8-23-2014

Study on the newbuilding price mechanism of Capesize bulkcarrier based on the econometric theory

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

MASTER OF SCIENCE

In

INTERNATIONAL TRANSPORT AND LOGISTICS

2014

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.

Lei Yue

Date: 25th Jun 2014

Supervised by:

Professor Hu Meifen

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Acknowledgments

This dissertation was developed as part of my studies to apply for the master degree of International Transportation and Logistics at World Maritime University and Shanghai Maritime University. These studies would not accomplish successfully without the generous support of a number of people and organizations to which I would like to express my thanks.

First of all, my sincere thank must be extended to my paper superior, Professor Hu Meifen. Her professional advice and valuable guidance consolidated the prerequisite to overcome many of the difficulties I encountered in the preparation process of this dissertation.

I also want to express my profound gratitude to my colleagues in Clarkson Research Service Limited. They provided me a large amount of shipping data and professional insight on the Capesize market, which do help me a lot in writing my dissertation.

Special thanks are surely extended to all of the professors and faculties attended this ITL program, whose professional knowledge and great effort are considerably helpful to my study in the ITL2014 and also greatly benefited this dissertation.

I also want to express my deepest appreciation to my family and friends, for the encouragement and understanding they gave from beginning to end.

Thank you all very much!

Abstract

Shipping business sections involve four markets – shipbuilding market, freight market, second-hand ship market and demolition market. Ship newbuilding, as the step to delivery new blood to the global fleet, matters a lot to the whole shipping industry.

As we know, ship, the core asset of shipping industry, requires high capital-intensity, therefore, every swing concerning about the newbuilding prices deserves our intense focus. By conducting the study on the newbuilding prices, we can explore the explanatory variables which affect the movement of newbuilding prices. And the result can be used while doing the newbuilding decision.

Capesize is one type of bulkcarrier, which is approximately 175,000 DWT, mainly used to transport iron ore. In recent years, Capesize market has witnessed large volatilities. Severe depression stroke on it in year 2008 along with the global financial crisis. However, with the development of China modern construction, demand for iron ore trade has ascended in the last several years. Market seemed to recover now. More and more shipowners want to take a share of this market and invest money in the Capesize newbuilding market.

This paper discusses the general market of Capesize bulkcarrier including the iron ore trade market, freight market and fleet condition. By deep analyzing the Capesize market, we can explore the factors affecting the newbuilding prices of bulkcarrier. An application of classic linear regression model can help us find the notable factors which have profound influence on the newbuilding prices of Capesize bulkcarrier. According to the final result, we can find the real driving force for the swing of newbuilding prices for Capesize bulkcarrier. And from this result, suggestion can be given to the shipowners and investors regarding about the Capesize newbuilding decisions.

KEY WORDS: Newbuilding price; Capesize bulkcarrier; Iron ore; Price mechanism

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List of Abbreviations

ARR	Accounting Rate of Return
BCI	Baltic Exchange Capesize Index
BDI	Baltic Exchange Dry Index
BOF	Basic Oxygen Furnace
CSSC	China State Shipbuilding Corporation
DWT	Deadweight Tonnage
IRR	Internal Rate of Return
LIBOR	London Interbank Offered Rate
NPV	Net Present Value
SDARI	Shanghai Merchant Ship Design & Research Institute
UNCTAD	United Nations Conference on Trade and Development

1 Introduction

1.1 Background of dissertation

Shipping is an ancient industry, which can be stretched back for 5,000 years. No one can deny the important role of shipping industry in our global economy. Shipping, as the bridge of different continents, has greatly stimulated the development of modern industry supply chain. Raw material from remote countries can be transported by ship over sea to another place where in need of it. Or another situation is some countries import one certain kind of material or product which is cheaper than their domestic ones like China imports iron ore from Brazil and Australia. Shipping enlarges the liquidity of raw material and processed products over the world, realizing the optimized allocation of global sources.

Shipping industry itself also has a complete industry chain, from the top-tier: shipping financing, ship newbuilding to the downstream: ship demolition. We can diversify the shipping business section according the life cycle of ship – ship newbuilding market, ship operation market, and ship demolition market. Additionally, in the ship operation market, we also have more sub-market segments like freight market, sales and purchase market. These shipping markets are inter-related.

Ship newbuilding market, as a vital part of shipping industry makes new blood to the whole shipping industry. Additionally, ship, as the core asset of the shipping industry requires high capital intensity. Therefore, for shipping owners and investors, every decision concerning about ship newbuilding issues matters a lot.

Price mechanism is an economic term that refers to the manner in which the prices of commodities affect the demand and supply of goods and services. While doing the investment decision on the newbuilding Capesize bulkcarrier, the investors or the owners need to understand the basic influencing mechanism on the newbuilding prices of Capesize bulkcarrier. Newbuilding market is not a single market apart from others, so deep analysis on the market characteristic of the whole Capesize bulkcarrier market is essential, which can help us to reveal the inner relationships about the four markets of Capesize bulkcarrier. Additionally, the thorough analysis on the newbuilding market of

Capesize bulkcarrier (including its existed fleet structure, order, deliveries) is also required.

After the analysis on both the whole Capesize bulkcarrier market and its single newbuilding market, we can find the external and internal explanatory factors to explore the relative accurate newbuilding price mechanism of Capesize bulkcarrier. Therefore, the investors or the owners can detect whether the newbuilding market of Capesize bulkcarrier is cost-driven or market-driven, which can help them to do the investment decision more precisely.

There are lots of experts and scholars at home and abroad having made academic contribution to this topic. However, most research findings, studied before financial crisis 2008, cannot catch up with the current maritime market situation. The trade pattern is different from year to year; therefore the newbuilding prices mechanism also keeps changing. Additionally, most study and research are aiming to explore the both prices and investment mechanism in more wide market scale such as for the whole bulkcarrier market. So the specific study on one bulkcarrier market segment is rare.

1.2 Literature review

1.2.1 Supply and demand of bulkcarrier and Capesize market

The supply and demand situation of the Capesize vessel market has changed dramatically since the financial crisis in 2008. Before 2008, most scholars and experts held the positive attitude towards the Capesize vessel market.

Both Stopford[1] (2007) and Jordan[2] (2007) believed that the bulk shipping market continued at a bullish pace into 2007 against predictions of a downturn. They pointed out that there was some downside risks involved even though the performance of Capesize market was more eye-catching owing to the raw material demand stimulated by a healthy world economy has been be-hind this strength. ZHU Xiaogang, et al.[3] (2005) also put forward the viewpoint that the transportation for Chinese raw material import especially the large demand for the Capesize vessel type from the import of iron ore has stimulated the market prosperity and it would be a wise decision for the shipowners to invest in the Capesize sector to realize the expansion and change of the fleet structure.

Nevertheless, after the economic crisis in 2008, the market has declined. Calum Kennedy[4] (2009) thought that the market situation especially the iron ore demand remained at a low level; and given that an immediate recovery of demand is nearly impossible, it seems that the existed Capesize bulkcarrier may exceed the iron ore requirement of these steel mills. But LI Xuejiao, et al[5] (2010) support that the expansion of the transportation capacity cannot catch up with the growth of iron ore seaborne trade demand and for domestic shipping companies, the lack of Capesize vessel to specialize in the iron ore transportation is obvious.

1.2.2 Newbuilding market of bulkcarrier and Capesize vessel

The shipping business market generally has four sub-divisions: the freight market (including the freight derivatives market), the sale and purchase market, the newbuilding market and the demolition market. The newbuilding market, as an important component of shipping market, provides new ships to the shipowner and investors. Regarding the newbuilding market, James Coldwell[6] (2011) and Sarah Holden[7] (2013) stated that the Capesize market was faced with the challenges of dealing with the force of ordering binge and delivery deluge respectively.

One of the particular features of newbuilding market is the time gap between the order and final delivery. If the investor chooses to build a new bulkcarrier, it always takes approximately one or two years before delivery. Therefore, making the right decision at right time concerning about newbuilding investment does matter a lot to the either the investors or owners.

Such as CAI Liming[8] (2009) and ZHU Mo et al.[9] (2012) are both talking about the viewpoint that the newbuilding prices are mainly driven by the cost while the second-hand prices are driven by the market. WANG Lei et al.[10] (2010) and ZHAN Zhihua et al.[11] (2012) studied on the cyclical fluctuating relationship between the average earnings and the newbuilding price of Capesize. His view was that the delay of the change in newbuilding prices for the one in the freight rates was about four or five months. Liu Liming et al.[12] (2011) employed panel co-integration testing and estimating techniques in their academic research. They held the view that newbuilding is commonly considered exogenous of freight markets, because its long cycle introduces long delays in the supply side. Stopford[13] (2009) explains the cycle of the freight market and describes

how shipowners who have earned cash in the freight market will order new ships due to their confidence on the future of the freight market, which was also the view shared by Koopmans[14] (1939). However, Beenstock et al.[15] (1993) discovered that an increase in freight rate results in a small response in newbuilding price and there is an absence of lags among prices through simulation, but this conclusion cannot be verified by observable market data.

1.2.3 Newbuilding prices mechanism of Capesize vessel

While doing the investment decision on the newbuilding Capesize vessel, the investors or the owners need to understand the basic influencing mechanism on the newbuilding prices of Capesize vessel. By well analyzing both the external and internal explanatory factors, the investors or the owners can explore the relative accurate newbuilding price mechanism of Capesize vessel. Beenstock[16] (1985) built the theoretical model about the freight market and newbuilding market. In this model, he first proposed that the traditional demand and supply theory could not be applied into the newbuilding market, because ships belong to the capital asset, with long period of use, and the decision about the newbuilding was mainly determined by the analysis on the current market and the anticipation of the future market. Therefore Beenstock put forward that we should apply the capital theory in the study on the newbuilding market. LI SHENGJiang[17] (2006) pointed out that the main influential factors on the newbuilding prices include the ship steel plate prices, the shipping index, orderbook DWT and so forth by using the multiple regression models. And ZHAO Yan[18] (2010) applied the ARMA model in the economics into the quantitative analysis on the shipping index, newbuilding volume and volatilities in the prices and also built the VEC model to analyze the long-term dynamic as well as the short waves between shipping index and vessel newbuilding prices, revealing the mutual relationship.

1.2.4 Investment opportunity on the newbuilding of Capesize vessel

The ultimate goal of studying the newbuilding price mechanism is to give the guidance to both investors and owners while doing the investment decision.

Concerning about the investment opportunity of vessel newbuilding, there are lots of experts and scholars at home and abroad having achieved academic accomplishments to this topic. ZHU Xiaogang[19](2005) built a model about the maximum profit as the

guidance for investment in newbuilding vessel, and set up the NPV as the main evaluation benchmark, which was inspired by Sloggett, J. E.[20] (1984). Sloggett first introduced how to use these financial indexes such as NPV, IRR, ARR to evaluate the economic benefit of the investment in the newbuilding vessel in his book, *Shipping finance: financing ships and mobile offshore installations* in 1984. Moreover, in WANG Zhipeng[21](2004)'s study, he explored the varying regularity about the newbuilding vessel and the second-hand vessel with 5 years to summarize the optimal occasion of newbuilding investment. Merikas, A. et al.[22](2008) argued that regarding about the investment decision of the shipping company about whether to build a new tanker or just purchase an available second-hand vessel, what matters is not the second hand price and its determinants per se, but instead the ratio (SP/NP) of second hand price over the new building price and its movement.

However, most research findings, studied before financial crisis 2008, cannot catch up with the current maritime market situation. The trade pattern is different from year to year; therefore the newbuilding prices mechanism also keeps changing. Additionally, most study and research are aiming to explore the both prices and investment mechanism in more wide market scale such as for the whole bulkcarrier market. So the specific study on one bulkcarrier market segment is rare.

1.3 Research purpose and methodology

1.3.1 Research purpose

1) Present the whole picture about the newbuilding market characteristics of Capesize bulkcarrier by thorough analysis on the supply and demand condition and spot market (including freight market and newbuilding market).

2) By applying the econometric theory, the dissertation aims to explore the newbuilding prices mechanism of Capesize bulkcarrier and find out what can affect, and to what extent, the movements of newbuilding prices of Capesize bulkcarrier with the time-series data collected from *Clarkson Research*.

3) Give the guidance to both investors and owners while doing the investment decision based on the theoretical price mechanism and other prices.

1.3.2 Research Methodology

General market analyses on the Capesize bulkcarrier will be carried out first to explore the market characteristics of this specific shipping market, including the iron ore trade condition, freight market of Capesize bulkcarrier and its fleet capacity.

The main method for data analysis used in this dissertation is the classic linear regression model in the econometrics. Before running the regression model, I would test the stationery of the statistics by applying the unit root test. And in order to avoid the multicollinearity problem, correlation would be carried out for the data groups. Regression would be conducted for two trails. And other related tests on five assumptions would also be made to examine the accuracy and rationality of the result. Software used in this dissertation to run the regression model is Eviews 7.2 developed by *Quantitative Micro Software*.

2 Market characteristics of bulkcarrier and Capesize vessel

2.1 Bulkcarrier and Capesize bulkcarrier

Cargo can be divided into bulk cargo and general cargo according to its package method. Based on the classification of cargoes, one specific type of vessel called bulkcarrier or bulk is designed to carry these unpackaged bulk cargo such as grain, coal, iron ore and so forth. The term of bulkcarrier has the following official definitions. As of 1999, the International Convention for the Safety of Life at Sea defines a bulk carrier as "*a ship constructed with a single deck, top side tanks and hopper side tanks in cargo spaces and intended to primarily carry dry cargo in bulk; an ore carrier; or a combination carrier.*"

Bulkcarriers are segregated into several groups according to different methods. Generally, it has four groups according to its deadweight. Clarkson Research Service Limited rules four sizes groups as follow:

Table 2- 1 Bulkcarrier classification

Bulkcarrier Type	DWT Range
Handysize	10 – 39,999 DWT
Handymax	40 -59,000 DWT
Panamax	60 – 99,999 DWT
Capesize	100,000 DWT

Source: Clarkson Research

Additional to the size classification method, bulkcarrier can also be categorized as per regions. For instance, Kamsarmax bulk carrier is designed to both barely fit through the Panama Canal and to barely be accommodated at the loading pier at Port Kamsar in the West African nation of Guinea. There are also other specialized bulk carriers such as open hatch carriers, chip carriers, ore carriers which are not introduced in detail one by one.

Ship classification society and related academic organizations state that *Capesize bulkcarriers are 100,000 – 180,000 deadweight tons, draft about 17meter to govern the*

design of large ships built to serve deep water terminals handling raw materials, such as iron ore, from Brazil. Too big for the Panama or Suez canals, Capesize vessels voyage via Cape Horn or the Cape of Good Hope. (From Shiptradehouse) However, with the trend of ship size enlargement, a standard Capesize bulkcarrier we always refer to is around 175,000 DWT. For the Capesize bulkcarriers which are below 150,000 DWT but above 100,000 DWT, we usually call them "Mini Cape".

Therefore, the Capesize bulkcarrier I choose to analysis in this dissertation is about 175,000 DWT, and the related freight rate, newbuilding price and other data would be the figures for 175,000 DWT Capesize bulkcarrier.

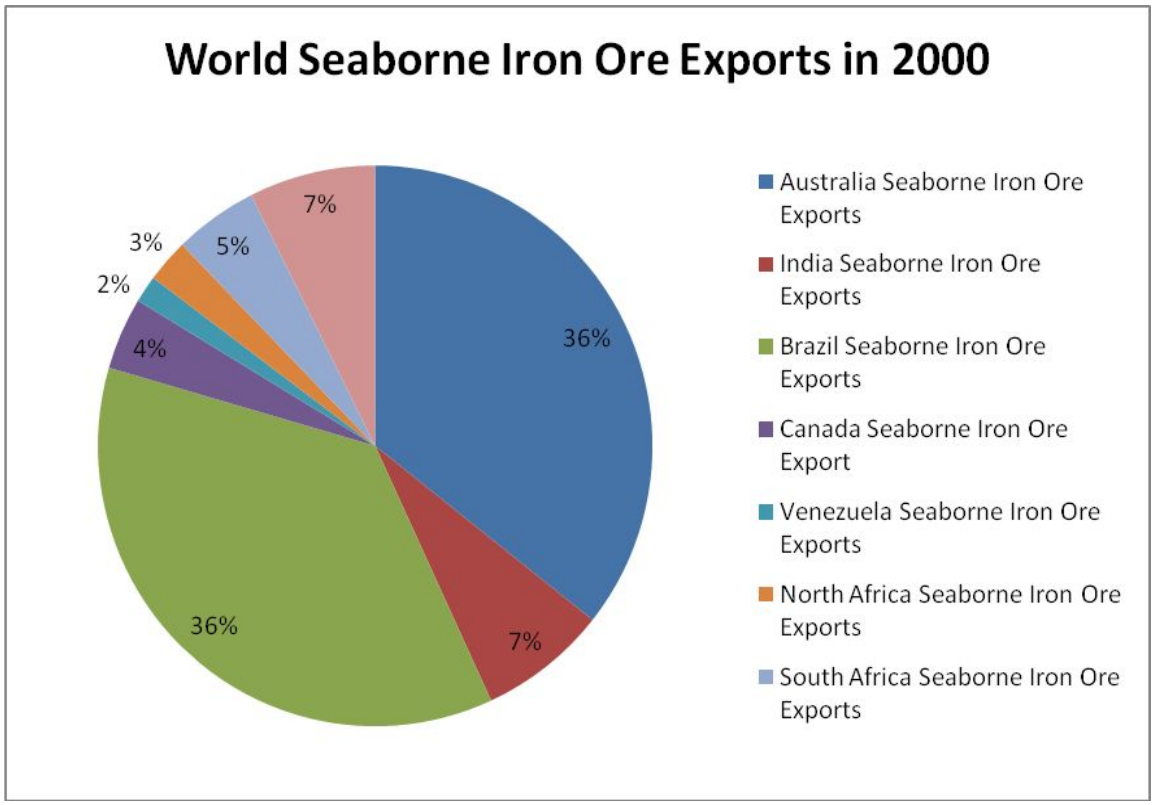
2.2 Supply and demand condition

Seaborne trade transportation is not a sole industry but a derived demand from the global trade. As the major cargo transported by Capesize bulkcarrier is iron ore, firstly we just have a deep look at the iron ore trade conditions.

Commercially, iron ore is usually an oxide, the primary minerals of which are hematite (Fe_2O_3) and magnetite (Fe_3O_4). About 99% of iron ore is used in the iron and steel industry. Ore is put into a blast furnace and smelted to produce molten iron, which is then converted to steel by removing most of the remaining carbon in a basic oxygen furnace (BOF). Iron ore is the raw material to produce steel, the most commonly used material to model industrial development.

