of amount of coastal two-way iron ore transportation.

In terms of the price of iron ore, we have to mention the annual iron ore price negotiations. The annual iron ore price negotiations began in 1981; after the negotiations discussed by the suppliers and manufacturers, it will be fixed a price for the iron ore. When the price has been determined, both two sides have to implement in accordance with the agreed price in a year. According to the traditional habit of negotiations, the international iron ore market divided into the Japanese market (Asia) and the European market. Each fiscal year, taking Japan iron ore users as the representative in the East and taking the German users as the main supplier representative in the Europe to determine the price of Asian market and European market with Australia's BHP Billiton Group, Hamersley company (belong to Riontinto Group) and VALE company of Brazil respectively. The mainstream of European steel mills involved in the negotiations includes: Arcelor-Mittal, TKS, TATA-Corus and Riva. The mainstream of Asian steel mills involved in the negotiations includes: Nippon Steel, JFE, POSCP and Bao Steel. Although on the surface, the business behavior in the negotiations seems to determine the price by the supply and demand sides according to the market situation, which reflects the rationality of market price to a certain extent. However, by virtue of its resource monopoly several mining enterprises mentioned above, they stand in an absolute advantage in price negotiations. As iron ore importer are often forced to accept the unreasonable high price. In 2010, the annual benchmark pricing system, which implemented 40 years, was broke up. Quarterly price system began to implement. One year later, quarterly pricing system also announced to disintegrate. BHP had

published a statement that is “In order to be more close to the market demand, from the beginning of 2011, our company would implement the monthly pricing system to the most exports of iron ore”. Many steel enterprises in China reluctantly accepted the monthly pricing system. Some professors point out that the pricing mechanism will strengthen the spot market. It will increase the cost of purchasing the iron ore for the steel enterprises. Pricing the spot market of iron ore boost the depressed iron ore market after the global economic crisis. From FOB to CIF price for the Australian miners have more advantages than miners in South Africa and Brazil obviously. Then the coal price rose sharply which makes Australian mining profitable. So the price of iron ore has affected our country on the number of iron ore imported in some degree. It is true that along with the continuous production of iron ore ports in the North, coastal iron ore two-way transportation demand may drop.

4.5.3 Influencing Factors of Coastal Oil and Grain Freight

During July 2007 – April 2014, the freight index of crude oil and refined oil changes smaller. One reason is with the development of pipeline transportation of crude oil, sea transport decreased gradually. The other reason is that China Shipping Group and Sinotrans Changhang Company mainly transport the domestic crude oil for long term with the COA price. In addition, the owner in China is more concentrated, mainly in the Petro China and Sinopec Group. According to the reflections from some ship companies, the owner in most extent determines the freight of refined oil. The market competition is not sufficient and intense.

The main influencing factors of the freight of crude oil and refined oil are international oil price, oil demand, the expectations of price adjustment and the supply condition of effective capacity.

The second half of 2013, the pig market picks up, grain transport demand has improved, and the coastal coal market goes up, so the freight of grain stops falling

and start increasing. The trend of coastal coal freight and coastal food freight in 2013 remains consistent.

Generally speaking, in the grain shipping market, coastal transportation of grain in China is mainly adjusted variety, it influenced by natural factors. In addition, the capacity, which flows between different goods in the coastal transport capacity, will cause the fluctuations of food price.

4.5.4 Operating Cost Influence the Freight Index

The operating cost of the ship includes two parts: the fixed cost and variable cost. Among them, the fixed costs include the depreciation cost and the interest, the crew salary expenses, ship repair and maintenance costs, marine material fee, material fee, marine insurance and enterprise management fees, etc. Variable costs include fuel fee, port charges, canal fee, cargo handling fees, etc. In this case, in order to obtain profit, shipping company will raise the freight. Therefore, any item in operating cost increases will make the freight rise. Especially the price of fuel fluctuates frequently; resulting in operating costs also changes.

4.5.5 Analysis of Other Factors Influencing the Freight Index

Some sudden natural disasters and political or military events will impact on coastal bulk cargo transport market, and lead to the short-term fluctuations of coastal freight index or in commodity index. Strong earthquake and tsunami in Japan, for example, the Japanese earthquake and tsunami destroyed many industrial infrastructures in the northeastern region of Japan within a few minutes. In a very short period of time to cause a very serious blow to the Japanese economy: energy, resource consumption in Japan will be shortage constraints in facilities, thereby reducing the number of imported crude oil, coal, iron ore objectively. Therefore, the cargo which planned to ship to Japan are likely to resell into the Chinese market, causing China coastal bulk freight fluctuations.

4.6 Comparison of Relationship between CCBFI and BDI

Baltic Freight Index (BDI) is published by the Baltic Exchange. It can reflect the freight level of the global dry bulk shipping market. It is a barometer of the development and the change of dry bulk shipping market. Similarly, CCBFI has become a barometer in China coastal dry bulk shipping market. Baltic Capesize Freight Index (BCI) is an important part of BDI, in which includes the route from Beilun to Beilun and Baoshan, the route from West Australia to Beilun or Baoshan, accounting the weight of 15%. That intensified the connection of China coastal dry bulk shipping market and International dry bulk shipping market. It needs to study that whether BDI will change when CCBFI fluctuates. Shi Wenming and Li Xuying have studied it. They used factor autoregressive model to test the relationship between CCBFI and BDI. Utilizing the tool of Granger test, IRF and variance decomposition revealed that there was no Granger causal relation between CCBFI and BDI. The fluctuation of these two indexes mainly depends on the shock by themselves. Therefore, the conclusion of the test is that there is a limited impact to international dry bulk shipping market for Chinese factors.