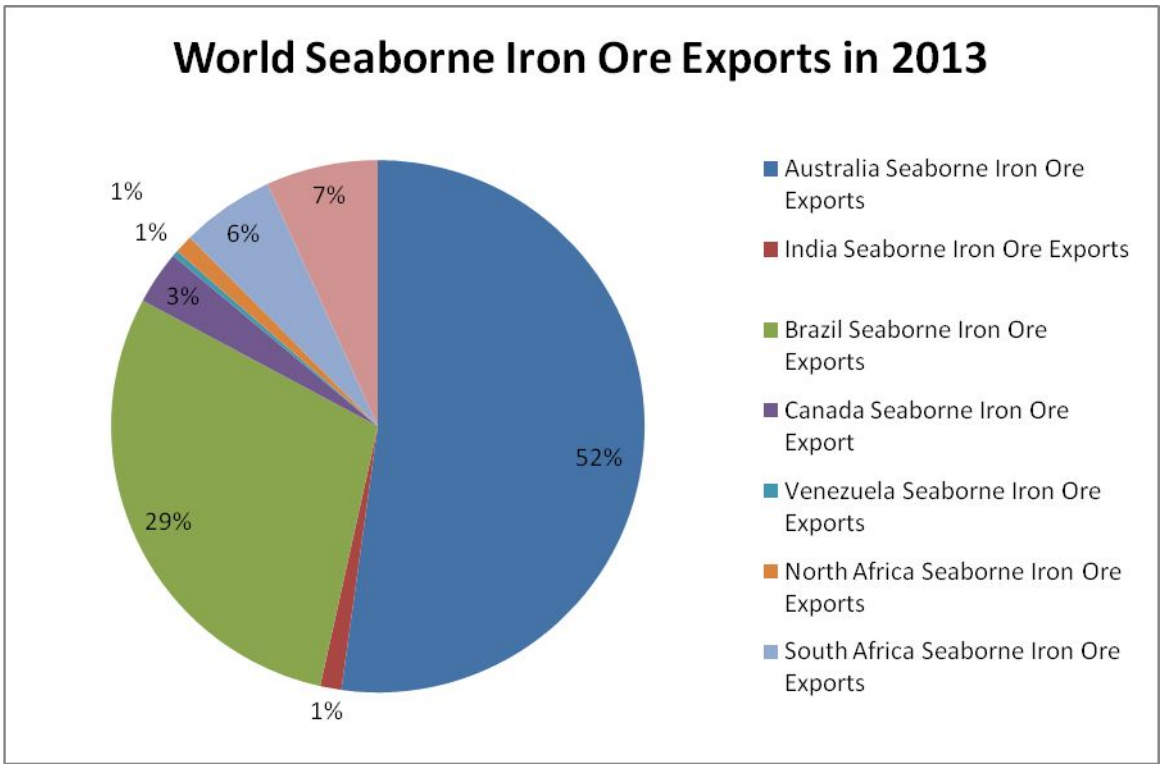
The iron ore industry is quite monopolistic, and several small handfuls of producers and manufacturers dominate the market. Australia and Brazil are both the dominated countries in the iron ore industry. Now the whole iron ore market is in the hand of three leading producers from these two countries. -- Companhia Vale Do Rio Doce in Brazil, BHP Billiton and RioTinto in Australia. The "Big Three" control about 61% of the world seaborne trade of iron ore based on the statistics of UNCTAD. Besides these three giants, India as a group has also joined the team to fill the current large supply gap of iron ore in recent years. According to speech delivered by Peter Tot, the vice president of BHP Billiton, India's exports are now the second largest supplier to China. From Figure 2-1 and Figure 2-2, we can see that in 2000, Australia and Brazil controls about 36 percent

iron ore export respectively. And in 2013, Australian iron ore mines seem to be so much favorable that make it control more than half of iron ore seaborne export.



Source: Clarkson Research

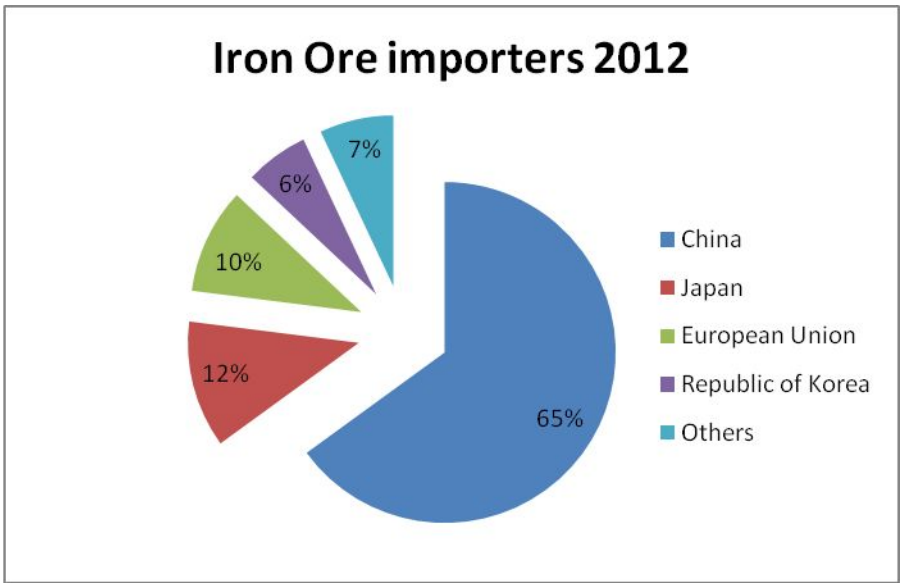
Figure 2- 1 World seaborne iron ore exports in 2000



Source: Clarkson Research

Figure 2- 2World seaborne iron ore exports in 2013

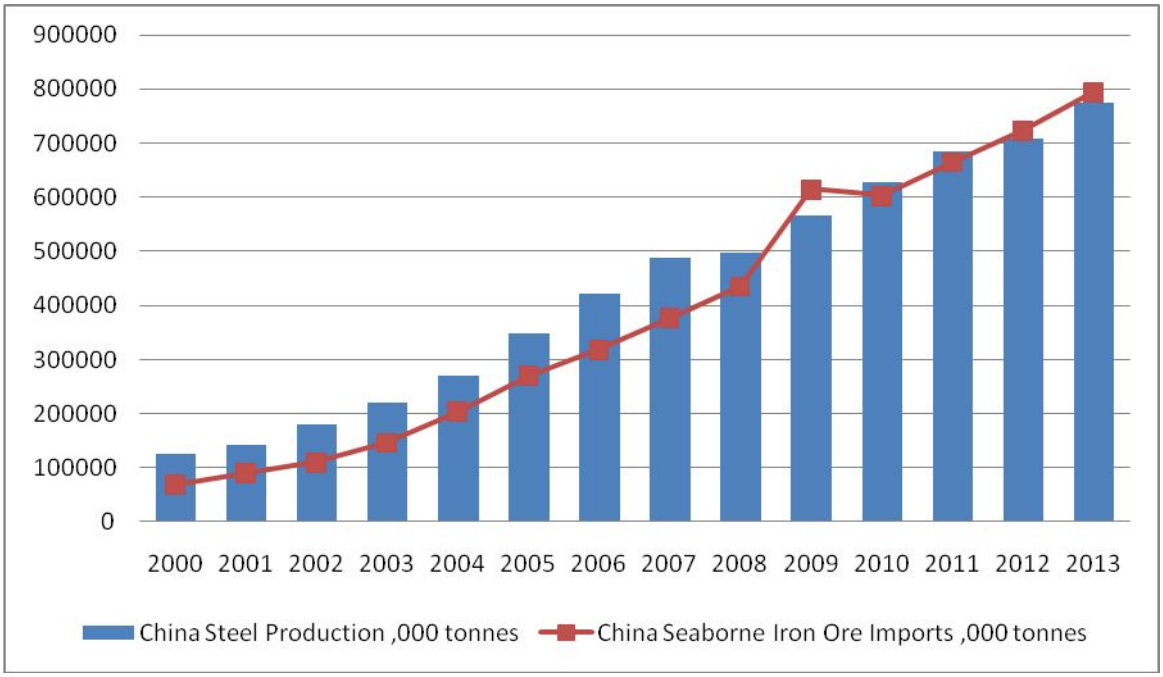
Concerning about the demand side, China is undoubtedly the largest consumer owing to its focus on the modern construction. Nearly 65 percent of iron ore is imported to China to produce steel and then be applied into modern construction.



Source: Clarkson Research

Figure 2- 3 World seaborne iron ore importers in 2012

However, modern construction is just the superficial reason. The real reason behind such over-demand phenomenon is that the domestic iron production in China cannot respond adequately to the spectacular growth in Chinese iron ore demand. Although Chinese domestic iron ore production has been surged in recent years, it still cannot compete with the "foreign good" with lower prices but better quality. Figure 2-4 represents the continuous growth of China steel production, along with the increased iron ore seaborne imports.



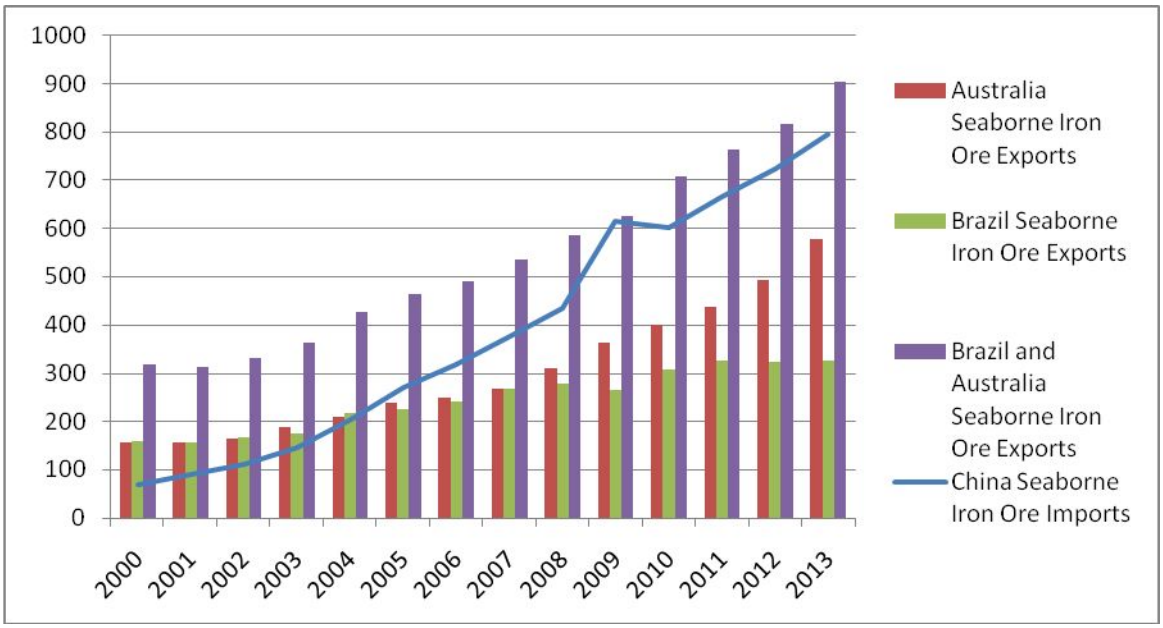
Source: Clarkson Research

Figure 2- 4 China steel production development and iron ore imports volume (2000~2013)

Furthermore, the leading role of China in the iron ore demand makes its every movement have profound effects on the freight capacity and on freight rates. The demand for seaborne iron ore and to a lesser extent thermal and coking coal have seen freight rates for large bulk carriers reach record levels, far in excess of anything seen in the past.

However, future for the whole iron ore market is not so promisingly. Lots of researchers think that China will slow down its development path since it has been growing at to a more sustainable level. However, according to Figure 5-2, it's obvious that the whole market had still remained in booming. The whole Australia and Brazil seaborne iron ore exports have maintained the uptrend since 2000, partially stimulated by the strong demand from China. China seaborne iron ore imports also performed quite

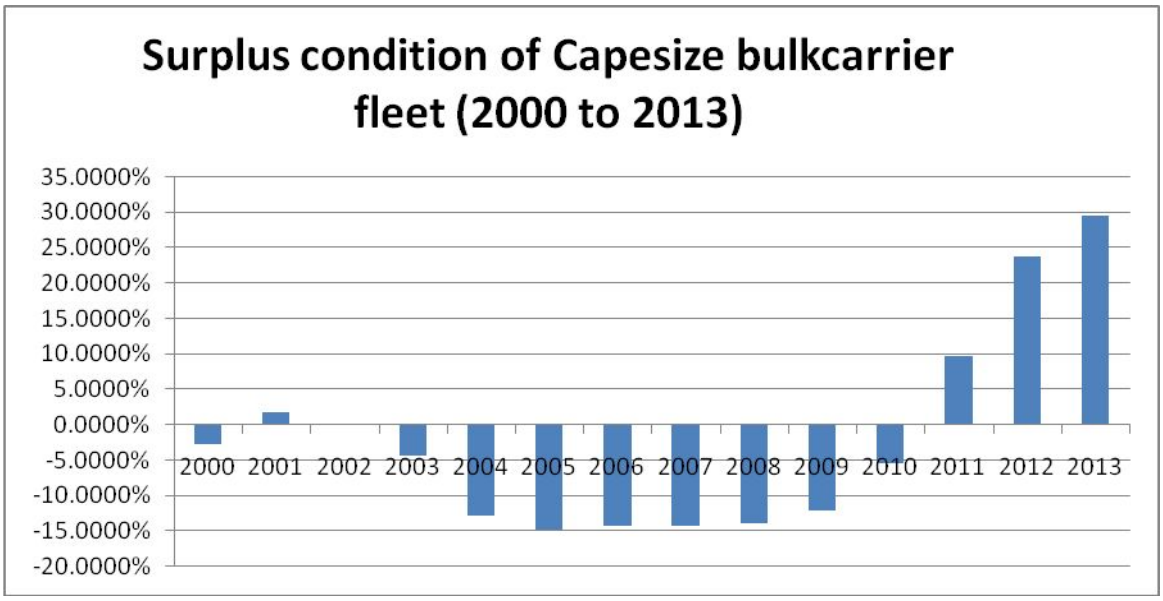
well even during the financial crisis, with a small peak in 2009 and 2010. The whole iron ore trade market is not as volatile as other dry bulk commodities. The market has in relative stable and sustainable development.



Source: Clarkson Research

Figure 2- 5 Iron ore exports volume of major countries and China import volume in 2012

Since the whole iron ore industry has been in quite sustainability, why the whole shipping market has met with so many volatilities? The answer is the imbalance between trade demand and available transportation capacity. Taking year 2002 as the balance point between Capesize transportation capacity and trade demand, it is clear in the Figure 2-6 that there was shortage of Capesize bulkcarriers during year 2004 and 2010. But since 2011 large surplus has occurred owing to the large amounts of shipbuilding orders during 2008 and the sudden collapse of global economy.



Source: Clarkson Research

Figure 2- 6 Surplus condition of Capesize bulkcarrier fleet (2000 to 2013)

2.3 General market of Capesize bulkcarrier

2.3.1 Capesize freight market

Freight market is one virtual place where shipping service is sold and brought. It is the core of shipping business section with lots of participants like cargo owners, ship owners, insurers, brokers and so on. Every newbuilding, demolition and S&P decision is based on the insight on the freight market of shipowners or investors. Therefore, thorough analysis on the shipping freight market can help us have a better understanding of the newbuilding market.

We all understand the freight market is greatly influenced by the seaborne transportation capacity and trade demand. Any imbalance will bring the up and down in the freight market. During the last decade, the whole shipping freight market has performed just like roller coaster with extreme ups and downs. Taking the year 2008, the severe global economic strike on the world, as the point of separation, I would make deep analysis on the freight market of Capesize Bulkcarrier in these two time-phases 2000 ~ 2007 and 2008 ~ 2014.

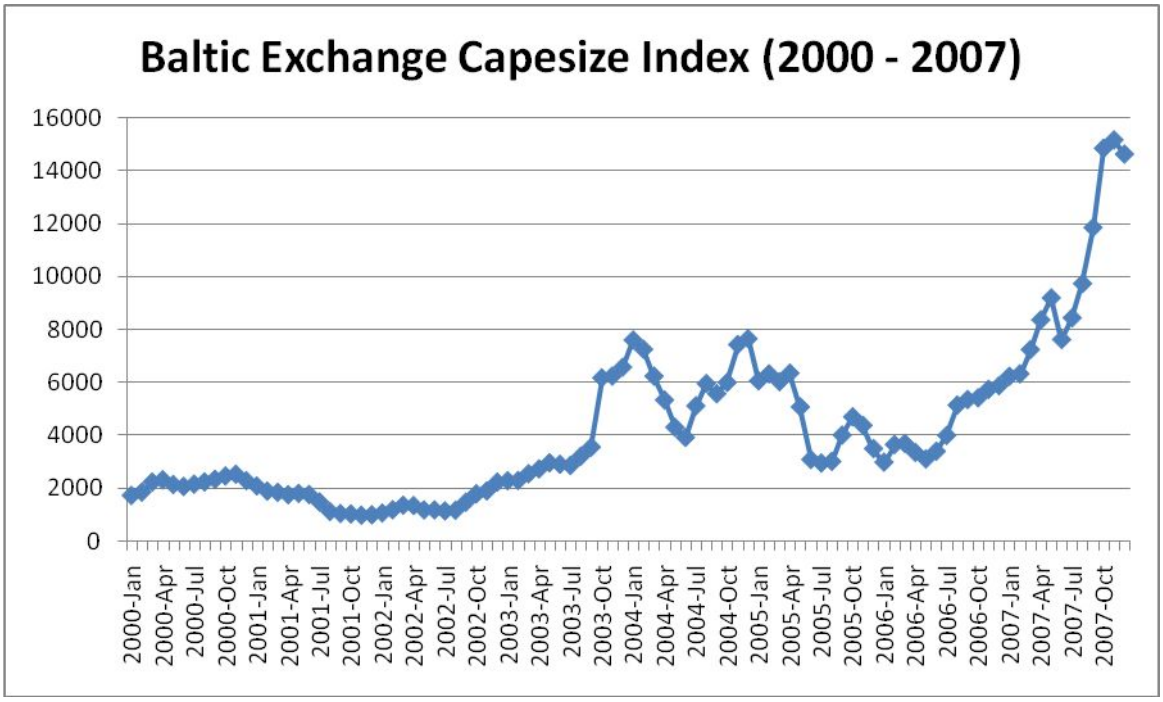
1) From year 2000 to 2007

The dry bulk market remained in the relative balance before 2008 and even met some over-demand. The whole market including the spot freight market and the time

forward market seemed to be involved in a booming period with quite sustainably growth in both trade and fleet size.

China factor has become the major driving force to the Capesize bulkcarrier section. Modern construction in China encouraged lots of domestic steel production enterprises to import iron ore from not only Brazil, Australia but also Indian Group, the new update in iron ore industry. Continuous climb in the demand side and considerable congestion in available fleet had pushed the freight of Capesize bulkcarrier to reach round and round peak.

Published by the Baltic Exchange, Baltic Capesize Index, as the barometer in the Capesize freight market, clearly showed out the spot market situation. As the following picture shows, BCI had been climb steadily from 2000 to 2006, with two minor rush times happened in Jan 2004 and Dec 2004, and a small trough in the middle of year 2004. However, such small fluctuation was considered as the normal market self-adjustment, which didn't have too much negative effect on the whole Capesize spot market.



Source: Clarkson Research

Figure 2- 7 Baltic Exchange Capesize Index (2000~2007)

The great leap happened in half year of 2007. The 2007 average earnings for dry bulk are $44,246/day and this is significantly higher than the 2006 average of $28,326/day. China's steel production once again created the record levels of output

boosting the iron ore and coking coal trades as well as the Capesize freight. In Nov 2011, BCI reached to its highest value, 15171 and average spot earnings for a modern Capesize vessel crept up to over $46491/day.

The prosperity in freight market also brought the new round upsurge of Capesize newbuilding, stimulating the increase of Capesize newbuilding prices, which will be analyzed in the following article.

All these excellent performance seemed to be the good signal for the future shipping market, but actually things failed to live up with people's expectations.

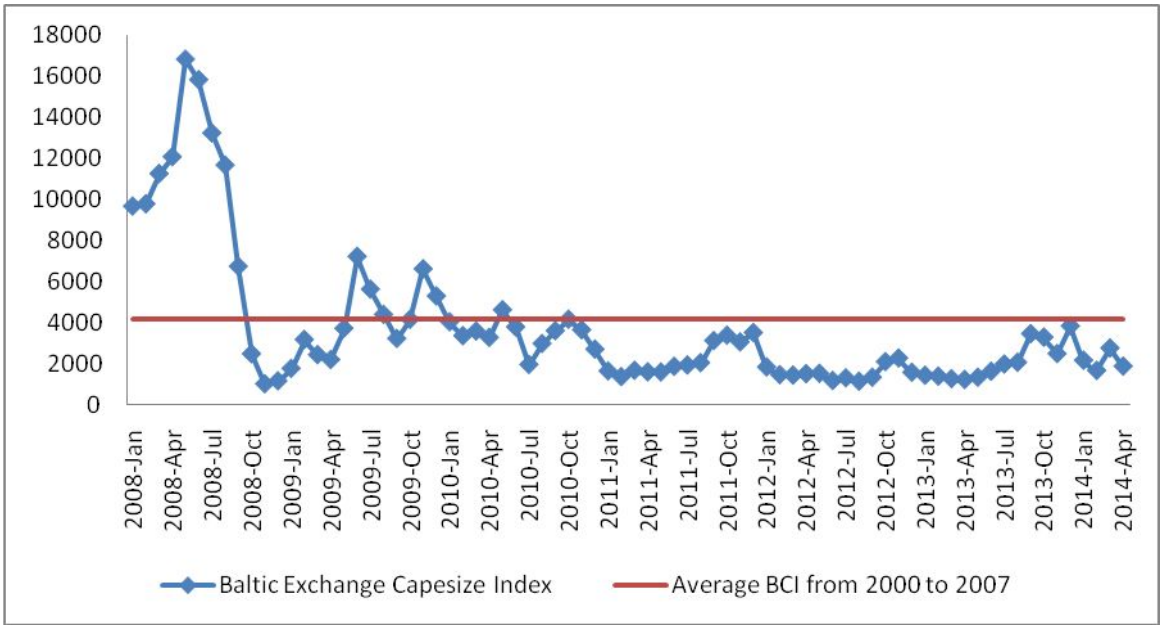
2) From year 2008 to 2014

Year 2008 up till now is not lucky enough as the previous generations. The whole dry bulk market has been seen some turbulence.

Booming period before 2008 had greatly stimulated the newbuilding market, which was proved to have significant bad influence on the latter shipping market. Because of the overhang shipping capacity, the whole shipping market has been in a terrible nightmare.

Capesize has not dropped so hardly like other bulkcarrier sub-sectors owing to the relative firm support from China at the beginning of 2008; China's steel production had maintained its upward trend, with growing China seaborne iron ore import volume. There was still a small peak during the mid of year 2008 which may be attributed to China's efforts, but after then, things changed. Capesize freight market met its "Waterloo", showing sharp drop in both spot rate and time charter rate.

BCI index seemed to join a diving competition. From relative high point at the beginning of 2008, it suddenly jumped into 1028 in Nov 2008, the lowest figure since it appeared. Since 2010, the BCI has been remained in a low performance, even lower than the average level of this index from 2000 to 2007.



Source: Clarkson Research

Figure 2- 8Baltic Exchange Capesize Index (2007~2014) with the average BCI from 2000 to 2007

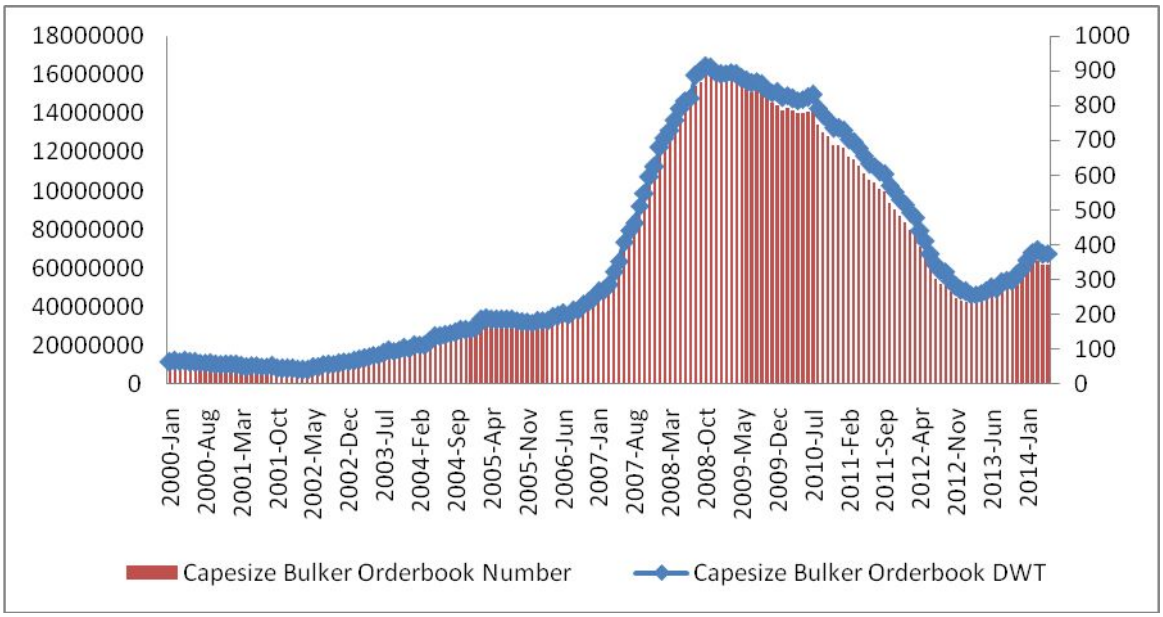
However, during recent years, especially in year 2014, lots of experts believe that the freight market for Capesize bulkcarrier will recover owing to the increased import demand of China and continuous export from three leading countries.

2.3.2 Capesize fleet condition

Fleet condition includes the numbers of ships that are on the active service now, the average age and the general conditions of these ships. Fleet develops every year with newbuilding vessels delivered and old vessels scraped. Ship owners or investors will make their newbuilding decisions with taking the current fleet condition and their expectation on the future market into consideration.

In the newbuilding side, orderbook shows us that the strong fluctuations, performing like a mirror of the freight market. When the freight market was booming, everyone wants to join the newbuilding club. Things were all going well until mid of year 2008, the financial crisis. Before 2008, nearly all the ship owners and other investors were passionate about the Capesize newbuilding issues with the faith that tomorrow would be better and better. However, after the bankruptcy of Lehman Brother, the whole global economy was in depression, bringing the Capesize newbuilding market also into the low ebb. Compared to the highest orderbook number 856 in the Oct 2008, the lowest number was just one-quarter of it, happened in Feb 2010. Lots of shipowners and investors chose

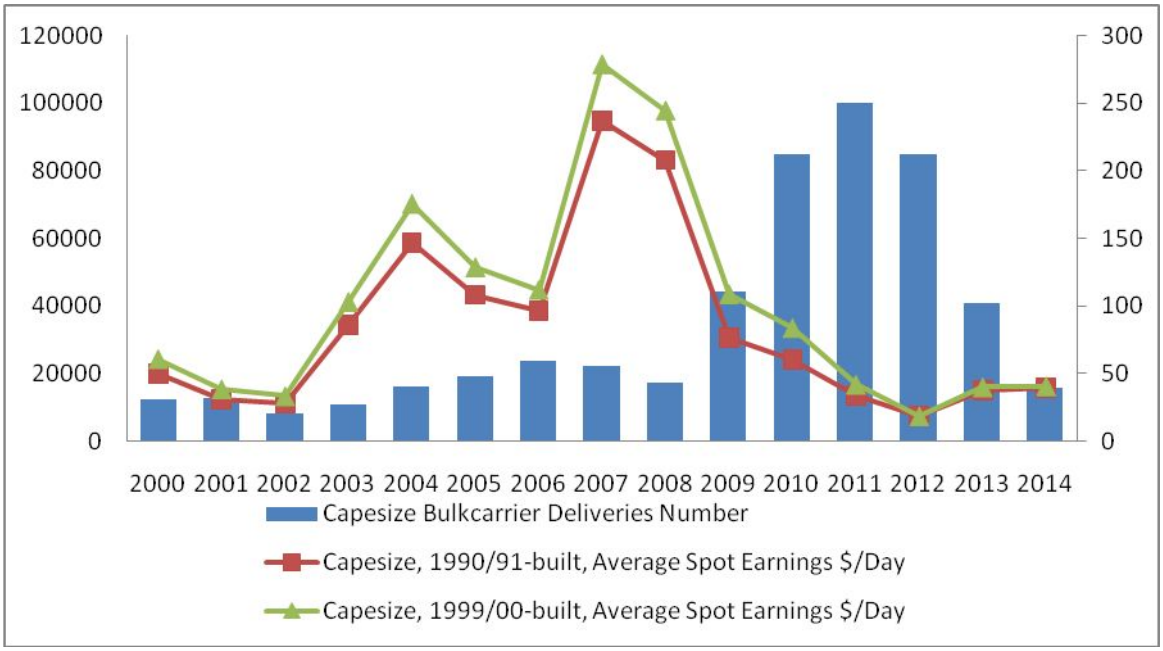
to take a conservative action instead of expanding their fleet owing to the flagging market. However, with such a long depression period, some shipowners and investors believe it's time for market recovery now, therefore, after the mid of year 2013, another growth in Capesize shipbuilding has appeared.



Source: Clarkson Research

Figure 2- 9 Capesize bulker orderbook in terms of number and DWT (2000~2014)

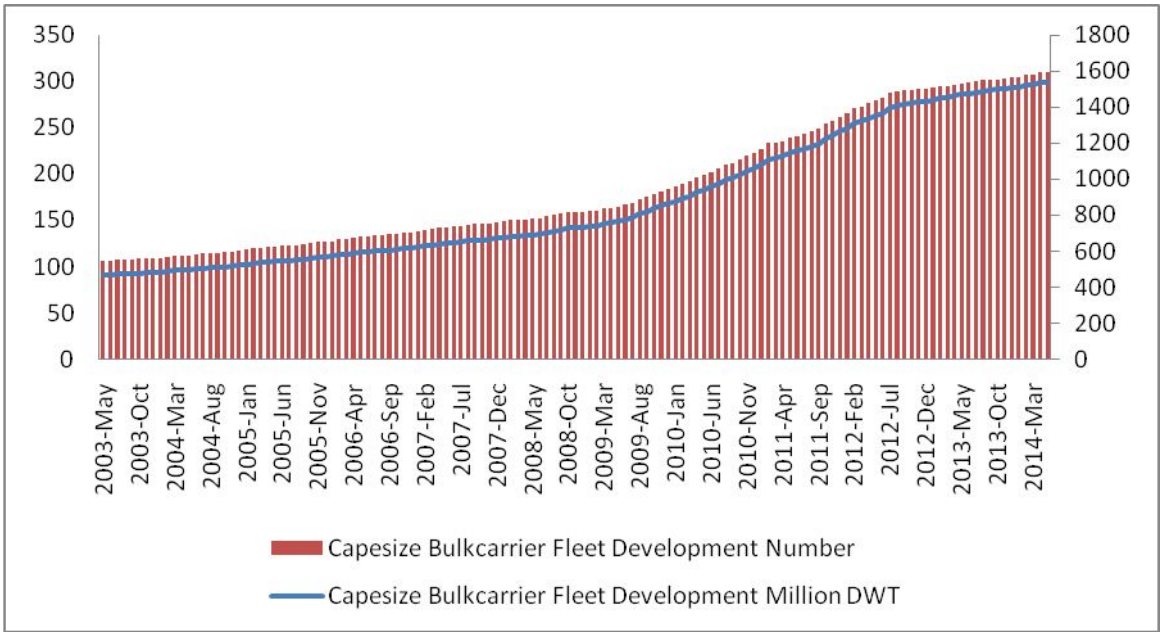
Concerning about the reasons for the fluctuations in the Capesize shipbuilding market, it must be the close inter-relation with the freight market. As I just mentioned before, every decision on the shipbuilding actually is based on the owners' expectation on the freight market. Market booming makes shipowners want to expand their fleets and one of the choices is to build a new ship. Just like Figure 2-10 shows, there are about four years' time lag between the freight market and the shipbuilding market. Prosperity in freight market happened in year 2007 and 2008 during which time shipowners and investors threw lots of money in shipbuilding, then these products of booming period took delivery in about year 2011. After year 2008, the whole freight market collapsed, along with the decreased delivery number in shipbuilding market.



Source: Clarkson Research

Figure 2- 10 Capesize bulker deliveries number compared to average spot earnings (2000~2014)

The whole Capesize fleet has maintained a stable increase since 2003 according to Figure 2-11. Both vessel numbers and million DWT have risen. In year 2003, there were about total 550 Capesize in service, but in year 2014, the number has tripled. The same goes for the fleet development in terms of million DWT. The growth trend became relative sharp during year 2009 and 2012, owing the credit to the shipbuilding peak in year 2007 and year 2008 while the freight market was in booming. Such steady growth tendency actually is not a good signal to the shipping market. Rampant development in Capesize without strong support from the trade demand side makes the shipping market in a terrible nightmare.



Source: Clarkson Research

Figure 2- 11 Capesize bulkcarrier fleet development (2000~2014)

Current fleet condition reflects the available transportation capacity. While doing the decision concerning about the shipbuilding, shipowners or investor need to consider carefully not only the freight market but also the transportation capacity. Money can only be earned in a balance demand and supply market. Overhang in shipping capacity would not do any good but bring unnecessary loss to shipowners.

3 Analysis on the cost of Capesize shipbuilding

3.1 Newbuilding cost for Capesize bulkcarrier

Ship, the asset in shipping industry, is highly capital intensive. Building a ship is not an easy thing as building a house or some other objects. Its enormous size, difficulty of craftsmanship, large demand for materials and labor make it the largest factory-produced product over the whole world. Newbuilding prices of Capesize bulkcarrier is definitely affected by the cost of shipbuilding. Newbuilding costs of one certain vessel are always divided into three major aspects as Figure 3-1 shows.

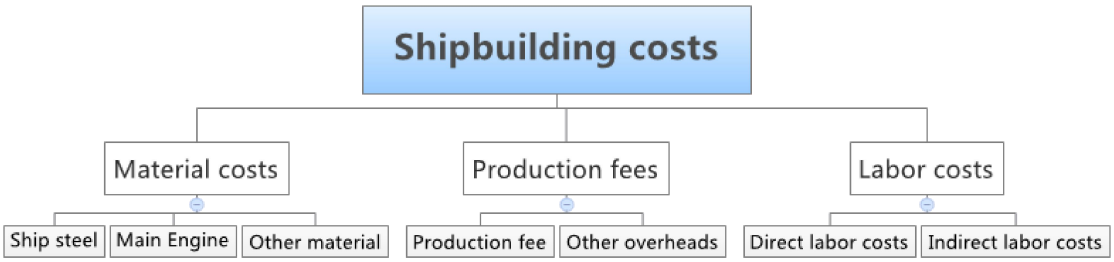


Figure 3- 1 Shipbuilding cost groups

3.1.1 Material cost

Material cost includes the costs of ship steel, main engine and other material.

Steel is the major material for vessel, and it is calculated that about 60 percent of newbuilding cost is the steel plate cost. Details for steel cost will be analyzed in the following chapter.

Main engine always occupies about 10 per cent in the total shipbuilding cost. The market for marine main engine is quite oligopolistic; the main producers are well-known Wartsila, MaK, and MAN B&W.

Other material costs involve the cost of welding material, cable, accessories, marine plants, and other machinery equipment. Welding material including the welding electrodes, sticks, solders and so forth is very important for the replacement cost. The total consumption of welding material mainly depends on the consumption of steel used in the whole ship construction. Cable can be estimated according to the deadweight of the

ship. Accessories and other materials refer to other material consumed in the process of newbuilding instead of the asset – ship itself. And this cost can also be estimated according to the steel consumption. Marine paints refer to the oil paints. Besides main engines, there is some other equipment in the shipbuilding need to be taken into the cost consideration like outfitting equipment, auxiliary engine, anchor, anchor chain and so forth.

3.1.2 Production fees

Production fee refer to the financial costs, design fees, survey fees, insurance, shipway bill, dock charges.

Shipyards pay great attention on the financial costs. Financial costs are composed of interest costs, credit costs, exchange rate cost, and so on. Proper depreciation also need be taken into account.

Exchange rate also plays a vital role in the total newbuilding cost. China is now losing its competitive price advantage partly due to the appreciation of the RMB. Chinese domestic shipyards cannot offer such favorable prices as they used to do because of the exchange rate risks; therefore, the total newbuilding cost has to increase. On the contrary, the depreciation of Yen, the national monetary unit of Japan, enables Japanese shipyard win lots of newbuilding order in recent years.

Design fees are quite popular in recent decades. SDARI as the major designer for bulkcarrier, has not its own newbuilding services, but only provide ship design services. Its design is always adopted by the shipyards under the CSSC Group such as Jiang Nan Shipyard, New century Shipyard. And the design fees need to be taken into their consideration while doing the newbuilding cost estimation if they apply the design of SDARI. Survey fees are also very important. As we all know, for sea-going ships, entry for classification society is almost essential. Surveyors from classification society will do related surveys during the whole process of ship newbuilding including the initial audition of design drawings, which will spend shipyards quite a large amount of money. The issue of certification of inspection also makes cost. There are also other costs such like dock charges, shipway bill involved in the production fee of shipbuilding.

3.1.3 Labor costs

Labor cost is another important component of newbuilding cost. It is always divided into indirect and direct labor costs. Direct labors costs mainly refer to the costs or the payments for those yard workers and other employee related to this shipbuilding project. Indirect labor costs mean those costs in the routine labor management, also referred to as overheads.

For three major ship newbuilding countries, the gap of labor cost is keeping narrow in recent years.