As the first index of the world's shipping industry, BDI is composed of 12 routes adjusted many times. There is a group that has 8 members in the Baltic Exchange. They are responsible for the calculation of BDI.

On the one hand, compared with the establishment method and operation method of BDI, CCBFI is lack of the specific shape of the ship, and only ask the routes and the DWT of the ship. On the other hand, the release time interval in the index, CCBFI is significantly longer than BDI.

5. Validation of ARIMA Model

5.1 The Establishment of ARIMA Mode

Berks Jenkins method, referred as B-J method or the ARIMA model method. The basic idea of ARIMA (Auto Regressive Moving Average) model is that treat the data sequence shaped by the predict objects over time as a random sequence, which means time series is a set of random variables, which depends on the time t , except those observations that caused by individual accident reasons. The interdependent relationship or the autocorrelation of the set of random variables represents the continuity development of the forecasted object, and that once the autocorrelation is described by the corresponding mathematical model, it can predict the future value based on the past and current value of time series.

The approach of establishing time series could be briefly described that the smallest squares method in accordance with the data series' uncertainty of certain part of the selection function, depends on its structural do single equation regression. Then using the regression residuals series u , establish the appropriate ARMA (n, m) model. And then use the ARMA model to replace the original error of regression equations. When predicting by using the equation, we can also use the ARMA model to get a prediction of the error terms. The ARMA model helps us to explain that variables, which is not explanatory in the regression equation. Finally, we estimate parameters of all combination of model sequences simultaneously.

ARMA model built on the assumption of random stationary, which belongs to a smooth linear statistical model. While for non-stationary time series, it can be analysis as a smooth time series only after a smooth treatment. Differential operators have strong extraction capabilities of certainty information. Many non-stationary series will show the nature of the stationary sequence after differential operations. We call it difference stationary sequence, which means non-stationary series. We can

use ARIMA model to fit the differential stationary series. Order differential is an example of steady nature of ARIMA model, which refers as auto regressive integrated moving average model.

5.1.1 Basic Steps of Modeling an Applicable ARIMA(p,d,q) Model

(1) Test the stationary of original sequence. If the sequence does not satisfy the condition of stability, it can be changed by differential transform (single whole order is d , then carried out d -order difference) or other transformations, such as the conversion of differential sequences so that satisfy the smooth conditions.

(2) Calculate a number of statistic (such as self-correlation coefficient and partial autocorrelation coefficients), which are able to describe the characteristics of the sequence, to determine the order of ARMA's p and q , and also select the parameters as few as possible in the initial estimation.

(3) Estimate unknown parameters of the model and test the significant of parameters and its reasonability.

(4) Diagnose and analysis to verify that the model is consistent with the characteristics of observed data.

For Step (3) and (4), it requires some statistics and tests to analyze whether the model selection in Step (2) is appropriate or not. The following aspects can judge it:

1) Whether all coefficients significantly not equal to 0. In another words, significant less than 0.05.

2) Whether the residuals are white noise, which means accompanied probability of Q statistic significantly greater than 0.05.

3) Whether the prediction is correct (the size of the predicted MAPE (mean absolute percentage error)).

4) Whether have larger fitting goodness and smaller AIC, BIC and HQIC.

5) Is there a much simpler model.

6) Whether intuitive sense or economic theory basis exists.