It is calculated in 2009 that Chinese shipyards had the absolute advantage in the labor cost, which makes them can offer cheaper prices to attract ship owners. On the contrary, labor cost in Japan and Korea was a bit more expensive which make them less competitive. However, with the development of China's economy, labor cost has ascended in recent years. Continuous growing labor cost, accompanied with the other management issues, may be the major reason for the bankruptcy of Chinese domestic shipyards during the financial crisis.

Table 3- 1 Labor cost in Japan, Korea and China

Cost Index	Japan	Korea	China
Unit labor cost (Dollars/per capital yearly)	36237.60	16684.80	3880.80
Production efficiency (CGT/per capital yearly)	185.60	123.73	17.54
Unit production cost (CGT/per capital yearly)	195.25	134.85	221.25

Source: CNBC International

Both labor and production fees would account for about 30 to 40 per cent in the total shipbuilding cost.

3.2 Ship steel of Capesize shipbuilding

Steel, as the major material to build a new ship, accounts for a large proportion of the total ship newbuilding cost.

Most ship steel is wide and thick, used in building the hull structure, and a small quantity of ship steel is thin plate, applying for the upper structure. As a ship has to sail on the sea for an extreme long period, the working environment for the ship is very awful. Marine organism and microorganism in the ocean would erode the hull, and the killer waves as well as the stress alternation would put higher requirement on the hull strength.

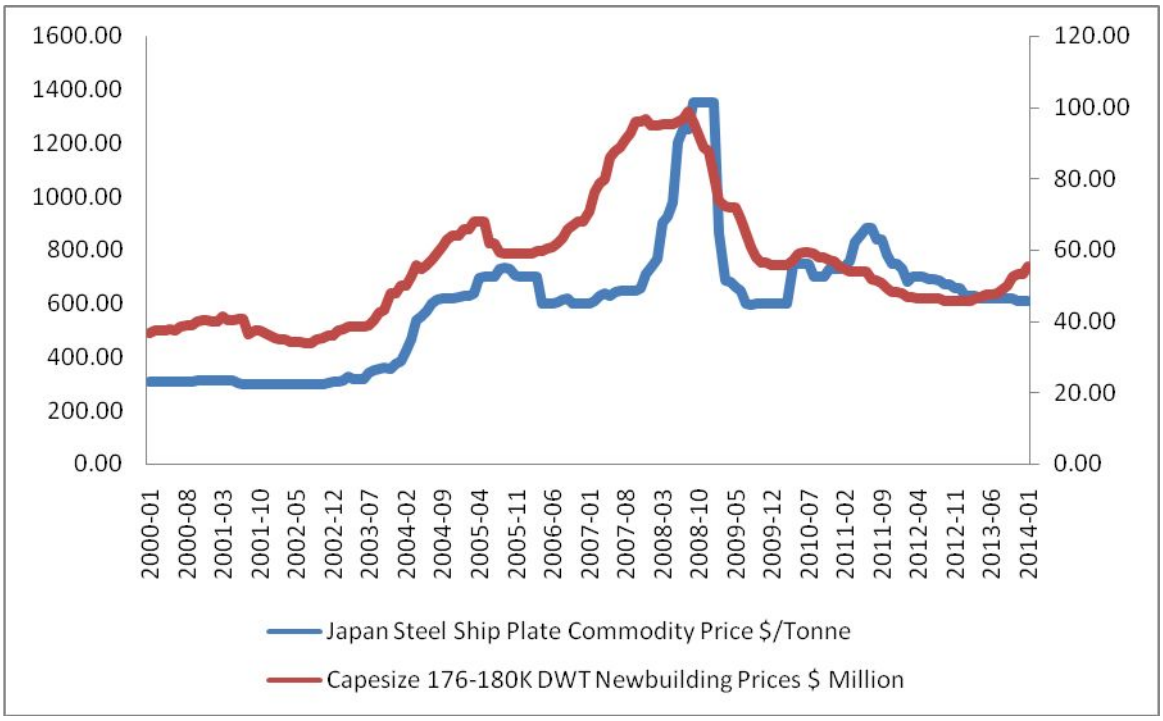
Therefore, steel used in the ship newbuilding process need to have high weld ability with proper strength, tenacity, low temperature resistance and corrosion resistance. Additionally, it also needs to be approved by classification society. We usually classify the ship steel according to its purposes as Table 3-2 shows.

Table 3- 2 Categories of ship steel and its application

Category	Application
Steel plate	Hull
Angle iron, fashioned iron	Hull structure
Flat-bulb steel	Keel
Steel tube	Fluid pipeline, pressure pipeline

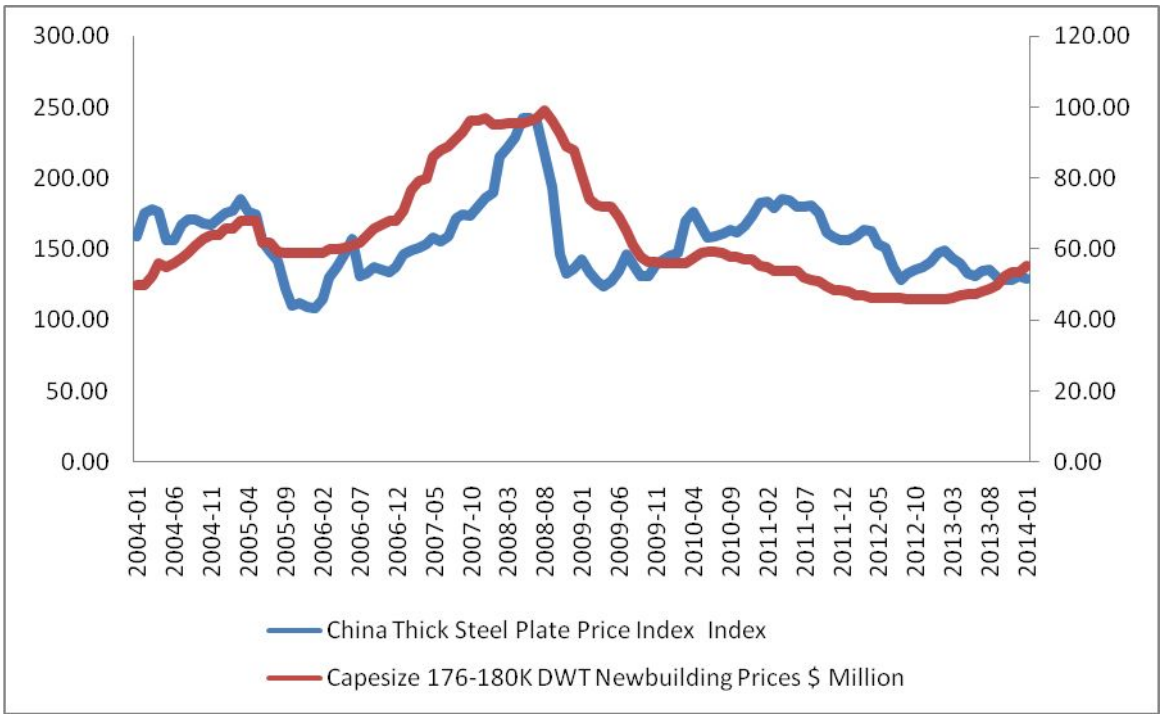
Source: Maritime Economics, 2009.

Volatilities in the steel prices bring lots of pressure on the ship newbuilding industry. Taken Japan steel ship plate commodity price for example, it is clear that the steel price has fluctuated drastically since 2000 with the general upward trend. Year 2009 saw the peak period for Japan steel plate prices which may be the derived from the depreciation of Yen. In addition, newbuilding prices and ship steel prices have interactive influence. Since year 2011, the shipping market has seemed to recover from the financial depression, bringing a new upsurge in ship newbuilding. Such upsurge has also promoted the ship steel price. Chinese comprehensive price index for thick and wide steel is an index reflecting the price fluctuation in China. As shown in the graph, we can also see that ship steel price in Chinese steel plants has nearly the same swing as the one in Japan.



Source: Clarkson Research

Figure 3- 2 Japan steel ship plate commodity price compared to the Capesize 176-180K DWT newbuilding prices



Source: MySteel.com

Figure 3- 3 China thick steel plate price index compared to the Capesize 176-180K DWT newbuilding prices

3.3 Marine equipment of Capesize shipbuilding

Marine equipment accounts for another large proportion of the total shipbuilding cost. Martin Stopford illustrated in Maritime Economics that material costs occupy about 53 percent in the total shipbuilding. And among this 54 per cent, main engine and major purchase account for 16 per cent and 20 per cent respectively in the total shipbuilding costs.

Main engine requires the second highest cost after ship steel. According to the statistics from Clarkson research, there are total 1592 Capesize bulkcarrier available in current market. All the Capesize bulkcarriers are motor ships, using the diesel engines with two-stroke. Market for two-stroke marine diesel engines is quite oligopolistic, and the three leading producers of two-stroke marine diesel engines around the world are MAN, Mitsubishi and Wartsila. Their market share is just illustrated in the following pie chart.

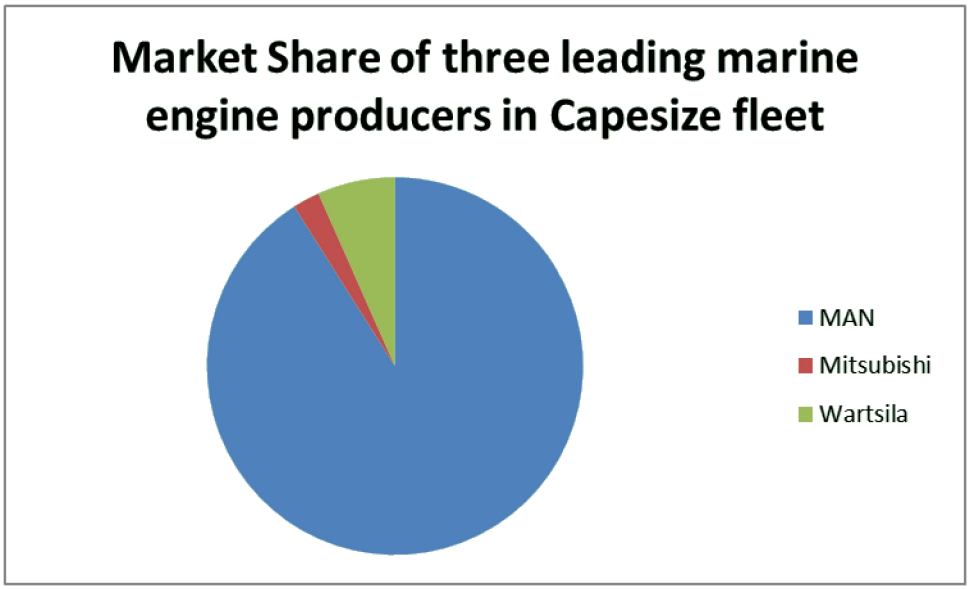


Figure 3- 4 Market Share of three leading marine engine producers in Capesize fleet

And the design type of diesel engine is 6S60MC, 6S70MC, and 6S80MC of MAN, 6UEC85LSII of Mitsubishi, and 7RT-flex82T-A, 6RTA72 of Wartsila. There is not large difference among these main designs for Capesize bulkcarriers. For those engines which are designed environmental-friendly, they always require higher prices.

4 Influential factors on the newbuilding prices of Capesize

4.1 General description on the influential factors

After thorough analyses on the both supply and demand condition of trade market and shipping market of Capesize bulkcarrier, we can find out that newbuilding market is not a sole industry. Newbuilding market, as a core part of shipping business section, has extreme close relationship with other sub-markets, especially the freight market. Besides this, as the derived industry from trade, every movement in the ship newbuilding market is affected by the global trade. Because the major commodity transported by Capesize is iron ore, therefore, the trade of iron ore means a lot to the Capesize newbuilding market.

The prices of newbuilding Capesize bulkcarrier will be affected by so many factors. These factors can be categorized into trade factors, cost factors and shipping market factors.

4.1.1 Trade factors

Trade factors, as its name implies, are those factors related to the trade, especially the iron ore trade. China plays an important role in the iron ore seaborne trade, ranking the first in the global iron ore importing countries. Most iron ore it imports will go into the steel production, so the Chinese steel production is also influential to the Capesize newbuilding market. Brazil, Australia as well as India are the leading iron ore exporting countries over the world, so their iron ore seaborne export volumes should be also taken into consideration. However, the monthly data are unavailable, so I just omit them in this article.

4.1.2 Cost factors

Ship, the asset of shipping industry, is a cost-intensive object. Capesize, owing to its large tonnage, requires a higher cost compared to other products. The cost factors of Capesize newbuilding bulkcarrier can be divided into several aspects, which just have been introduced in Chapter 3.

As the major material of newbuilding ship is steel, the prices of steel matter a lot to the newbuilding prices of Capesize bulkcarriers. Attention would be paid on the steel

prices in three Asian leading countries – China, Japan and Korea in this article. Additionally, cost factors also include some factors which cannot be quantified like the eco-friendly design. For instance, the ship named “Wuchang” with the energy-efficient standard type – B.Delta, has a higher price than normal bulkcarrier.

Financing cost factors are also part of the cost factors. Capital intensity implies that shipowners or investors cannot pay the money by themselves. Most newbuilding transactions are based on the financing activities especially the bank loans. Therefore, the interest rates as well as the LIBOR rates count for much in the final Capesize newbuilding prices. Beyond that, even with the popularity of US Dollars, currency of these three leading shipbuilding countries – JPY, CNY, and KRW will also affect the newbuilding prices. Most operating cost of the shipyards, which will be partially included in the newbuilding prices, is calculated in terms of local currency. And the inflation or deflation of one certain currency will also bring some impacts on the newbuilding prices.

4.1.3 Shipping market factors

Shipping market factors refer to those factors inside the shipping market – freight market, second-hand market and newbuilding market.

In freight market, the freight rate is the most direct factor. When the freight market is booming with relative high freight rate, shipyards will be occupied with newbuilding orders. Scarcity of resources along with the prosperous market condition will drive up the newbuilding prices. On the contrary, if the market is in depression with extreme low freight rate, most shipways in shipyards are empty, the shipyards may be willing to receive some newbuilding orders even the prices are low. The most representative freight rate – related factors about Capesize market is Baltic Capesize Index, the index containing route assessments based on time-charter hire rates "USD paid per day per Metric Ton" of Capesize. Besides this, average earnings are also influential.

Second-hand shipping market is closely related to the newbuilding market as well. Prices for the second-hand Capesize bulkcarriers are negatively related to the newbuilding prices.

Ship scrap number and DWT also can explain the movement of newbuilding prices of Capesize bulkcarrier. In order to maintain the fleet capacity, ship owners always choose to scrap old vessels and build some new ones. Therefore, ship scrap numbers will

affect the newbuilding orders, then having an indirect influence on the newbuilding prices.

In ship newbuilding market itself, prices can be affected by lots of factors. Orderbook, contracting and deliveries in terms of DWT represent the new transportation capacity as well as the occupancy of shipways. Higher numbers in the orderbook, contracting and deliveries will definitely impulse the newbuilding prices.

4.2 Numerical analyses on the influential factors

Lots of factors can explain the movement of Capesize newbuilding prices, but not all of them can be quantified or found in the monthly-series. Therefore, the independent variables I choose in the regression model of Capesize newbuilding prices would be those that can be quantified in terms of monthly series. Nevertheless, the impact of other factors should not be omitted. Based on the classification method mentioned above, I just illustrate about 20 influential factors in terms of three major groups.

4.2.1 Trade factors

1) China Seaborne Iron Ore Imports (Million Tonnes): As the largest import country of iron ore, China's imports volume definitely has a profound influence on the Capesize shipping market.

2) China Steel Production (,000 Tonnes): China large import of iron ore is mainly used on its modern construction. Steel is the main material to conduct the construction projects; therefore, the steel production also weighs a lot the Capesize shipping market.

3) Industrial Production China (% Yr/Yr): Industrial Production China Change Ratio yearly represents the development path of China economy, an important Chinese factor for Capesize newbuilding market.

4) World Steel Production (,000 Tonnes): Most iron ore is shaped into steel; world steel production reflects the amount of iron ore used during the fixed time period.

4.2.2 Cost factor

1) Japan Steel Ship Plate Commodity Price ($/Tonne): Ship steel plate is the major material in shipbuilding process. As Japan is the one of the largest shipbuilding leaders over the world. Its ship plate commodity price may affect the final newbuilding prices.

2) Libor Interest Rates (%): Shipbuilding requires a large sum of money investment. For most shipowners and investors, they would not choose to pay all the money by themselves. Most shipbuilding projects would involve the financing activities. Libor (full name as London Inter-Bank Offered Rate) is always regarded as the base rate for most commercial loans.

3) Japan Interest Rates (%): Japan's vital role in the shipbuilding market cannot be ignored.

4) China Thick Steel Plate Price Index: China Thick Steel Plate Price Index is an index conducted by Mysteel.com, a Chinese website proving the comprehensive bulk cargo information. The Index reflects the prices volatilities of China thick steel plate, the main material for shipbuilding.

4.2.3 Shipping market factors

1) Baltic Exchange Dry Index: BDI is a comprehensive index, representing the spot freight market of all dry bulk sectors. Owing to the close inter-relation between freight market and shipbuilding market, the freight index needs to be paid large attention on.

2) Baltic Exchange Capesize Index: BCI is the index designed to reflect the freight market of Capesize bulkcarrier, and it's the part of BDI index. Every decision concerning about the Capesize shipbuilding is based on the anticipation of shipowners and investors for the freight market.

3) Capesize, 1999/00-built, Average Spot Earnings Index: Above index is just about how much the freight shipowners can receive from one voyage charter or a period of time charter. However, what the shipowners really care is the money they can finally put into their own pocket. Average spot earnings are just the figures which freight minus the operation cost, reflecting the real profit of the ships.

4) 1 Year Time Charter Rate 150,000 dwt Bulkcarrier ($/Day): Also the freight rate but a time charter freight rate mirrors the short-term charter market of Capesize bulkcarrier.

5) Bulkcarrier Average Newbuilding Prices ($/DWT): Bulkcarrier average newbuilding prices is an overall price, containing all the types of bulkcarrier.

6) Capesize Bulker Orderbook (DWT): Orderbook reflects the condition of the current shipbuilding market. The larger the orderbook (DWT) is, the more crowded the

current shipbuilding market is. Lack of enough shipways would push the rise of Capesize newbuilding prices.

7) Capesize Bulker Contracting (DWT): Capesize bulkcarrier contracting represents the newbuilding orders during a period of time. Contracting condition in terms of DWT can reflect the shipbuilding market for a fixed period of time.

8) Capesize Bulkcarrier Deliveries (DWT): Vessel deliveries mean that the vessel is delivered to the shipowners and will be applied into the transportation service. Capesize bulkcarrier deliveries can reveal the current transportation capacity, then affecting the swing of newbuilding prices.

9) Capesize 180K 5 Year Old Secondhand Prices ($ Million): Secondhand prices, in theory, are closely related to the newbuilding prices. Expanding fleet has two approached: one is to build a new vessel and the other is to purchase a second-hand vessel which is available in the market. Therefore, second-hand prices would directly affect shipowners 'decision concerning about the shipbuilding.

10) Capesize Sales ($ Million): Capesize sales in terms of $ million reveal the total purchase deals amount during one month. It is the other indicator of second-hand market.

11) Capesize Scrap Value (($ Million): In theory, demolition market is always positive related to the shipbuilding market. Thus, Capesize scrap value can also help us explore the rule of newbuilding price fluctuation.

12) Capesize Bulkcarrier Fleet Development (Million DWT): Capesize bulkcarrier fleet development shows us the fleet increase or decrease condition from year to year. Any surplus or deficit of the fleet capacity will affect the newbuilding prices.

4.2.4 Dummy variable

Dummy variable is set here to reveals the large influence of financial crisis on the Capesize newbuilding prices around year 2008. Such strong impact cannot be quantified, therefore, I chose to apply dummy variable, setting value 1 from 2007-03 to 2009-01 and value 0 for other years, to reflect the influence of economic crisis on the global shipping market.

4.3 Dynamic relations between Capesize shipbuilding prices and the influential factors

There are total 20 explanatory variables plus one dummy variable which I suppose will affect the movements of Capesize newbuilding prices. Before running the regression model, I just made self-assumption on the relationships between Capesize newbuilding prices and these 20 independent variables, which shows in the following table. All the assumption is just based on the basic shipping knowledge, and the true relationship will be identified from the result of regression model.

Table 4- 1 Dynamic relation assumption between Capesize newbuilding prices and the independent variables

No.	Group	Variables	Unit	Relation assumption
1	Trade factors	China Seaborne Iron Ore Imports	Million Tonnes	+
2		China Steel Production	,000 Tonnes	+
3		Industrial Production China	% Yr/Yr	+
4		World Steel Production	,000 Tonnes	+
5	Cost factors	Japan Steel Ship Plate Commodity Price	$/Tonne	+
6		LIBOR Interest Rates	%	+
7		Japan Interest Rates	%	+
8		China Thick Steel Plate Price Index	Index	+
9	Shipping market factors	Baltic Exchange Dry Index	Index	+
10		Baltic Exchange Capesize Index	Index	+
11		Capesize, 1999/00-built, Average Spot Earnings Index	Index	+
12		1 Year Timecharter Rate 150,000 dwt	$/Day	+
13		Bulkcarrier Average Newbuilding Prices	$/DWT	+
14		Capesize Bulker Orderbook	DWT	-
15		Capesize Bulker Contracting	$ Million	-
16		Capesize Bulkcarrier Deliveries	DWT	-
17		Capesize 180K 5 Year Old Secondhand Prices	$ Million	-
18		Capesize Sales	$ Million	-
19		Capesize Scrap Value	$ Million	+
20		Capesize Bulkcarrier Fleet Development	Million DWT	/
21		Dummy variable		/

Notes: "+" means "positive relationship", "-" means "negative relationship" and "/" means uncertain relationship.

5 The econometric analysis on the newbuilding prices of Capesize bulkcarrier

5.1 Econometric theory and regression model

Econometrics is a composition of economics, mathematics and statistics as illustrated in Figure 5-1. By using the inference among these three elements to quantify economic phenomena, econometrics makes statements or hypotheses that are mostly qualitative in nature. The aim of econometrics is to convert qualitative statements (such as "the relationship between two or more variables is positive") into quantitative statements (such as "operation for a ship increased three times by consumption expenditure increases by 95 per cents for every one dollar increase in disposable income"), using the mathematics equations to express such inter-relationship. (*Maddala, G. S., & Lahiri, K. 1992*). With the help of econometrics models, we can transform those theoretic economic models into versions that can be estimated. For instance, we all know that spot freight rates have an impact on the newbuilding prices, or in other words, there is an inter-relation between these two. By applying econometrics models, we can estimate and explain in which extent spot freight rates can affect the movement of newbuilding prices. Such accurate quantitative inference between the dependent and independent variables can help decision-makers make more proper judgment, not just to do something without foundation.

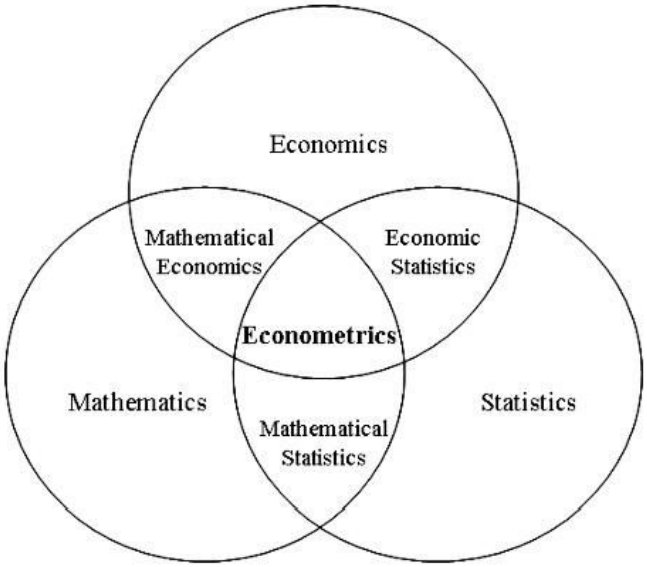


Figure 5- 1 Composition of Econometrics

Regression is a mathematical statistics method in econometric subject, aiming at exploring the correlativity among different variables. What regression analysis concerned about is describing and evaluating the relationship between a given variable and one or more other variables; it is an attempt to explain movements in a variable by reference to movements in one or more other variables.

Generally, we use the model

$$y_t = \alpha + \beta x_t + \mu_{t,} t = 1, 2, ..., T \text{ (Equation 5- 1)}$$

This equation can be used to express the relationship between one dependent variable and one independent variable. But in fact the dependent variable always depends on more than one independent variable. Therefore, we write the equation like:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + ... + \beta_k x_{kt} + \mu_t, t = 1, 2, ...T \text{ (Equation 5- 2)}$$

β is the coefficient attached to the independent variables (B1 is the coefficient attached to the constant term), representing the partial effect of the given explanatory variable on the explained variable, after eliminating the effect of all other variables.

5.2 Regression model on the newbuilding prices of Capesize bulkcarrier

5.2.1 Stationary Test

One of the premises of a correct regression model is that the data should be

stationary time-series, otherwise will lead to the spurious regression problems. One classic method to run the stationary test is unit root test. Unit test root is the base to explore the co-integration relationship among variables, which can help to transfer the nonstationarytimeseries into stationary ones, thus we can carry out the following related research. If there is unit root occurred in the time-series data, we always use first difference or second difference to eliminate unit root. One method for unit root test is ADF Test, an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models.

ADF test is applied to the model like

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \ldots + \beta_k x_{kt} + \mu_t, t = 1, 2, \ldots T \text{ (Equation 5-3)}$$

The unit root test is then carried out under the null hypothesis (donated H_0 and β =0.5) against the alternative hypothesis (donated H_1 and β >0.5). Once a value for the test statistic is:

$$T = \frac{\hat{\beta} - \beta^*}{SE(\hat{\beta})} \text{ (Equation 5-4)}$$

In the regression model for Capesize newbuilding prices, result of ADF test on the data group for level shows as following:

Table 5- 1ADF fisher unit root test on Capesize newbuilding prices for level

Null Hypothesis: Unit root (individual unit root process)
Series: Y, X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15, X16, X17, X18, X19, X20, X21
Date: 05/10/14 Time: 18:54
Sample: 2004M01 2014M01
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 12
Total number of observations: 2588
Cross-sections included: 22

Method	Statistic	Prob.**
ADF - Fisher Chi-square	72.7762	0.0041
ADF - Choi Z-stat	-2.64292	0.0041

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results CAPE

Series	Prob.	Lag	Max Lag	Obs
Y	0.5859	1	12	119
X1	0.9482	2	12	118
X2	0.8171	12	12	108
X3	0.1771	1	12	119
X4	0.4616	12	12	108
X5	0.0615	1	12	119
X6	0.8190	1	12	119
X7	0.3800	1	12	119
X8	0.0331	1	12	119
X9	0.0821	1	12	119
X10	0.0491	1	12	119
X11	0.0391	1	12	119
X12	0.1771	1	12	119
X13	0.5221	2	12	118
X14	0.2304	3	12	117
X15	0.0298	1	12	119
X16	0.5691	3	12	117
X17	0.1886	1	12	119
X18	0.0313	3	12	117
X19	0.0575	0	12	120
X20	0.9210	3	12	117
X21	0.3762	0	12	120

It is clear that the data show great stationary in the unit root test, therefore, we need to add time lag to eliminate the stationary problems. By testing for the first difference and second difference, results shows that non-stationary problems can be all eliminated for the data with second difference.

Table 5- 2 ADF fisher unit root test on Capesize newbuilding prices for 2nd difference

Null Hypothesis: Unit root (individual unit root process)
Series: Y, X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15, X16, X17, X18, X19, X20, X21
Date: 05/10/14 Time: 18:56
Sample: 2004M01 2014M01
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 1 to 10
Total number of observations: 2502
Cross-sections included: 22

Method	Statistic	Prob.**
ADF - Fisher Chi-square	1352.63	0.0000
ADF - Choi Z-stat	-34.7696	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(CAPE,2)

Series	Prob.	Lag	Max Lag	Obs
D(Y,2)	0.0000	2	12	116
D(X1,2)	0.0000	8	12	110
D(X2,2)	0.0000	10	12	108
D(X3,2)	0.0000	2	12	116
D(X4,2)	0.0000	10	12	108
D(X5,2)	0.0000	1	12	117
D(X6,2)	0.0000	2	12	116
D(X7,2)	0.0000	5	12	113
D(X8,2)	0.0000	1	12	117
D(X9,2)	0.0000	7	12	111
D(X10,2)	0.0000	3	12	115
D(X11,2)	0.0000	7	12	111
D(X12,2)	0.0000	7	12	111
D(X13,2)	0.0000	1	12	117
D(X14,2)	0.0000	1	12	117
D(X15,2)	0.0000	7	12	111
D(X16,2)	0.0000	8	12	110
D(X17,2)	0.0000	1	12	117
D(X18,2)	0.0000	4	12	114
D(X19,2)	0.0000	4	12	114
D(X20,2)	0.0000	1	12	117
D(X21,2)	0.0000	2	12	116

Since data with second difference meet the requirement of stationary test, therefore, all the data used in the following would be transferred into second difference value with two months difference. (*See Appendix II*)

5.2.2 Multicollinearity solution

There are total 21 independent variables including the dummy variable in the regression model of Capesize newbuilding prices. Under some circumstances, some independent variables are highly correlated with each other. Such high correlation (always higher than 0.8) will lead problems in the following regression result like spurious regression. In order to avoid such multicollinearity problems, we just have a simple look at the matrix of correlations between the individual variables. *(See Appendix III)*

Table 5- 3 Correlation of X8, X9, X10and X11

	X9	X10	X11
X9	1		
X10	0.973867	1	
X11	0.959995	0.990431	1
X12	0.923986	0.893236	0.863198

From the table, we can find that these four individual variables -- Baltic Exchange Dry Index, Baltic Exchange Capesize Index, Capesize, 1999/00-built, Average Spot Earnings Index and 1 Year Timecharter Rate 150,000 dwt are highly correlated. In order to avoid the multicollinearity problems occurred in final regression result, I just choose the easiest one –removing the other three variable and keep only BCI available.

Additionally, 1 Year Timecharter Rate 150,000 dwt also has high correlation with Capesize 180K 5 Year Old Secondhand Prices. Since the previous one is removed from the independent variables, so the secondhand prices would be remained.

5.2.3 Regression trials

After all the pre process work on the raw data, then we just have a look at the regression result for the first and second trial.

Total 18 individual variables were involved in the first regression trials, and from the result, we can see that only 5 explanatory variables are significant variable (with Probability< 0.05 approximately).

Table 5- 4 First regression trial

Dependent Variable: Y
Method: Least Squares
Date: 05/10/14 Time: 19:04
Sample: 2004M03 2014M01
Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	-0.022125	0.026837	-0.824420	0.4117
X2	-3.38E-05	6.43E-05	-0.525950	0.6001
X3	-0.111808	0.057031	-1.960470	0.0527
X4	-3.72E-05	3.80E-05	-0.978937	0.3300
X5	-0.001435	0.002116	-0.678232	0.4992
X6	0.613087	0.543086	1.128894	0.2616
X7	0.137121	3.744559	0.036619	0.9709
X8	0.014320	0.015030	0.952770	0.3430
X10	0.000345	0.000105	3.292476	0.0014
X13	0.094220	0.008996	10.47316	0.0000
X14	3.50E-08	3.61E-08	0.969444	0.3347
X15	7.27E-08	7.55E-08	0.962961	0.3379
X16	-1.08E-07	1.57E-07	-0.686117	0.4942
X17	-0.076852	0.025355	-3.031021	0.0031
X18	-0.000130	0.000535	-0.243190	0.8084
X19	0.175820	0.167292	1.050979	0.2958
X20	-0.063145	0.088969	-0.709736	0.4795
X21	2.907601	1.171250	2.482478	0.0147
C	0.299508	0.360574	0.830643	0.4082

R-squared	0.817408	Mean dependent var	0.075630
Adjusted R-squared	0.784541	S.D. dependent var	3.377009
S.E. of regression	1.567524	Akaike info criterion	3.882246
Sum squared resid	245.7132	Schwarz criterion	4.325972
Log likelihood	-211.9936	Hannan-Quinn criter.	4.062429
F-statistic	24.87049	Durbin-Watson stat	1.039862
Prob(F-statistic)	0.000000		

The other 13 variables with probability> 0.05 may not be considered in the second regression trials. However, Wald Test needs to be carried out before the removal.

The threshold was whether the Probability is under 5%, and only X3, X10, X13, X17and X20 were qualified to be retained. Then Wald Test would be used to measure if we could really take the 13 variables away. Refer to the Wald Test, it is a parametric statistical test, used to test the true value of the parameter based on the sample estimate. If the final probability is more than 0.05, it means the removal of these insignificant variables is proper.

Table 5- 5 Wald Test

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.773813	(16, 97)	0.7109
Chi-square	12.38101	16	0.7174

Null Hypothesis: C(1)= C(2)= C(4)= C(5)= C(6)= C(7)= C(8)= C(9)= C(11)= C(12)= C(14)= C(15)= C(16)= C(18)= C(19)= C(20)= 0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	-0.020877	0.027356
C(2)	-5.01E-05	6.76E-05
C(4)	-2.99E-05	3.88E-05
C(5)	-0.001783	0.002218
C(6)	0.655584	0.548460
C(7)	0.185805	3.822822
C(8)	0.018779	0.015414
C(9)	-0.000159	0.000749
C(11)	-0.004044	0.008931
C(12)	5.55E-05	3.88E-05
C(14)	3.21E-08	3.66E-08
C(15)	6.34E-08	7.62E-08
C(16)	-1.33E-07	1.58E-07
C(18)	-3.65E-05	0.000553
C(19)	0.110292	0.173480
C(20)	-0.080898	0.090694

Restrictions are linear in coefficients.

From the result, the probability turns out to be about 0.71, larger than the 0.05 (with Level of confidence as 95%). Therefore, these 13 independent variables would be removed and only the left 5 significant variables will be considered in the second regression trial.

According to the second regression result showing in the Table 5-6, the probability for these five individual variables–X3, X10, X13, X17and X20 is still smaller than 0.05, which means that it is not rejected by the null.

Table 5- 6 Second regression trial

Dependent Variable: Y
Method: Least Squares
Date: 05/10/14 Time: 19:20
Sample: 2004M03 2014M01
Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X3	-0.112931	0.053204	-2.122609	0.0360
X10	0.000337	9.26E-05	3.641014	0.0004
X13	0.099982	0.006644	15.04922	0.0000
X17	-0.053601	0.018788	-2.852886	0.0052
X21	2.450478	0.861507	2.844409	0.0053
C	0.039024	0.142008	0.274805	0.7840

R-squared	0.799034	Mean dependent var	0.075630
Adjusted R-squared	0.790142	S.D. dependent var	3.377009
S.E. of regression	1.547016	Akaike info criterion	3.759638
Sum squared resid	270.4383	Schwarz criterion	3.899762
Log likelihood	-217.6984	Hannan-Quinn criter.	3.816538
F-statistic	89.85705	Durbin-Watson stat	0.946324
Prob(F-statistic)	0.000000		

5.2.4 Autocorrelation, heteroscedasticity and normality test

After the successful regression trial, several tests need to be carried out to verify the validity of the final result.

The autocorrelation for certain figures describes the correlation of the value itself at different times, as a function of the two times or of the time lag. Classic linear regression model requires no serial correlation of the stochastic error term, because autocorrelation may lead to invalidation of the final result. Therefore, we need to explore whether there is autocorrelation involved in the variables of this regression model. Result in Table 5-8 shows that Prob.Chi-Square is larger than 0.05, which means that the regression model just pass the test of autocorrelation by the adjustment of ARMA.