5.1.2 Modeling Flow Chart of ARIMA Model

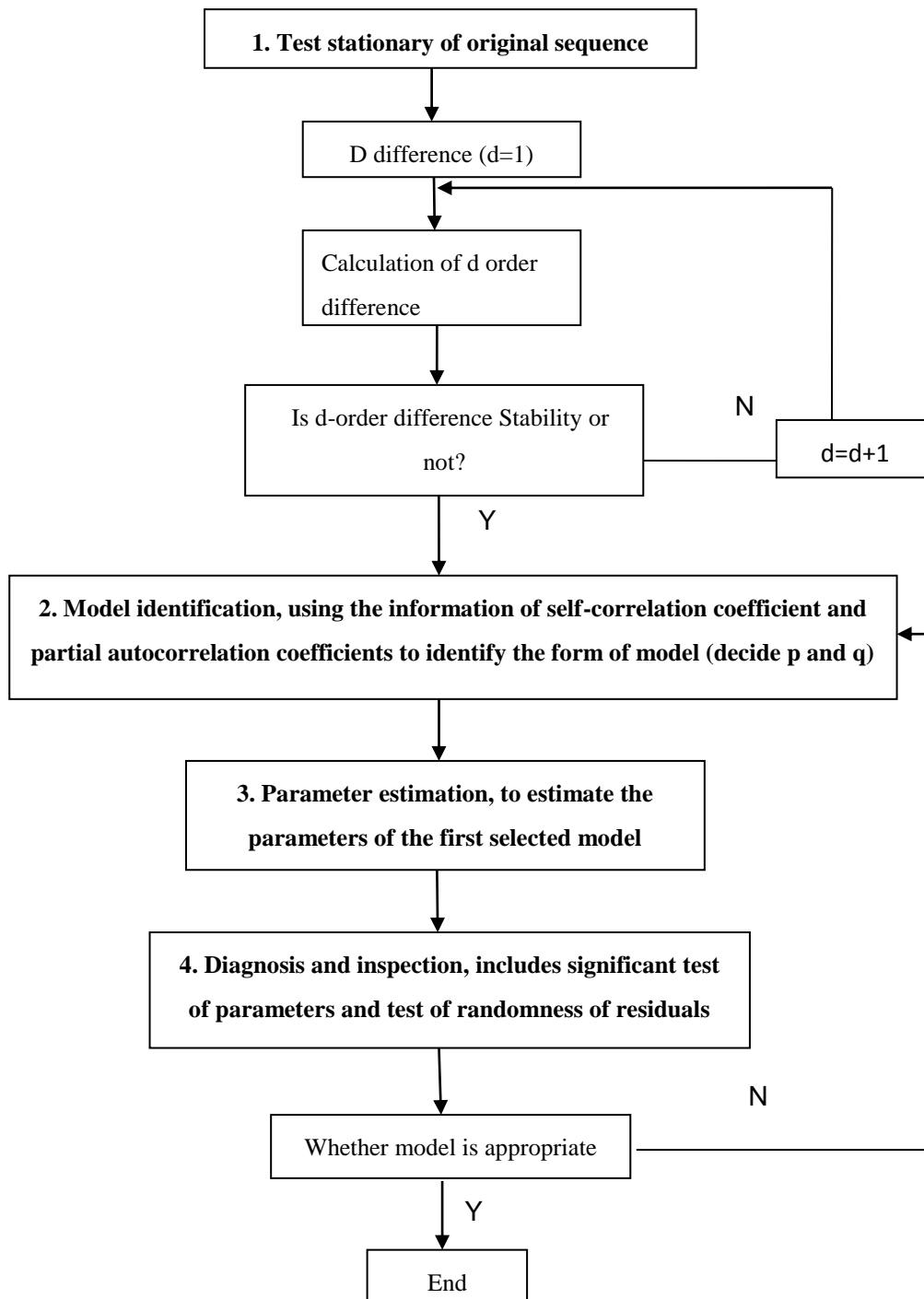


Figure13 Flow Chart of ARIMA Model

5.2 Specific Application of CCBFI ARIMA (p,d,q) Model

5.2.1 Timing Analysis of Raw Data

Raw data are from Shanghai Shipping Exchange CCBFI. Sample interval of composite index raw data is from Oct 26, 2011 to Apr 30, 2014. Firstly, we need to determine the stability of data. Using software EViews 7.2 to draw timing diagram is as follow:

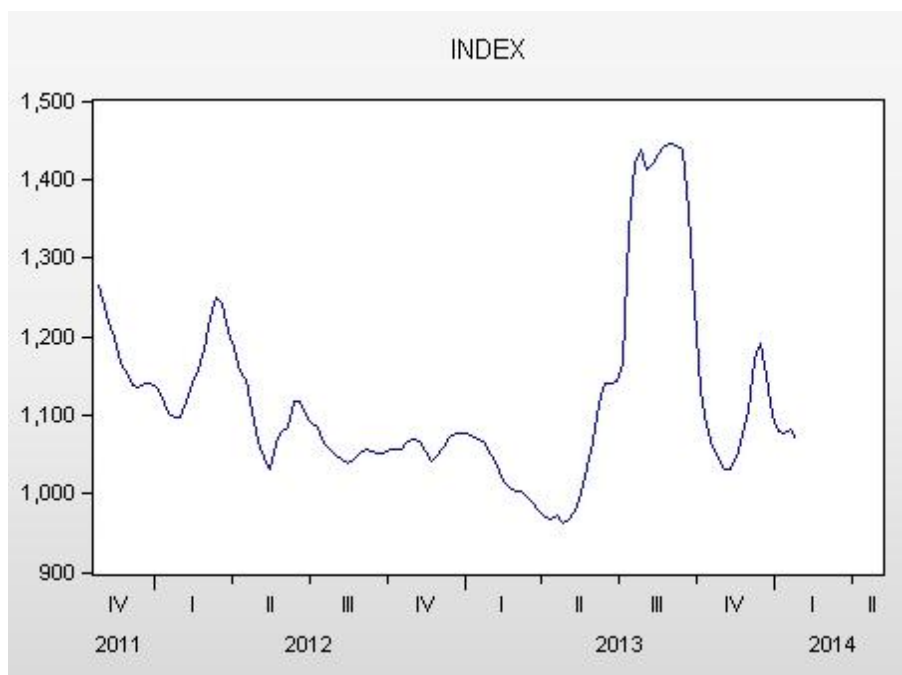


Figure14 Sequence Diagram of CCBFI

From the timing diagram, we can make a conclusion that the composite index was at a downward trend from 2011 to the beginning of year 2012, and then after a short term rise, came out a downward trend again. This downward trend continued until the second quarter of 2013, and then suddenly emerged a rapid rebound, which lasted around a quarter. In the third quarter of 2013, there was a significant decline, which was existed until April 2014.

Depends on above preliminary analysis, we can infer that the composite index time sequence data is not stable. In order to further prove that the index is not stable, we still need unit testing. The standard method of sequence smooth checking is unit root test. Dickey-Fuller proposed that using augmented DF (Dickey-Fuller) tests to check the unit roots, which contain related sequences of higher-order sequences. Now, we use the above unit root tests to determine the order d of a single integer. Firstly we did ADF checking of the original sequence CCBFI. The test results were as follows:

Table5 Results of ADF Test

Sequence	Inspection Forms	ADF Value	1% Critical Value	5% Critical Value	10% Threshold	P
index	(c,t,2)	-2.563831	-4.039797	-3.449365	-3.149922	0.2976(unstable)

On above table, c represents has the constant term, t represents has a trend term, q represents first-order exponent number equals 2 (Selection of lag intervals for endogenous is the smallest AIC criterion). From the above table, we can see that the ADF value of sequence index is -2.563831, greater than 1%, 5% and 10% threshold level, which indicates that sequence index is not stable.