Table 5- 7ARMA adjustment of second regression trial model

Dependent Variable: Y
Method: Least Squares
Date: 05/10/14 Time: 19:38
Sample (adjusted): 2004M06 2014M01
Included observations: 116 after adjustments
Convergence achieved after 37 iterations
MA Backcast: 2004M02 2004M05

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X10	0.000178	6.69E-05	2.660808	0.0090
X13	0.106440	0.005789	18.38535	0.0000
X17	-0.045294	0.014690	-3.083260	0.0026
X21	1.940262	0.558863	3.471803	0.0008
C	0.013787	0.292202	0.047182	0.9625
AR(1)	0.815479	0.252704	3.227010	0.0017
AR(2)	-0.110794	0.346293	-0.319942	0.7497
AR(3)	-0.189491	0.196006	-0.966760	0.3359
MA(1)	0.165664	0.229024	0.723348	0.4711
MA(2)	-0.774814	0.110875	-6.988156	0.0000
MA(3)	0.649044	0.112722	5.757902	0.0000
MA(4)	0.620540	0.219886	2.822103	0.0057

R-squared	0.932505	Mean dependent var	-0.017241
Adjusted R-squared	0.925366	S.D. dependent var	3.359400
S.E. of regression	0.917761	Akaike info criterion	2.763937
Sum squared resid	87.59758	Schwarz criterion	3.048791
Log likelihood	-148.3083	Hannan-Quinn criter.	2.879571
F-statistic	130.6234	Durbin-Watson stat	1.942452
Prob(F-statistic)	0.000000		

Inverted AR Roots	.59-.43i	.59+.43i	-.36	
Inverted MA Roots	.73-.66i	.73+.66i	-.66	-.97

Table 5- 8 Autocorrelation test result

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.371610	Prob. F(12,92)	0.1938
Obs*R-squared	17.60332	Prob. Chi-Square(12)	0.1283

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/10/14 Time: 19:39
Sample: 2004M06 2014M01
Included observations: 116
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X10	2.53E-05	7.22E-05	0.350293	0.7269
X13	0.000339	0.006015	0.056375	0.9552
X17	-0.001626	0.015569	-0.104429	0.9171
X21	0.218475	0.604881	0.361186	0.7188
C	-0.078542	0.291085	-0.269826	0.7879
AR(1)	-1.648006	0.866719	-1.901430	0.0604
AR(2)	1.884876	0.941923	2.001094	0.0483
AR(3)	-0.942870	0.517459	-1.822114	0.0717
MA(1)	16.83528	10.09763	1.667251	0.0989
MA(2)	-8.249881	4.943809	-1.668730	0.0986
MA(3)	-7.630089	4.585153	-1.664086	0.0995
MA(4)	15.93629	9.564398	1.666209	0.0991
RESID(-1)	-15.09634	9.578879	-1.576002	0.1185
RESID(-2)	10.42264	6.471428	1.610563	0.1107
RESID(-3)	-6.981431	4.222618	-1.653342	0.1017
RESID(-4)	4.750396	2.856684	1.662906	0.0997
RESID(-5)	-3.103922	1.846173	-1.681273	0.0961
RESID(-6)	1.978756	1.225635	1.614473	0.1098
RESID(-7)	-1.529120	0.807344	-1.894014	0.0614
RESID(-8)	0.951690	0.523404	1.818272	0.0723
RESID(-9)	-0.791368	0.357041	-2.216464	0.0291
RESID(-10)	0.420230	0.242775	1.730943	0.0868
RESID(-11)	-0.301358	0.176885	-1.703689	0.0918
RESID(-12)	-0.024069	0.138992	-0.173171	0.8629

R-squared	0.151753	Mean dependent var	-0.001619
Adjusted R-squared	-0.060309	S.D. dependent var	0.872763
S.E. of regression	0.898696	Akaike info criterion	2.806247
Sum squared resid	74.30415	Schwarz criterion	3.375955
Log likelihood	-138.7623	Hannan-Quinn criter.	3.037516
F-statistic	0.715606	Durbin-Watson stat	2.039828
Prob(F-statistic)	0.818429		

Heteroscedasticity is the term relative to homoscedasticity. One important assumptions of classic linear regression model is that stochastic error term in the population regression function meets the requirement of homoscedasticity. If such

requirement cannot be satisfied, it means that the stochastic error term shows heteroscedasticity. One of the best ways to test the heteroscedasticity is White's general test. In statistics, the White test is a statistical test that establishes whether the residual variance of a variable in a regression model is constant: that is for homoscedasticity. And if the probability Chi-Square (90) is larger than 0.05, there yet is no heteroscedasticity in the error term and the regression model meet the requirement of this assumption. From Table 5-9, answer is clear that the regression model of Capesize newbuilding prices already passed the test.

Table 5- 9 Heteroscedasticity test result

Heteroskedasticity Test: White			
F-statistic	3.630521	Prob. F(90,25)	0.0003
Obs*R-squared	107.7554	Prob. Chi-Square(90)	0.0978
Scaled explained SS	118.3813	Prob. Chi-Square(90)	0.0241
Test Equation:			
Dependent Variable: RESID^2			
Method: Least Squares			
Date: 05/10/14 Time: 19:42			
Sample: 2004M06 2014M01			
Included observations: 116			

Normality test is used to determine if a data set is well-modeled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed. If the residuals are not normally distributed, then the dependent variable or at least one explanatory variable may have the wrong functional form, or important variables may be missing, etc. Correcting one or more of these systematic errors may produce residuals that are normally distributed. Therefore, we need to carry out the normality test to verify the residues. Probability which is larger than 0.05 represents that the residuals are not normally distributed. According to Figure 5-2, probability is about 0.067, clearly larger than 0.05.

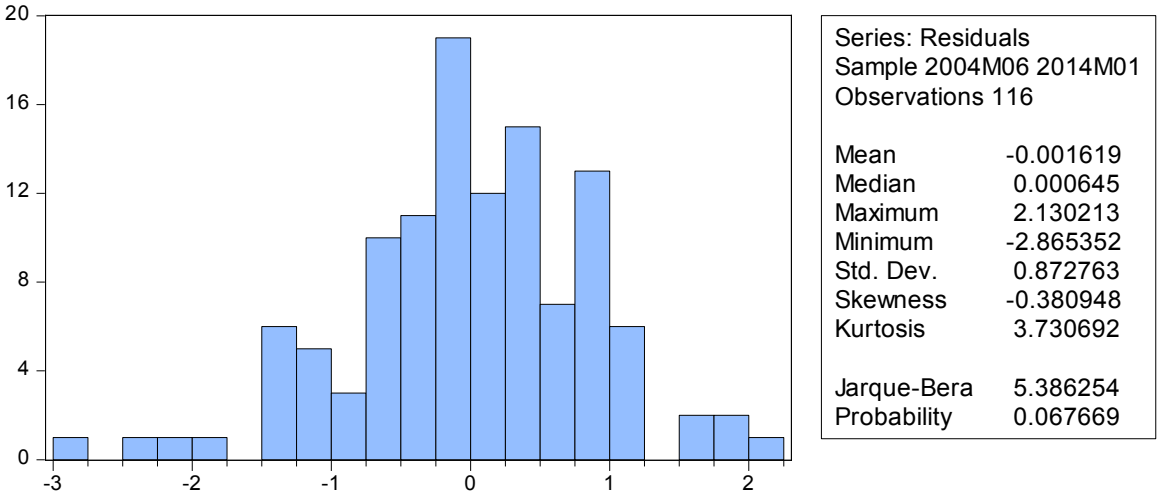


Figure 5- 2 Normality test result

After the preprocessing, regression trials, and the several important tests which are required to meet the assumptions of classic linear regression model, finally we got the regression equation like:

$$y = 0.000177993560322*x_{10} + 0.106439922074*x_{13} - 0.0452941676645*x_{17} + 1.94026168448*x_{21} + 0.0137866331375$$

(Equation 5- 5)

5.3 Price mechanism of Capesize bulkcarrier and suggestions about the newbuilding decision

5.3.1 Price mechanism

Total four significant variables are verified in the final regression result, and they are Baltic Exchange Capesize Index, Bulkcarrier Average Newbuilding Prices, Capesize 180K 5 Year Old Secondhand Prices and the dummy variable. Combined with the previous assumptions on the dynamic relationships between Capesize newbuilding prices and these variables, I summarized the results in the following Table 5-10 showing accuracy of these assumptions.

Table 5- 10 Comparison between actual and assumed relation

Independent variables	Actual relation	Assumed relation
Baltic Exchange Capesize Index	+	+
Bulkcarrier Average Newbuilding Prices	+	+
Capesize 180K 5 Year Old Secondhand Prices	-	-
Dummy variable	+	/

Notes: "+" means "positive relationship", "-" means "negative relationship" and "/" means uncertain relationship.

Three factors with large influence on the movement of Capesize newbuilding prices all belong to the shipping market factors group.

Baltic Exchange Capesize Index, as the parameter for the freight market of Capesize shipping market, works as a weather vane for those shipowners. It can provide a helpful window on both the health of today's markets and trend of future conditions. Full blast in the freight market would give these shipowners a cordial on the future market and promote more shipbuilding programs, thus enhancing the newbuilding prices of Capesize bulkcarrier. The relationship between BCI and Capesize newbuilding prices are positive according to the regression model result just as I assumed in the previous chapter.

Bulkcarrier Average Newbuilding Prices is a comprehensive price for all the bulkcarriers including Handysize, Handymax, Panamax and Capesize. The booming in such an overall prices will definitely push the rise of Capesize newbuilding prices and vice versa. And this overall price is positively related to the Capesize newbuilding price.

Capesize 180K 5 Year Old Secondhand Prices is the price factor for the second-hand market. As I mentioned before, second-hand prices has extreme close relation with the newbuilding market. Second-hand ship and a newbuilding ship, as two choices of fleet expansion, their prices are always negatively related in theory. And the regression result just proved it. If the secondhand price for Capesize bulkcarrier is high, most shipowners would choose to put a newbuilding order instead of purchasing an old vessel, which has lower prices and can better adapt to the owners' requirement. However, if the secondhand vessel has lower price compared to the newbuilding one, shipowners

may prefer the one which can be put into operation immediately rather than waiting for the construction.

The last explanatory variable – dummy variable actually in also involved in the shipping market factor groups. Dummy variable is set in the regression model in order to reflect the abnormal period happened in the shipping market around year 2008. Its large impact on the newbuilding prices of Capesize bulkcarrier can just explain that the true driving force of the prices is the shipping market itself.

Since all these explanatory variables are concerned about the shipping market, we can find that the Capesize newbuilding prices is nearly driven by the shipping market factors, in other words, its price mechanism is market-driven, and the main drivers are condition of both freight market and second-hand market.

5.3.2 Investment suggestion

For some purposes such as expand the fleet capacity expansion or just replacement the old vessels, shipowners or investors will consider about launching some shipbuilding programs. When they invest money in building a new Capesize bulkcarrier, they need to have a deep look at the whole shipping market since the newbuilding price of Capesize bulkcarrier is totally market-driven. Among all these explanatory variables, both the current condition and future anticipation need to be taken into serious consideration matter most to the newbuilding prices of Capesize bulkcarrier.

As BCI has large impact on the Capesize newbuilding market, shipowners need to conduct deep study on it while making investment decision by analyzing the cycle of BCI figures, and its future trend. Extreme high or low values are both worrying signal which deserve to pay more attentions. Lots of shipowners had been badly batted by their blind newbuilding action owing to the lack of proper foresee on the future freight market. Around year 2008, so many shipowners were blinded by the overwhelming BCI figures, and failed in making correct consideration on the future condition.

Regarding about the current shipping market, Capesize shipping market seems to recover from that severe financial crisis with the stable growth of BCI since year 2012. Even the uptrend of BCI is not so obvious, but so far the market is still in healthy operation according to some experts' words. Therefore, suggestion for most shipowners now is to grasp this opportunity, but not take so radical action. Shipowners or investors

can consider about some Capesize newbuilding programs, but should not invest money immediately since the freight market has been still in low level and transportation capacity of Capesize bulkcarrier is still in oversaturation.

Second-hand price is proven to have significant impact on the movement of Capesize newbuilding prices in both theoretical and econometric aspects. So as the shipowners, a deep look at the second-hand prices for the same type of bulkcarriers is necessary. Shipowners can evaluate the price difference between a newbuilding Capesize and an available second-price Capesize with taking the other factor like timeliness into consideration. Additionally, second-hand prices can be worked as a benchmark for the shipowners to do valuation on the Capesize newbuilding prices.

Second-hand prices for Capesize bulkcarrier have increased since year 2012, which means the relative competitive prices in newbuilding ships according to the regression result. Therefore, the current period may be a good opportunity for the shipowners or investors to build new Capesize in low prices instead of purchasing an available second-hand one with the fleet expansion purpose.

However, we understand that Capesize, owing to its large tonnage and construction techniques, requires more money invested and puts more limitations on the seaborne trade. So shipowners or investors still need to be cautious about every decision concerning about the Capesize newbuilding programs because the painful lessons learnt during the financial crisis even though the whole market seems to express a good signal for newbuilding action.

5.3.3 Conclusion

Capesize newbuilding price is a composition of so many complicated factors. Every swing in relevant cost market, trade market and shipping market will cause the fluctuation in the Capesize newbuilding prices. Some factors can be quantified which are applied in the regression model in Chapter 5. And from the regression model, Baltic Capesize Index and Capesize 180K 5 Year Old Secondhand Prices are proven to have the most significant impact on the movement of Capesize newbuilding prices.

However, there are still some other factors which cannot be quantifiedsuch as the rules and regulations, some government support and cooperation between traders and shipowners.

For shipowners or investors, more attention need to be paid on the decision concerning about the Capesize newbuilding. Both two vital factors – freight market and second-hand market should be deeply analyzed before making the investment decision. In terms of current situation, it may be a good time to launch some newbuilding programs, but just as mentioned before, radical behavior should be avoided. Additionallyshipowners or investors also need to consider about these qualitative factors like the ship demolition subsidies promoted by Chinese government. Shipbuilding for Capesize bulkcarrier is a complex program, which need very detailed and deep look into both the external market environment and internal company situation. Shipowners or investors must think thrice before their acting.

References:

1 Stopford, M. (2007). Capesize Market – Enjoying a Bit of High Rolling. Clarkson SIN.
2 Jordan, D. (2007). A Capesize Boom, but not without Shadows. Clarkson SIN.
3 Zhu, X.G (2005). Investment decision of ocean ships transported iron ore. Shipping Management, 27(6), 5-8
4 Kennedy, C. (2009). Cause for Concern for Capesizes in 2009. Clarkson SIN.
5 Li, X.J & LIU W (2010). The effect about shipping freight on the Chinese import prices of iron ore. Shipping Management, 32(8), 7-10.
6 Coldwell, J. (2011). Capesize Fleet Feels the Force of Ordering Binge. Clarkson SIN.
7 Holden, S. (2013). The Capesize Challenge: Dealing with a Delivery Deluge. Clarkson SIN.
8 Cai, L.M (2009). Study on the newbuilding tanker and bulkcarrier prices based on the econometric theory (Master' thesis, Shanghai Jiaotong University).
9 Zhu, M., & Zhang, Q. (2012). Effect Factors of Newbuilding Price Based on Double-log-linear Regression Model. Chongqing Jiotong Daxue Xuebao(Ziran Kexue Ban), 31(3), 506-511
10 Wang, L., & Li, X. (2010). Cross-spectral analysis on relationship between average earnings and new ship price of Capesizes. Journal of Shanghai Maritime University, 3, 021.
11 Zhan, Z.H & LIN, G.L (2012). Study on the relation between freight rate on the Capesize bulkcarrier route and the newbuilding order. China Business & Trade, 30, 094.
12 Liu, L.M (2011). A directional relationship between freight and newbuilding markets: A panel analysis. Journal of Maritime Economics and Logistics,13(1), 44-60.
13 Stopford, M. (2008). Maritime Economics 3e. Routledge.
14 Koopmans,T.C.(1939).Tanker Freight Rates and Tankship Building, An Analysis of cyclical fluctuations. Netherlands Economics Institute report No.27. Haarlem, Holland.
15 Beenstock,M.(1985). A Theory of Ship Prices. Maritime Policy and Management 12: 215-225.
16 Beenstock, M., & Vergottis, A. (1993). Econometric modeling of world shipping (Vol. 16). Springer.
17 Li, S.J (2011). Will the newbuilding market reach to the bottom in the second times. China Ship Survey, 2011(8), 61-64.

18 Zhao, Y (2010). Study on the effect about the fluctuation in freight on the newbuilding market (Master' thesis, Dalian Maritime University).
19 Zhu, X.G (2005). Investment decision of ocean ships transported iron ore. Shipping Management, 27(6), 5-8
20 Sloggett, J. E. (1984). Shipping finance: financing ships and mobile offshore installations. Fairplay Publications
21 Wang, Z.P (2004). Study on the investment opportunity in shipping (Doctoral dissertation, Dalian Maritime University)
22 Merikas, A. G., Merika, A. A., & Koutroubousis, G. (2008). Modelling the investment decision of the entrepreneur in the tanker sector: choosing between a second-hand vessel and a newly built one. Maritime Policy & Management, 35(5), 433-447.
23 Jorgenson, J. D., & Kirk, W. S. (2005). Iron ore. United States Geo log i cal Survey, 84-85.
24 Kavussanos, M. G., & Visvikis, I. D. (2004). Market interactions in returns and volatilities between spot and forward shipping freight markets. Journal of Banking & Finance, 28(8), 2015-2049.
25 Maritime Safety Committee's 70th Session, January 1999". American Bureau of Shipping. Archived from the original on 4 September 2007. Retrieved 2007-04-09.
26 Stachurski, J. (2009). Economic dynamics: theory and computation. MIT Press.
27 Stanley, P. (1943). U.S. Patent No. 2,308,713. Washington, DC: U.S. Patent and Trademark Office.
28 Stopford, M. (1997). Maritime economics. Psychology Press.
29 Wooldridge, J. (2012). Introductory econometrics: A modern approach. Cengage Learning.