5.2.2 Data Processing Smoothly

From the above sequence diagram, we can determine that the composite index time series data is not stable. Consequently, it requires a smooth processing of the original sequence. Differential is a commonly used way to doing smooth treatment. Differential also known as differential function or differential operation, where is a concept in mathematics. After the first differential of the original sequence, remove the long-term trend of the sequence and generate a new sequence, which is d index. Its timing diagram is as follow:

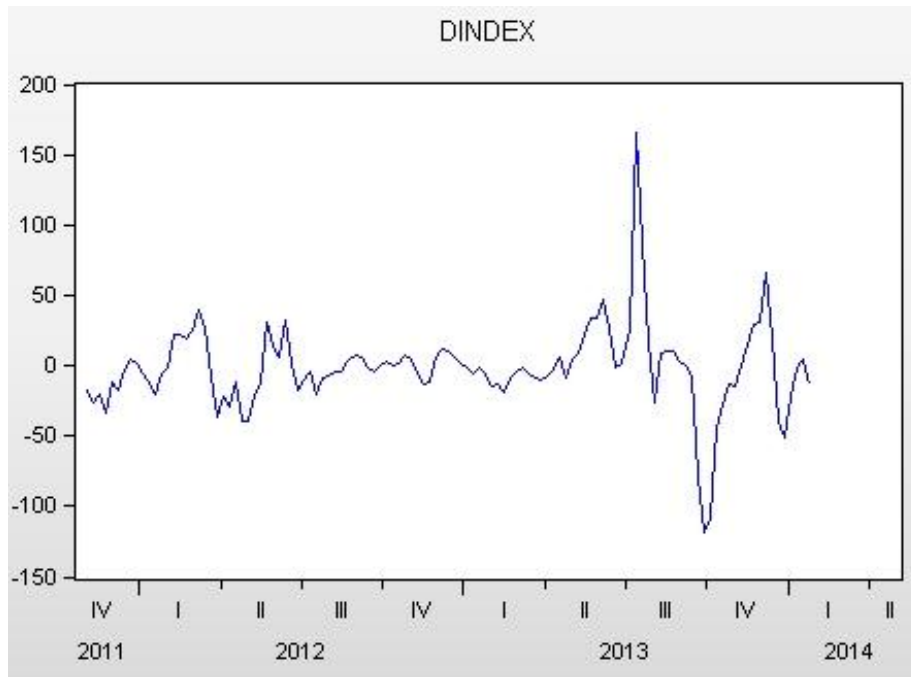


Figure15 New Sequence Diagram

From the above d index timing diagram, we can basically infer that it has a significant stability. Even if the data fluctuated up and down outstandingly during fiscal year 2013, but as a consequence of its fluctuation rage being closed, it can be seen as comparatively stable. Judging the sequence stable or not only depends on the timing diagram is not enough, therefore we still need unit root tests. Unit root test results of d index are as follows:

Table6Test d index

Sequence	Inspection Forms	ADF Value	1% Critical Value	5% Critical Value	10% Threshold	P
D index	(0,0,1)	-5.821664	-2.585226	-1.943637	-1.614882	0.0000(Stable)

The ADF value of sequeece d index -5.821664, less than the significant level of 1%, 5%, 10% threshold, which indicating sequence d index is smooth. Comprehensive index will be stable only through one differential, we can see that

composite index sequence is an integrated order sequence, which says the order of single integer d equals to 1. In another words, CCBFI index $\sim I(1)$.

5.2.3 Parameter estimations of ARIMA (p,d,q) model

P, d, q are parameters of ARIMA model. Their value is determined by d index's autocorrelation and partial correlation function diagrams. In sequences, because composite index sequence is integrated of order one sequence, so $d=1$. Since d index's autocorrelation and partial correlation function diagram is as follow:

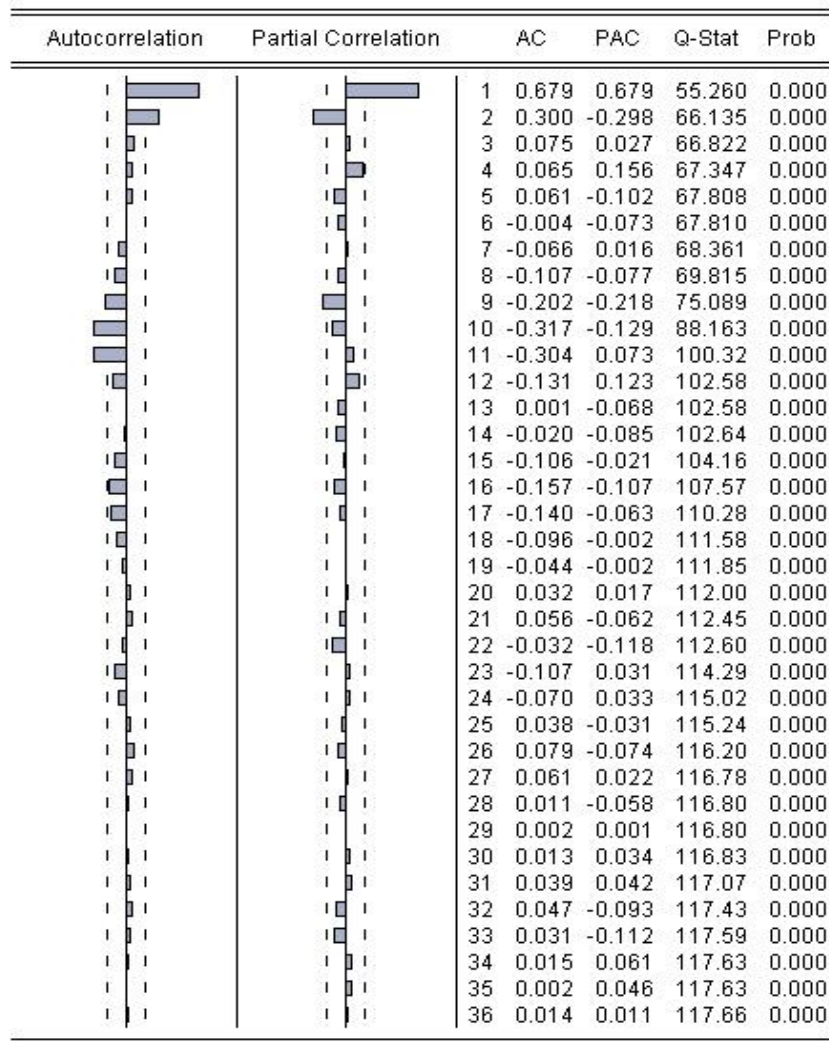


Figure16 Index's Autocorrelation and Partial Correlation Function Diagram

It can be seen from above figure that d index autocorrelation and partial correlation functions in two significant time is not 0, the partial correlation function of lag 4 period is comparatively prominent. So we can initial determined that auto regression order p equals 2, moving average order q equals 2. Therefore, we can choose the ARIMA model (2,1,2).

5.2.4 Estimates of ARIMA Model

Results of estimation of ARIMA (2,1,2) are as follows:

Table7 Estimation of ARIMA(2,1,2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.399854	4.951109	-0.282735	0.7779
AR(1)	0.278108	0.336391	0.826741	0.4102
AR(2)	-0.095882	0.226911	-0.422554	0.6734
MA(1)	0.621064	0.324202	1.915670	0.0580
MA(2)	0.389291	0.145709	2.671695	0.0087
R-squared	0.525217	Mean dependent var		-1.316522
Adjusted R-squared	0.507953	S.D. dependent var		30.87520
S.E. of regression	21.65774	Akaike info criterion		9.031108
Sum squared resid	51596.37	Schwarz criterion		9.150453
Log likelihood	-514.2887	Hannan-Quinn criter.		9.079550
F-statistic	30.42126	Durbin-Watson stat		1.990820
Prob(F-statistic)	0.000000			
Inverted AR Roots	.14+.28i	.14-.28i		
Inverted MA Roots	-.31-.54i	-.31+.54i		

From above table, we can figure out that ARIMA (2,1,2)'s degree of fitting adjusted R-squared is 0.508. And also fitting model passes the F test, which significance level of 0.05. It says that ARIMA (2,1,2) model fitting results basically fine, which can truly reflect the raw data information. In addition, model lagging polynomial reciprocal roots fall into the unit range and meet the basic requirements of a smooth process. Meanwhile, we can obtain the fitting equation:

$$(1-0.278B)(1+0.096B^2)(1-B)Y_t = -1.3998 + (1-0.621B)(1-0.389B^2)\varepsilon_t.$$

Among the equation, Y_t means the original time sequence, ξ_t means random errors, $\xi_t \sim N(0, 8.24)$, B means differential operators.

5.2.5 Diagnostic of ARIMA Model

Previous Sections already using the ARIMA (2,1,2) model did a sequence Index fitting. However, ARIMA (2,1,2) fit original data must have some residuals. So it's necessary to do a residuals inspection as well. If the residual sequence is a white noise sequence, then it can be concluded that ARIMA (2,1,2) fitting is valid.

ARIMA (2,1,2) model residual sequence's autocorrelation and partial correlation function diagram is as follow:

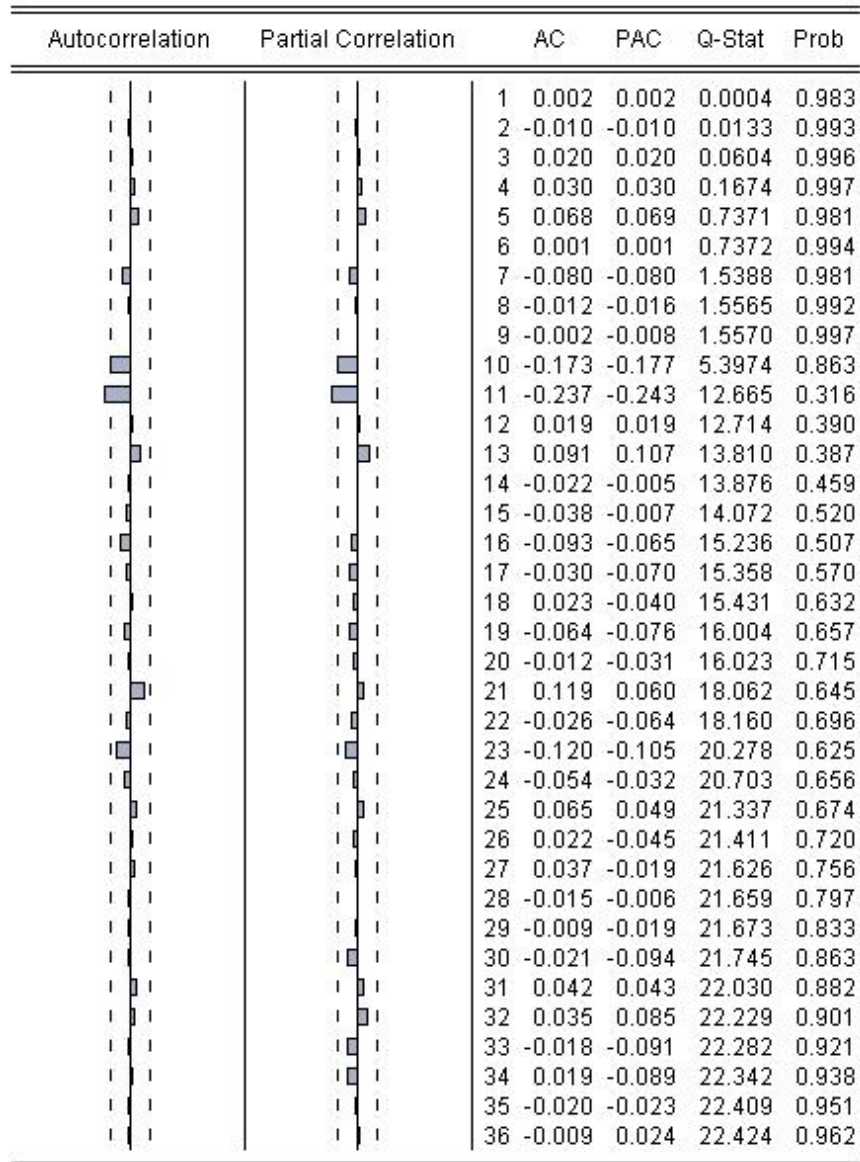


Figure17 ARIMA (2,1,2) Model Residual Sequence's Autocorrelation and Partial correlation Function Diagram

From the above diagram, we can see that residual sequence's autocorrelation coefficient and partial correlation coefficient almost close to 0, which means between residual differential does not exist correlation. In addition, statistic of Q-star is 22.424, significant level 0.962, which is bigger than 0.05, means residual sequence is a white noise sequence. It can be known that ARIMA (2,1,2) model is real and effective.

6. CCBFI Short-term Forecast by using ARIMA

Depending on the analysis above, I finally choose ARIMA (2,1,2) model as the best model. I will do a CCBFI extrapolation for May 9, 2014 and following weeks by using ARIMA (2,1,2) model in the following paragraph.

6.1 Extrapolation Forecast for ARIMA model – Static Prediction

Static prediction can only predict data of future first phase because forecast period is relatively short. So results of forecast are reliability. ARIMA (2,1,2) model static prediction results are as follows:

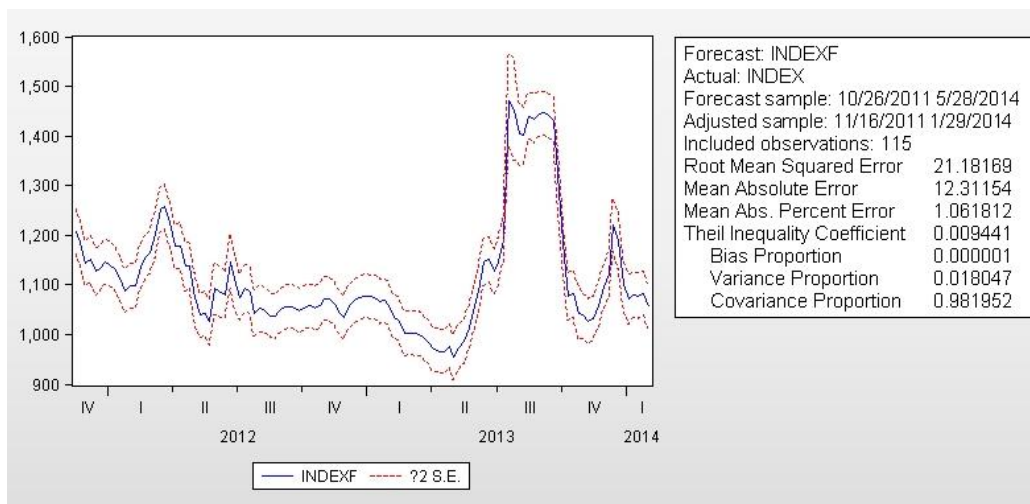


Figure18 ARIMA (2,1,2) Model Static Prediction Results

From the above diagram, the predicted value (blue curve) is within twice of the standard deviation (red curve), indicating that the predictions are more accurate. Therefore, next one week, May 9's composite index is 1,055.80409.

The scatterplot of comparative between static and actual predictions is as follow:

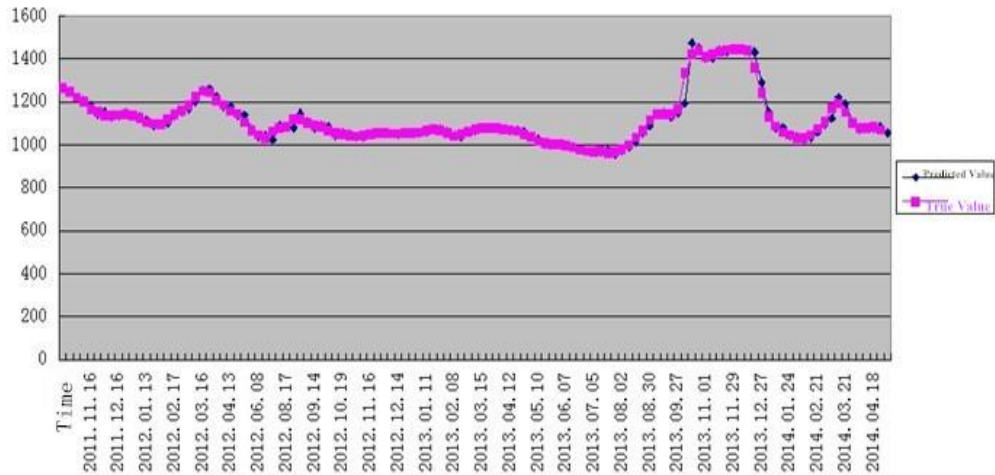


Figure19 Scatterplot of Comparative Between Static and Actual Predictions

6.2 Extrapolation forecast for ARIMA model – Dynamic Prediction

Dynamic prediction can predict the value of a relatively long period. Therefore, the accuracy is lower than the static prediction. Results of ARIMA (2,1,2) dynamic prediction are as follows:

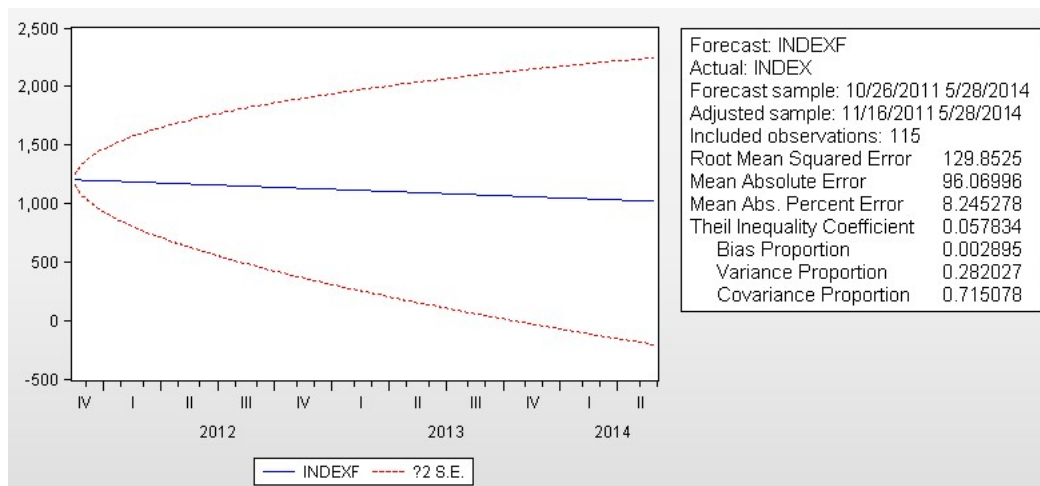


Figure20 Results of ARIMA (2,1,2) Dynamic Prediction

The predictive value of the dynamic prediction is also within twice of the value of standard deviation. Values of five future predictions are:

Table8 Values of Five Future Predictions

Time Periods	Predicted Value
2014/5/9	1041.433573
2014/5/16	1040.033719
2014/5/23	1038.622866
2014/5/30	1037.234012
2014/6/6	1035.834159
2014/6/13	1034.434305
2014/6/20	1033.034451
2014/6/27	1031.634598

Line chart of comparison between dynamic forecast true values and predicted values is as follow:

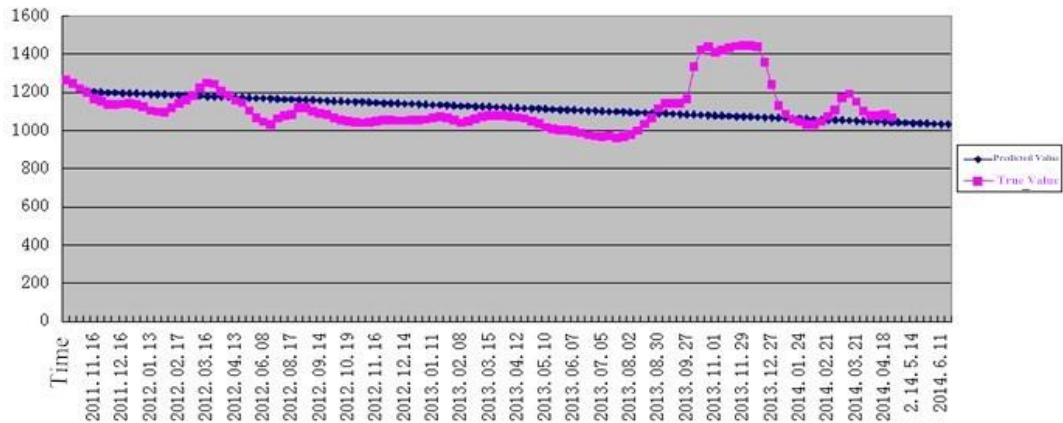


Figure21 Comparison between Dynamic Forecast Real Values and Predicted Values

6.3 ARIMA Model's Extrapolation Predicted and True Value Comparison

Until so far that thesis was been written, the latest CCBFI that released on May 9th, 2014, which was published every Friday by Shanghai Shipping Exchange's official website routinely was 1,042.24.

Table9 Static Predictive Value and Dynamic Predictive Value

Date	CCBFI	Static Predictive Value	Dynamic Predictive Value
2014/5/9	1042.24	1055.80409	1041.433573

From the above comparison, we can learn that the difference between ARIMA dynamic forecasting's CCBFI and the true value released by the Shanghai Shipping Exchange is -0.80643. Therefore, we can know that following weeks of the CCBFI value, which predicted by ARIMA (2,1,2) model are relatively high reliability.

6.4 Disadvantages of ARIMA model's extrapolation forecast

I have to mention that despite the ARIMA model first step precision forecasting is pretty high, but it only applt to short-term forecasts while not ideal for long-term prediction effects. In addition, as a consequence of the complexity of data, ARIMA model order determination is difficult to define the most suitable time series models. And then through sample autocorrelation and partial correlation, sometimes it is hard to make a discrimination directly. It requires temptation gradually from low to high, which increased workload undoubtedly, and maybe the received model is not the best model as well.