Appendix I

	Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Date	Capesize 176-180K DWT Newbuilding Prices	China Seaborne Iron Ore Imports	China Steel Production	World Steel Production	Japan Steel Ship Plate Commodity Price	LIBOR Interest Rates	Japan Interest Rates	China Thick Steel Plate Price Index	Baltic Exchange Dry Index	Baltic Exchange Capesize Index	Capesize, 1999/00-built, Average Spot Earnings Index	1 Year Timecharter Rate 150,000 dwt	Bulkcarrier Average Newbuilding Prices	Capesize Bulker Orderbook	Capesize Bulker Contracting	Capesize Bulkcarrier Deliveries	Capesize 180K 5 Year Old Secondhand Prices	Capesize Sales	Capesize Scrap Value	Capesize Bulkcarrier Fleet Development	Dummy variable
	$ Million	Million Tonnes	,000 tonnes	,000 tonnes	$/Tonne	%	%	Index	Index	Index	Index	$/Day	$/DWT	DWT	DWT	DWT	$ Million	$ Million	$ Million	Million DWT	
2004-01	50.00	12.71	19391.60	60904.0000	385.00	1.20	1.38	159.00	5229.00	7599	522	56625	476.48	20178165	1156872.00	1046034.00	60.00	103.30	6.25	93.79	0.00
2004-02	50.00	18.51	19724.30	57221.0000	425.00	1.18	1.38	175.00	5450.00	7247	517	67031	486.97	20289003	286596.00	688455.00	61.00	65.75	8.04	94.97	0.00
2004-03	52.50	18.83	21847.50	63525.0000	467.50	1.16	1.38	178.00	5131.00	6231	432	55188	511.98	19887144	2374784.00	350830.00	60.00	63.00	8.05	95.66	0.00
2004-04	56.00	17.34	20875.40	62828.0000	540.00	1.27	1.38	176.00	4489.00	5330	352	47300	544.37	21911098	2784239.00	170081.00	60.50	49.00	8.05	96.01	0.00
2004-05	55.00	12.99	21052.40	65320.0000	553.33	1.48	1.38	156.00	3596.00	4296	275	43000	522.93	24525256	1119528.00	931066.00	53.00	18.00	7.77	96.18	0.00
2004-06	56.00	16.05	20797.60	63723.0000	573.33	1.80	1.38	156.00	2902.00	3911	239	30000	493.03	24713718	1353626.00	591666.00	45.00	45.00	6.47	97.11	0.00
2004-07	57.50	17.96	21987.90	64790.0000	600.00	1.92	1.38	167.00	3778.00	5109	311	40700	503.34	25475678	1671841.00	716823.00	52.00	205.20	7.62	97.70	0.00
2004-08	59.00	16.19	23356.00	64331.0000	613.75	1.95	1.38	170.00	4169.00	5951	366	43750	524.78	26430696	703905.00	354393.00	56.50	311.00	7.72	98.42	0.00
2004-09	61.00	18.45	23758.10	65195.0000	620.00	2.06	1.38	170.00	4141.00	5565	352	42500	537.95	26780208	2050059.00	735986.00	56.50	160.50	8.04	98.77	0.00
2004-10	63.00	15.93	24936.80	68518.0000	620.00	2.23	1.38	168.00	4539.00	5992	374	47500	566.70	28094281	376997.00	383588.00	57.00	100.50	8.01	99.51	0.00
2004-11	64.00	19.54	25035.50	67298.0000	620.00	2.50	1.38	167.00	5309.00	7426	495	57375	579.42	28087690	1252116.00	909854.00	63.00	390.00	8.20	99.89	0.00
2004-12	64.00	20.15	26533.40	66545.0000	625.00	2.72	1.38	171.00	5519.00	7649	525	58700	585.61	28429952	1333391.00	549458.00	64.50	100.00	8.30	101.72	0.00
2005-01	66.00	20.61	25095.30	67472.0000	630.00	2.90	1.40	175.00	4502.00	6054	430	53750	616.41	29213885	5219975.00	1084750.00	66.50	127.50	8.63	102.50	0.00
2005-02	66.00	18.00	24806.40	65564.0000	630.00	3.05	1.40	177.00	4532.00	6318	430	58125	622.57	33349110	1063135.00	357371.00	72.00	336.70	8.84	103.59	0.00
2005-03	68.00	23.99	27543.90	70775.0000	640.00	3.28	1.40	185.00	4678.00	6023	398	56500	649.58	34054874	472311.00	1088628.00	72.00	150.00	8.74	103.94	0.00
2005-04	68.00	24.01	28085.80	69190.0000	695.00	3.39	1.40	176.00	4532.00	6347	405	56700	657.73	33438557	177890.00	383415.00	72.00	249.00	8.77	105.03	0.00
2005-05	68.00	21.52	29729.60	72197.0000	700.00	3.48	1.40	174.00	3667.00	5066	329	51625	659.06	33233032	768782.00	542506.00	70.50	38.00	7.67	105.42	0.00
2005-06	62.00	21.69	28547.40	69066.0000	700.00	3.60	1.40	155.00	2746.00	3078	204	36312	642.75	33459308	354149.00	523494.00	69.25	24.00	6.50	105.96	0.00
2005-07	62.00	21.30	29244.00	70518.0000	700.00	3.81	1.40	148.00	2220.00	2943	178	31100	642.75	33289963	533496.00	586454.00	64.50	0.00	7.78	106.48	0.00
2005-08	59.50	22.62	30456.00	67733.0000	727.50	4.03	1.38	141.00	2203.00	3004	173	28938	622.62	33237005	533961.00	906560.00	62.50	27.00	7.22	106.93	0.00
2005-09	59.00	22.56	30357.00	68327.0000	735.00	4.06	1.38	122.00	2803.00	4001	234	34050	617.31	32864406	529467.00	1232586.00	61.00	313.80	7.55	107.84	0.00
2005-10	59.00	21.71	31673.00	70862.0000	731.25	4.36	1.38	110.00	3161.00	4694	285	38125	615.97	32161287	772954.00	560598.00	61.00	108.00	7.14	109.22	0.00
2005-11	59.00	26.64	30478.00	68347.0000	705.00	4.56	1.38	112.00	2916.00	4366	268	34688	606.45	32373643	505678.00	1135943.00	60.50	0.00	7.32	109.78	0.00
2005-12	59.00	25.93	32041.00	68214.0000	700.00	4.66	1.38	109.00	2600.00	3490	207	29550	606.45	31743378	1277647.00	351300.00	57.00	54.00	7.28	110.81	0.00
2006-01	59.00	26.01	30166.00	69107.0000	700.00	4.73	1.38	108.00	2262.00	2976	170	25500	593.67	32669725	1759720.00	1447471.00	53.00	118.50	7.28	111.16	0.00
2006-02	59.00	24.25	29462.00	64529.0000	700.00	4.92	1.38	114.00	2444.00	3645	211	28000	589.04	32981974	319410.00	709004.00	53.00	354.70	7.13	112.61	0.00
2006-03	60.00	28.87	32889.00	71502.0000	700.00	5.06	1.38	130.00	2599.00	3681	216	26300	588.89	32592380	2860786.00	737405.00	54.00	413.50	7.34	113.32	0.00
2006-04	60.00	26.57	33711.00	69539.0000	600.00	5.22	1.38	137.00	2465.00	3346	191	26625	588.89	34715761	1958872.00	1252844.00	54.00	65.00	7.58	114.06	0.00
2006-05	60.50	23.84	35934.00	70861.0000	600.00	5.29	1.38	146.00	2442.00	3095	173	25488	598.96	35415128	1674069.00	529380.00	56.00	135.00	7.77	115.18	0.00
2006-06	61.00	28.16	36619.00	69460.0000	600.00	5.50	1.39	157.00	2718.00	3389	189	28750	609.03	36559817	178120.00	1059013.00	56.50	200.30	7.20	115.37	0.00
2006-07	62.00	23.98	36091.00	68886.0000	605.00	5.59	1.38	131.00	3050.00	3987	230	35938	637.10	35678924	2496321.00	171827.00	60.00	98.90	7.53	116.43	0.00
2006-08	63.50	31.95	36700.00	67799.0000	616.00	5.43	1.44	132.00	3687.00	5134	299	50000	653.56	38003418	1244231.00	1072364.00	74.00	276.50	7.52	116.60	0.00
2006-09	66.00	27.62	36162.00	69072.0000	620.00	5.41	1.63	137.00	4039.00	5347	316	50000	669.91	38175285	4304186.00	733552.00	76.00	212.25	8.31	117.68	0.00
2006-10	67.00	21.49	37684.00	70364.0000	600.00	5.39	1.63	135.00	4028.00	5411	325	51000	680.53	41745919	2408647.00	1445220.00	76.50	125.75	8.62	118.41	0.00
2006-11	68.00	27.94	37957.00	67387.0000	600.00	5.37	1.63	133.00	4190.00	5734	347	51562	681.71	42709346	3136612.00	522374.00	79.00	748.50	8.31	119.48	0.00
2006-12	68.00	28.28	38081.00	66086.0000	600.00	5.35	1.63	137.00	4336.00	5872	365	50950	685.04	44791555	4351837.00	1109883.00	81.00	136.60	8.62	120.01	0.00
2007-01	71.00	35.39	38119.00	69220.0000	602.50	5.38	1.63	146.00	4462.00	6226	400	53625	693.39	47918421	1726150.00	1197000.00	82.50	187.00	8.93	121.12	0.00
2007-02	76.50	28.36	36135.00	66290.0000	610.00	5.39	1.63	149.00	4398.00	6320	421	54125	718.79	48447571	3477961.00	793088.00	83.50	425.00	8.93	122.31	0.00
2007-03	79.00	35.30	40157.00	73796.0000	628.00	5.31	1.73	150.80	5123.00	7237	473	60400	737.84	51132444	7920687.00	1106609.00	93.00	878.00	9.10	123.11	1.00
2007-04	80.00	33.06	40318.00	71986.8200	640.00	5.36	1.88	153.50	5754.00	8363	524	72750	743.84	57946522	7408562.00	1171269.00	95.00	626.00	9.32	124.21	1.00
2007-05	86.00	27.27	41304.00	75387.2300	630.00	5.37	1.88	157.40	6402.00	9192	567	83125	767.16	63457815	10689636.00	587330.00	100.00	694.00	9.22	125.38	1.00
2007-06	88.00	26.64	42121.00	74369.0000	642.00	5.39	1.88	155.40	5772.00	7616	479	68800	782.81	73560121	5994756.00	555338.00	101.00	154.50	9.31	125.97	1.00
2007-07	89.00	33.36	41252.00	74245.0000	650.00	5.38	1.88	158.90	6572.00	8439	516	82000	807.14	79114723	5331345.00	1390944.00	106.50	1783.50	10.58	126.53	1.00
2007-08	91.00	28.87	41583.00	74329.0000	650.00	5.40	1.88	171.20	7195.00	9736	620	93100	835.05	83055124	9468591.00	360410.00	120.00	22.50	11.03	127.92	1.00
2007-09	93.00	32.68	42712.00	75404.0000	650.00	5.32	1.88	173.70	8586.00	11856	781	110000	851.71	92163309	7211144.00	562035.00	130.00	292.00	11.26	128.28	1.00
2007-10	96.00	27.88	42922.00	77347.0000	650.00	5.07	1.88	172.70	10426.00	14855	970	134250	868.53	98812418	8522242.00	357403.00	136.00	619.00	10.50	128.84	1.00
2007-11	96.00	34.74	39691.00	75589.0000	656.00	4.85	1.88	179.40	10543.00	15171	962	137200	881.31	106977257	6516114.00	1150620.00	152.00	362.00	10.39	129.20	1.00
2007-12	97.00	33.54	41000.00	75626.0000	710.00	4.67	1.88	185.60	9854.00	14634	876	135000	896.16	112342751	12476374.00	1270207.00	150.00	78.00	10.42	130.35	1.00
2008-01	95.00	36.08	40564.00	76122.0000	735.00	3.91	1.88	189.00	7170.00	9669	578	94875	893.81	122422918	5747010.00	534777.00	143.50	121.40	10.20	131.62	1.00
2008-02	95.00	37.76	38884.00	71486.0000	770.00	3.00	1.88	215.10	6874.00	9780	580	109000	897.14	127035151	4851585.00	358187.00	139.50	218.70	13.67	132.15	1.00
2008-03	95.50	35.15	44868.00	80063.0000	900.00	2.80	1.88	221.10	8063.00	11252	655	111250	897.73	131528549	5445557.00	735018.00	145.00	145.50	14.55	132.51	1.00
2008-04	95.50	42.21	44676.00	78336.0000	927.50	2.83	1.88	228.10	8287.00	12066	724	116500	897.73	136209052	6385269.00	358053.00	145.00	140.00	14.71	133.25	1.00
2008-05	95.50	37.95	46013.00	80962.0000	980.00	2.74	1.88	241.80	10844.00	16808	1071	130200	908.15	142236348	5060855.00	562285.00	153.00	616.70	14.07	133.84	1.00
2008-06	96.00	36.93	46944.00	79024.0000	1200.00	3.09	1.88	241.50	10245.00	15815	967	135312	908.74	146734918	2445144.00	1261993.00	153.00	568.00	13.86	134.92	1.00
2008-07	97.00	38.69	44886.00	78944.0000	1250.00	3.12	1.88	239.20	8936.00	13221	825	132000	916.11	147918069	12704435.00	477642.00	155.00	42.00	14.14	136.45	1.00
2008-08	99.00	36.77	42568.00	77880.0000	1250.00	3.10	1.88	216.20	7402.00	11665	689	112600	925.24	159781465	2456285.00	705550.00	153.00	18.50	14.10	138.18	1.00
2008-09	96.00	38.51	39614.00	78750.9800	1350.00	3.39	1.88	193.10	4975.00	6741	346	84000	917.08	161532200	3107567.00	475339.00	134.00	733.90	11.93	139.80	1.00
2008-10	92.50	30.04	35901.00	82143.9600	1350.00	3.81	1.88	145.60	1808.00	2490	98	20100	870.76	164164428	1311242.00	927763.00	75.00	367.00	4.35	141.52	1.00
2008-11	89.00	31.91	35189.00	82095.0000	1350.00	2.60	1.83	132.60	819.00	1028	23	12500	800.57	163649407	0.00	1018521.00	48.00	25.00	5.99	142.20	1.00
2008-12	88.00	33.88	37792.00	81419.0400	1350.00	2.20	1.68	135.90	747.00	1172	45	13250	787.95	161350886	351822.00	1209519.00	45.00	0.00	5.97	142.70	1.00
2009-01	81.00	32.04	41192.00	82748.0000	1350.00	1.64	1.60	142.10	905.00	1776	91	17850	715.66	160313189	1981050.00	533312.00	45.00	27.00	5.96	143.56	1.00
2009-02	74.00	45.97	40422.00	79712.4400	862.50	1.77	1.48	133.40	1816.00	3179	209	24000	662.31	160508927	1666667.00	812511.00	48.50	145.75	6.49	143.91	0.00
2009-03	72.50	51.11	45101.00	85904.6800	685.00	1.82	1.48	127.20	1958.00	2442	135	20000	660.55	161182083	361082.00	1055226.00	48.50	64.90	7.26	146.09	0.00
2009-04	72.00	55.87	43413.00	83365.0000	680.00	1.67	1.48	123.50	1659.00	2206	111	20562	655.96	160127939	0.00	1125000.00	48.50	145.70	5.96	147.84	0.00
2009-05	72.00	52.34	46460.00	86460.0000	662.00	1.37	1.48	126.60	2540.00	3725	231	25100	650.71	158282939	0.00	885447.00	52.00	208.65	5.33	149.14	0.00
2009-06	69.00	54.22	49309.00	84627.0000	650.00	1.17	1.48	134.30	3823.00	7226	465	37562	619.66	157056492	2017239.00	1936471.00	56.00	563.90	5.65	150.75	0.00
2009-07	65.00	56.87	50676.00	86038.0000	602.00	0.99	1.48	145.70	3362.00	5628	340	34485	594.02	155697260	4293914.00	3298250.00	59.00	340.35	5.65	152.83	0.00
2009-08	61.00	48.28	52327.00	85477.0000	597.50	0.84	1.48	139.00	2685.00	4400	242	31375	579.79	156692924	1622127.00	1540114.00	58.00	61.75	5.87	156.73	0.00
2009-09	58.00	63.05	50711.00	88007.0000	600.00	0.68	1.48	130.30	2351.00	3232	174	24750	557.69	155019937	0.00	2919329.00	58.00	121.00	6.30	159.03	0.00
2009-10	56.50	44.14	51747.00	90237.0000	600.00	0.59	1.48	130.90	2746.00	4163	248	26550	555.92	152100608	3381742.00	2285990.00	52.50	17.10	6.62	162.23	0.00
2009-11	56.50	49.82	47262.00	89786.0000	600.00	0.53	1.48	138.70	3941.00	6618	426	34875	559.68	150744360	3182144.00	2133205.00	52.50	41.70	6.95	165.06	0.00
2009-12	56.00	60.90	47664.00	89964.0000	600.00	0.47	1.48	142.30	3572.00	5296	311	29875	559.09	151113299	0.00	2458309.00	55.00	52.00	7.18	167.74	0.00
2010-01	56.00	45.56	52535.00	89897.0000	600.00	0.42	1.48	145.10	3168.00	4041	221	29600	557.34	148314990	3986762.00	3040611.00	55.00	226.05	8.04	170.20	0.00
2010-02	56.00	48.45	50357.00	83997.2900	600.00	0.39	1.48	146.70	2678.00	3367	176	27125	558.00	149261141	1155378.00	2568677.00	56.50	206.23	8.43	173.37	0.00
2010-03	56.00	57.71	54968.00	92893.3100	600.00	0.39	1.48	169.50	3207.00	3591	211	28500	560.31	147847842	3216281.00	4210613.00	62.00	114.50	8.85	175.94	0.00
2010-04	57.50	53.94	55403.00	92817.0000	750.00	0.46	1.48	175.90	3043.00	3286	176	27900	578.70	146683510	3082936.00	2563920.00	62.00	232.97	9.26	180.27	0.00
2010-05	59.00	50.48	56143.00	95391.0000	750.00	0.65	1.48	166.00	3838.00	4626	276	30500	581.35	147202526	3824965.00	2630509.00	60.00	20.50	8.01	182.83	0.00
2010-06	59.50	45.76	53766.00	89614.0000	750.00	0.75	1.48	157.30	3088.00	3793	224	28500	592.19	148219982	5235510.00	3433344.00	59.00	323.70	7.77	185.72	0.00
2010-07	59.50	49.90	51743.00	90320.0000	750.00	0.72	1.48	158.80	1910.00	1969	90	22400	589.99	149501850	2550839.00	4587115.00	56.00	0.00	8.29	189.27	0.00
2010-08	59.00	43.02	51636.00	90510.0000	700.00	0.57	1.48	160.60	2432.00	2987	167	24750	586.22	142437282	1407904.00	2137919.00	56.00	44.60	9.23	193.38	0.00
2010-09	58.00	51.30	47945.00	92121.0000	700.00	0.48	1.48	162.80	2719.00	3609	213	26000	580.44	139102788	1150158.00	3509471.00	55.00	76.00	9.04	195.65	0.00
2010-10	58.00	44.17	50304.00	98115.0000	700.00	0.46	1.48	161.20	2693.00	4163	233	26000	580.44	136741216	356427.00	3652019.00	56.50	197.70	9.23	199.31	0.00
2010-11	57.25	55.39	50173.00	94225.0000	730.00	0.45	1.48	165.70	2321.00	3656	194	23750	579.55	132545674	2935926.00	2668566.00	55.50	191.50	9.93	202.69	0.00
2010-12	57.00	56.88	51524.00	95268.0000	730.00	0.46	1.48	173.50	2031.00	2711	127	19200	579.26	132272670	2367457.00	3576140.00	50.00	145.60	9.97	206.09	0.00
2011-01	55.50	66.87	59871.00	94261.0000	730.00	0.46	1.48	182.50	1401.00	1653	50	15938	577.49	130883987	2564748.00	6417303.00	50.00	220.55	10.39	209.54	0.00
2011-02	55.00	47.78	54307.00	89886.0000	740.00	0.46	1.48	183.20	1181.00	1375	29	14125	574.05	126431432	874822.00	2071900.00	50.00	61.25	10.07	215.73	0.00
2011-03	54.00	57.93	59416.00	100626.0000	760.00	0.46	1.48	178.50	1493.00	1682	56	13500	568.78	125234354	748309.00	3705198.00	47.00	78.00	10.84	216.77	0.00
2011-04	54.00	51.17	59032.00	99860.0000	830.00	0.44	1.48	185.10	1343.00	1608	40	11252	567.35	121737065	714454.00	3206866.00	47.00	12.00	11.60	219.10	0.00
2011-05	54.00	51.54	60245.00	104979.0000	860.00	0.41	1.48	183.70	1352.00	1602	42	10188	567.35	117600877	410293.00	4105237.00	45.00	103.50	11.57	222.14	0.00
2011-06	54.00	49.16	59932.00	104154.0000	880.00	0.40	1.48	179.10	1433.00	1876	59	10500	567.35	113905933	2467761.00	3543008.00	44.00	44.20	11.12	224.92	0.00
2011-07	52.00	52.84	59300.00	103361.0000	880.00	0.41	1.48	179.62	1366.00	1941	63	11370	545.83	112830776	410340.00	3436283.00	40.00	33.00	12.06	226.79	0.00
2011-08	51.50	57.20	58752.00	101755.0000	840.00	0.51	1.48	180.24	1387.00	2054	78	11881	534.57	109804833	1623227.00	2845005.00	39.00	113.00	11.63	230.07	0.00
2011-09	51.00	58.75	56700.00	102793.0000	840.00	0.52	1.42	174.71	1840.00	3128	158	14850	526.27	108583055	0.00	5760252.00	39.00	168.00	11.44	232.43	0.00
2011-10	49.50	48.34	54673.00	105855.0000	780.00	0.60	1.44	160.93	2072.00	3391	188	15375	506.97	102479054	354000.00	3269361.00	40.00	215.80	11.30	238.06	0.00