7. Shipping Companies' Business Decisions based on CCBFI

Facing of the competition of coastal shipping market became more and more intense, there is no doubt that freight index is the most direct and the most sensitive ruler, which reflects changes of market supply and demand and changes of price. Forecasting and applications of reasonable and effective Chinese coastal shipping freight index plays a vane and signs role in all shipping companies. Specifically, shipping enterprise is able to do short-term or long-term capacity adjustment based on the predicted value of CCBFI so that adapt to market changes. Similarly, different shipping enterprises have different views on the shipping market condition and index forecasts. Therefore, different enterprises make different business decisions.

7.1 China Shipping Company Case

Under analysis and utilization of 2012 Chinese coastal dry bulk freight index trend, we did a forecasting for 2013 Chinese coastal dry bulk freight index. At the same time, each shipping enterprise made appropriate adjustments for 2013 market strategy as well. For example, facing of CCBFI in 2012 consistently lower than index in 2011 and volatility significantly, coupled with index trend forecast for 2013, in the coastal, ocean and pool (multi model) this three kinds of dry bulk shipping transportation sectors, China Shipping Development focused on developing ocean dry bulk cargo transportation. In the first half of 2013, during the Group's dry bulk shipping business, international ocean dry bulk transportation turnover accounted for an increase of 3% to 69%. In the term of capacity, in June 2013, China Shipping Development totally has 123 cargo vessels, 8.612 million dwt, the size of single vessel continued rising to 70,000 dwt, which increased 3,900 dwt compared with 2012. It's obvious to see the trend that ships largely. Meanwhile, new dry bulk

capacity 6 ships, 587,000 dwt, ship deliveries decreased compared to last year's. And also, the size of single delivered vessels fell behind 0.1 million tons as well. The pace of ships scrapping has accelerated. In 2013, step by step disposed poor old ships, which high fuel consumption, small tonnage, and worse market competitiveness. Constantly optimize the fleet structure, improve the fleet competitiveness, the total capacity of the scale was still ranked first in domestic coastal dry bulk ship-owners.

7.2 Major Shipping Enterprise Operating Conditions Overview

As of June 2013, China Shipping Development has completed dry bulk cargo transportation turnover of 106.065 billion tons nautical miles (about 196.432 billion tons km), which increased 22.3%. Operation income was 2.586 billion RMB in advance, which decreased 8.3%. Chang Jing Shipping Group Phoenix Co., has completed freight turnover 32.02 billion tons kilometers, which decreased 32.27%, and operating income 483 million RMB, which decreased 2.82%. Ningbo Marine Co. Ltd has completed freight turnover 13.905 billion tons km, which increased 8.78%, and achieved that main business income of 384 million RMB, which decreased 0.78%. Zhongchang Marine Co. Ltd has completed freight turnover 4.135 billion tons kilometers, which decreased 9.94%, operating income of 130 million RMB, which decreased 10.8%. In addition, from operating profits of first three quarters of 2013, during selected coastal dry bulk transport companies, Jan to Sep periods, only China Shipping Haisheng Co. Ltd gained profits, others were losses. While degrees of losses reduced in the same period last year.

Table10 Profit of Coastal Dry Bulk Shipping Companies (Billion)

Company	2011	2012	Year-on-year	2013
China Ocean Development	8.28	-8.07	43%	-11.57
Chang Hang	-4.66	-7.60	-32%	-5.14
China Ocean HaiSheng	-0.05	-1.60	-153%	0.84
Ning Bo Shipping Company	0.28	-1.28	-73%	-0.35
Zhong Chang Shipping Company	0.09	-1.27	-16%	-1.07

All things are constantly engaged in changes, especially in the shipping markets, market was affected not only by the internal factors, but also by promoting and constrains by external factors. Each shipping enterprises have their own decision making system in general, even made a lot of operation decisions through the subjective feeling determination of market trends. This kind of subjective judgment by previous experiences exist a certain risks. Some experienced shipping enterprises made decisions not only relying on experience to judge the market, but also through index forecasts. By subjective experiences and objective data predictions, it provided double protections for shipping enterprises in the fierce market competition.

8. Conclusion

Firstly, the established method of CCBFI and the significance of the research are briefly introduced, and then analyze CCBFI since the implementation of the new plan, and describe the trend of CCBFI. Based on it, we mainly analysis of the coastal coal shipping market and iron ore shipping market to summarize many factors of influencing CCBFI.

Because the coastal dry bulk shipping market is a complicated and changeable market, the participants of it are very competitive, so many factors will affect the fluctuation of CCBFI such as economic, political, market, nature and human. CCBFI shows a random fluctuation. The ARIMA model is a random time series model. Some scholars have used this model to make a short-time forecast the BDI successfully. This dissertation established the ARIMA model of CCBFI successfully and made short-time prediction.

Through the reasonable description and accurate prediction of CCBFI by ARIMA model shows that the model is proper. However, there is one thing should be explained clearly. With the passage of time, CCBFI may be changed, other rules might be hidden, like seasonal fluctuation, the long-term trend etc. The time of implementation of new CCBFI establishment plan is not very long, so the adjustment by seasonal cannot be done easily. Therefore, once the market emerges new changes, we must make the corresponding changes according to the latest data in order to ensure the rationality of the model.

As I mentioned before, despite the ARIMA model first step precision forecasting is pretty high, but it only applt to short-term forecasts while not ideal for long-term prediction effects.

This disseration is only a preliminary demonstration for the feasibility of establishing the ARIMA model of CCBFI. It did not make comparison for different models. Because of my limited knowledge, there will be some shorcomings and mistakes in this paper, I sincerely hope that they can be pointed out by teachers.

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