2011-11	48.50	62.47	49883.00	104195.0000	750.00	0.67	1.48	157.52	1835.00	3065	153	14000	501.03	99212093	382000.00	4151178.00	40.00	138.00	11.31	241.28	0.00
2011-12	48.50	61.34	52164.00	104936.0000	750.00	0.78	1.48	155.76	1869.00	3516	205	15300	501.03	95442915	2045500.00	3059075.00	36.00	35.70	11.22	245.42	0.00
2012-01	48.00	57.96	56733.00	107152.0000	730.00	0.80	1.48	156.10	1039.00	1846	47	11250	495.60	92554140	2208939.00	5113900.00	38.00	18.15	11.03	249.47	0.00
2012-02	47.00	62.99	55883.00	100575.0000	680.00	0.76	1.48	159.04	703.00	1468	25	10000	488.34	88518141	746782.00	3372292.00	36.50	32.00	10.69	254.27	0.00
2012-03	47.00	61.31	61581.00	112238.0000	700.00	0.74	1.48	163.44	859.00	1450	22	9000	486.67	85715440	561872.00	4384415.00	35.00	94.60	10.46	256.67	0.00
2012-04	46.50	56.06	60575.00	109359.0000	700.00	0.73	1.48	162.40	1021.00	1519	32	10375	486.08	79252321	0.00	4751517.00	35.00	195.60	11.04	260.05	0.00
2012-05	46.50	62.31	61234.00	112037.0000	700.00	0.73	1.48	153.47	1101.00	1536	42	9750	486.08	74140804	0.00	4240671.00	35.00	46.50	9.68	263.34	0.00
2012-06	46.50	56.45	60213.00	111224.0000	690.00	0.74	1.48	150.87	937.00	1187	29	10300	483.11	67380133	1050575.00	6551354.00	35.00	77.05	8.37	265.86	0.00
2012-07	46.50	56.32	61693.00	110296.0000	690.00	0.73	1.48	137.07	1056.00	1316	33	11031	481.68	61878535	207000.00	3253814.00	33.00	176.50	9.11	271.45	0.00
2012-08	46.50	60.32	58703.00	109065.0000	685.00	0.72	1.48	128.08	761.00	1154	10	8175	470.86	58652867	1166591.00	1551087.00	33.00	75.65	9.33	273.71	0.00
2012-09	46.00	63.81	57946.00	111022.0000	670.00	0.67	1.48	132.44	707.00	1342	34	9000	466.75	58147547	0.00	3699980.00	32.50	780.10	8.72	274.65	0.00
2012-10	46.00	54.32	59096.00	114184.0000	670.00	0.58	1.48	134.83	952.00	2104	90	11500	462.87	53636945	104200.00	2168087.00	32.50	91.50	9.49	276.59	0.00
2012-11	46.00	63.09	57471.00	109140.0000	660.00	0.53	1.48	137.22	1025.00	2280	103	10800	461.21	50388058	0.00	1558479.00	32.50	180.50	9.02	277.77	0.00
2012-12	46.00	68.97	57656.00	110606.0000	660.00	0.51	1.48	140.24	856.00	1584	37	9688	461.21	48469579	720000.00	1248190.00	32.50	70.30	9.03	278.39	0.00
2013-01	46.00	63.25	63622.00	112882.0000	630.00	0.49	1.48	147.13	771.00	1441	34	9812	461.21	47820439	2172000.00	3625230.00	33.00	231.80	9.70	279.52	0.00
2013-02	46.00	55.05	61830.00	107659.0000	630.00	0.47	1.48	148.53	745.00	1398	33	10000	461.21	46367209	1624000.00	1293137.00	34.00	63.90	9.17	281.89	0.00
2013-03	46.50	62.85	66293.00	119556.0000	630.00	0.45	1.48	143.41	876.00	1275	28	9650	461.79	46342167	4122000.00	3499772.00	34.00	0.00	9.39	282.01	0.00
2013-04	47.00	64.41	65650.00	116124.0000	620.00	0.44	1.48	139.47	874.00	1237	28	9844	463.26	46784395	3590000.00	2173643.00	33.00	85.80	9.70	284.71	0.00
2013-05	47.50	66.41	67034.00	119994.0000	620.00	0.42	1.48	132.72	851.00	1347	36	9850	466.15	47783675	3491320.00	1408832.00	34.00	78.96	9.14	286.12	0.00
2013-06	47.50	60.39	64664.00	119173.0000	620.00	0.41	1.48	130.67	940.00	1637	62	10500	466.15	49865043	1202000.00	1716455.00	34.00	81.30	9.01	286.78	0.00
2013-07	48.00	71.13	65470.00	116636.0000	620.00	0.40	1.48	134.01	1123.00	1986	74	11250	471.81	49350588	4948628.00	1806694.00	34.00	0.00	8.79	288.24	0.00
2013-08	49.00	66.67	66277.00	112605.0000	620.00	0.40	1.48	135.33	1088.00	2069	82	14300	476.65	52486194	1794100.00	1000525.00	34.00	178.50	7.90	289.61	0.00
2013-09	50.00	72.77	65420.00	107919.0000	620.00	0.39	1.48	130.08	1681.00	3467	199	17438	477.83	53279769	1827900.00	1549243.00	38.00	81.80	8.76	289.93	0.00
2013-10	52.50	65.38	65081.00	99253.0000	620.00	0.36	1.48	127.67	1883.00	3294	181	16250	487.37	53206426	5092900.00	1511088.00	40.00	302.50	8.99	291.14	0.00
2013-11	53.50	75.62	60879.00	87802.0000	610.00	0.35	1.48	127.55	1559.00	2494	120	15400	491.64	56464338	6447600.00	1975495.00	44.00	0.00	9.32	292.28	0.00
2013-12	53.50	71.01	62350.00	82060.0000	610.00	0.35	1.48	130.16	2178.00	3843	237	19625	493.73	58503343	4755000.00	498416.00	44.00	352.50	9.25	293.05	0.00
2014-01	55.50	85.17	68727.00	86420.0000	610.00	0.34	1.48	128.61	1472.00	2171	101	16838	512.77	62159927	7290000.00	2860376.00	46.00	271.40	9.68	293.10	0.00
															2754000						
															1888000						
															1368000						

Appendix II

	Y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Date	Capesize 176-180K DWT Newbuilding Prices	China Seaborne Iron Ore Imports	China Steel Production	World Steel Production	Japan Steel Ship Plate Commodity Price	LIBOR Interest Rates	Japan Interest Rates	China Thick Steel Plate Price Index	Baltic Exchange Dry Index	Baltic Exchange Capesize Index	Capesize, 1999/00-built, Average Spot Earnings Index	1 Year Timecharter Rate 150,000 dwt	Bulkcarrier Average Newbuilding Prices	Capesize Bulker Orderbook	Capesize Bulker Contracting	Capesize Bulkcarrier Deliveries	Capesize 180K 5 Year Old Secondhand Prices	Capesize Sales	Capesize Scrap Value	Capesize Bulkcarrier Fleet Development	Dummy variable
	$ Million	Million Tonnes	,000 tonnes	,000 tonnes	$/Tonne	%	%	Index	Index	Index	Index	$/Day	$/DWT	DWT	$ Million	DWT	$ Million	$ Million	$ Million	Million DWT	
2004-03	2.50	6.12	2455.90	2621.00	82.50	-0.04	0.00	19.00	-98.00	-1368.00	-90.00	-1437.00	35.50	-291021.00	1217912.00	-695204.00	0.00	-40.30	1.80	1.87	0.00
2004-04	6.00	-1.17	1151.10	5607.00	115.00	0.09	0.00	1.00	-961.00	-1917.00	-165.00	-19731.00	57.40	1622095.00	2497643.00	-518374.00	-0.50	-16.75	0.01	1.04	0.00
2004-05	2.50	-5.84	-795.10	1795.00	85.83	0.32	0.00	-22.00	-1535.00	-1935.00	-157.00	-12188.00	10.95	4638112.00	-1255256.00	580236.00	-7.00	-45.00	-0.28	0.52	0.00
2004-06	0.00	-1.29	-77.80	895.00	33.33	0.53	0.00	-20.00	-1587.00	-1419.00	-113.00	-17300.00	-51.34	2802620.00	-1430613.00	421585.00	-15.50	-4.00	-1.58	1.10	0.00
2004-07	2.50	4.97	935.50	-530.00	46.67	0.43	0.00	11.00	182.00	813.00	36.00	-2300.00	-19.59	950422.00	552313.00	-214243.00	-1.00	187.20	-0.15	1.52	0.00
2004-08	3.00	0.14	2558.40	608.00	40.42	0.15	0.00	14.00	1267.00	2040.00	127.00	13750.00	31.75	1716978.00	-649721.00	-237273.00	11.50	266.00	1.25	1.31	0.00
2004-09	3.50	0.49	1770.20	405.00	20.00	0.15	0.00	3.00	363.00	456.00	41.00	1800.00	34.61	1304530.00	378218.00	19163.00	4.50	-44.70	0.42	1.07	0.00
2004-10	4.00	-0.26	1580.80	4187.00	6.25	0.28	0.00	-2.00	370.00	41.00	8.00	3750.00	41.92	1663585.00	-326908.00	29195.00	0.50	-210.50	0.29	1.09	0.00
2004-11	3.00	1.09	1277.40	2103.00	0.00	0.43	0.00	-3.00	1168.00	1861.00	143.00	14875.00	41.47	1307482.00	-797943.00	173868.00	6.50	229.50	0.16	1.12	0.00
2004-12	1.00	4.22	1596.60	-1973.00	5.00	0.49	0.00	3.00	980.00	1657.00	151.00	11200.00	18.91	335671.00	956394.00	165870.00	7.50	-0.50	0.29	2.21	0.00
2005-01	2.00	1.07	59.80	174.00	10.00	0.40	0.02	8.00	-807.00	-1372.00	-65.00	-3625.00	36.99	1126195.00	3967859.00	174896.00	3.50	-262.50	0.43	2.61	0.00
2005-02	2.00	-2.15	-1727.00	-981.00	5.00	0.33	0.02	6.00	-987.00	-1331.00	-95.00	-575.00	36.96	4919158.00	-270256.00	-192087.00	7.50	236.70	0.54	1.87	0.00
2005-03	2.00	3.38	2448.60	3303.00	10.00	0.38	0.00	10.00	176.00	-31.00	-32.00	2750.00	33.17	4840989.00	-4747664.00	3878.00	5.50	22.50	0.11	1.44	0.00
2005-04	2.00	6.01	3279.40	3626.00	65.00	0.34	0.00	-1.00	0.00	29.00	-25.00	-1425.00	35.16	89447.00	-885245.00	26044.00	0.00	-87.70	-0.07	1.44	0.00
2005-05	0.00	-2.47	2185.70	1422.00	60.00	0.20	0.00	-11.00	-1011.00	-957.00	-69.00	-4875.00	9.48	-821842.00	296471.00	-546122.00	-1.50	-112.00	-1.07	1.48	0.00
2005-06	-6.00	-2.32	461.60	-124.00	5.00	0.21	0.00	-21.00	-1786.00	-3269.00	-201.00	-20388.00	-14.98	20751.00	176259.00	140079.00	-2.75	-225.00	-2.27	0.93	0.00
2005-07	-6.00	-0.22	-485.60	-1679.00	0.00	0.33	0.00	-26.00	-1447.00	-2123.00	-151.00	-20525.00	-16.31	56931.00	-235286.00	43948.00	-6.00	-38.00	0.11	1.06	0.00
2005-08	-2.50	0.93	1908.60	-1333.00	27.50	0.43	-0.02	-14.00	-543.00	-74.00	-31.00	-7374.00	-20.13	-222303.00	179812.00	383066.00	-6.75	3.00	0.72	0.97	0.00
2005-09	-3.00	1.26	1113.00	-2191.00	35.00	0.24	-0.02	-26.00	583.00	1058.00	56.00	2950.00	-25.44	-425557.00	-4029.00	646132.00	-3.50	313.80	-0.23	1.36	0.00
2005-10	-0.50	-0.91	1217.00	3129.00	3.75	0.33	0.00	-31.00	958.00	1690.00	112.00	9187.00	-6.65	-1075718.00	238993.00	-345962.00	-1.50	81.00	-0.08	2.29	0.00
2005-11	0.00	4.08	121.00	20.00	-30.00	0.50	0.00	-10.00	113.00	365.00	34.00	638.00	-10.86	-490763.00	-23789.00	-96643.00	-0.50	-313.80	-0.23	1.94	0.00
2005-12	0.00	4.22	368.00	-2648.00	-31.25	0.30	0.00	-1.00	-561.00	-1204.00	-78.00	-8575.00	-9.52	-417909.00	504683.00	-209298.00	-4.00	-54.00	0.14	1.59	0.00
2006-01	0.00	-0.63	-312.00	760.00	-5.00	0.18	0.00	-4.00	-654.00	-1390.00	-98.00	-9188.00	-12.78	296082.00	1254042.00	311528.00	-7.50	118.50	-0.04	1.38	0.00
2006-02	0.00	-1.68	-2579.00	-3685.00	0.00	0.26	0.00	5.00	-156.00	155.00	4.00	-1550.00	-17.41	1238596.00	-958237.00	357704.00	-4.00	300.70	-0.15	1.80	0.00
2006-03	1.00	2.86	2723.00	2395.00	0.00	0.33	0.00	22.00	337.00	705.00	46.00	800.00	-4.78	-77345.00	1101066.00	-710066.00	1.00	295.00	0.06	2.16	0.00
2006-04	1.00	2.32	4249.00	5010.00	-100.00	0.30	0.00	23.00	21.00	-299.00	-20.00	-1375.00	-0.15	1733787.00	1639462.00	543840.00	1.00	-289.70	0.45	1.45	0.00
2006-05	0.50	-5.03	3045.00	-641.00	-100.00	0.23	0.00	16.00	-157.00	-586.00	-43.00	-812.00	10.07	2822748.00	-1186717.00	-208025.00	2.00	-278.50	0.43	1.86	0.00
2006-06	1.00	1.59	2908.00	-79.00	0.00	0.28	0.01	20.00	253.00	43.00	-2.00	2125.00	20.14	1844056.00	-1780752.00	-193831.00	2.50	135.30	-0.38	1.31	0.00
2006-07	1.50	0.14	157.00	-1975.00	5.00	0.30	0.00	-15.00	608.00	892.00	57.00	10450.00	38.14	263796.00	822252.00	-357553.00	4.00	-36.10	-0.24	1.25	0.00
2006-08	2.50	3.79	81.00	-1661.00	16.00	-0.07	0.05	-25.00	969.00	1745.00	110.00	21250.00	44.53	1443601.00	1066111.00	13351.00	17.50	76.26	0.32	1.23	0.00
2006-09	4.00	3.64	71.00	186.00	15.00	-0.18	0.25	6.00	989.00	1360.00	86.00	14062.00	32.81	2496361.00	1807865.00	561725.00	16.00	113.35	0.78	1.25	0.00
2006-10	3.50	-10.46	984.00	2565.00	-16.00	-0.04	0.19	3.00	341.00	277.00	26.00	1000.00	26.97	3742501.00	1164416.00	372856.00	2.50	-150.75	1.10	1.81	0.00
2006-11	2.00	0.32	1795.00	-1685.00	-20.00	-0.04	0.00	-4.00	151.00	387.00	31.00	1562.00	11.80	4534061.00	-1167574.00	-211178.00	3.00	536.25	0.00	1.80	0.00
2006-12	1.00	6.79	397.00	-4278.00	0.00	-0.04	0.00	2.00	308.00	461.00	40.00	-50.00	4.51	3045636.00	1943190.00	-335337.00	4.50	10.85	0.00	1.60	0.00
2007-01	3.00	7.45	162.00	1833.00	2.50	0.01	0.00	13.00	272.00	492.00	53.00	2063.00	11.68	5209075.00	-1410462.00	674626.00	3.50	-561.50	0.62	1.64	0.00
2007-02	8.50	0.08	-1946.00	204.00	10.00	0.04	0.00	12.00	62.00	448.00	56.00	3175.00	33.75	3656016.00	-873876.00	-316795.00	2.50	288.40	0.31	2.30	0.00
2007-03	8.00	-0.09	2038.00	4576.00	25.50	-0.07	0.10	4.80	661.00	1011.00	73.00	6775.00	44.45	3214023.00	6194537.00	-90391.00	10.50	691.00	0.17	1.99	1.00
2007-04	3.50	4.70	4183.00	5696.82	30.00	-0.04	0.25	4.50	1356.00	2043.00	103.00	18625.00	25.05	9498951.00	3930601.00	378181.00	11.50	201.00	0.39	1.90	1.00
2007-05	7.00	-8.03	1147.00	1591.23	2.00	0.06	0.15	6.60	1279.00	1955.00	94.00	22725.00	29.32	12325371.00	2768949.00	-519279.00	7.00	-184.00	0.12	2.27	0.00
2007-06	8.00	-6.42	1803.00	2382.18	2.00	0.04	0.00	1.90	18.00	-747.00	-45.00	-3950.00	38.97	15613599.00	-1413806.00	-615931.00	6.00	-471.50	-0.01	1.76	0.00
2007-07	3.00	6.09	-52.00	-1142.23	20.00	0.01	0.00	1.50	170.00	-753.00	-51.00	-1125.00	39.98	15656908.00	-5358291.00	803614.00	6.50	1089.50	1.36	1.15	0.00
2007-08	3.00	2.23	-538.00	-40.00	8.00	0.00	0.00	15.80	1423.00	2120.00	141.00	24300.00	52.24	9495003.00	3473835.00	-194928.00	19.00	-132.00	1.72	1.95	0.00
2007-09	4.00	-0.68	1460.00	1159.00	0.00	-0.06	0.00	14.80	2014.00	3417.00	265.00	28000.00	44.57	13048586.00	1879799.00	-828909.00	23.50	-1491.50	0.68	1.75	0.00
2007-10	5.00	-0.99	1339.00	3018.00	0.00	-0.32	0.00	1.50	3231.00	5119.00	350.00	41150.00	33.48	15757294.00	-946349.00	-3007.00	16.00	596.50	-0.53	0.92	0.00
2007-11	3.00	2.06	-3021.00	185.00	6.00	-0.47	0.00	5.70	1957.00	3315.00	181.00	27200.00	29.60	14813948.00	-695030.00	588585.00	22.00	70.00	-0.87	0.92	0.00
2007-12	1.00	5.66	-1922.00	-1721.00	60.00	-0.40	0.00	12.90	-572.00	-221.00	-94.00	750.00	27.63	13530333.00	3954132.00	912804.00	14.00	-541.00	-0.08	1.51	0.00
2008-01	-1.00	1.34	873.00	533.00	79.00	-0.95	0.00	9.60	-3373.00	-5502.00	-384.00	-42325.00	12.50	15445661.00	-769104.00	-615843.00	-8.50	-240.60	-0.19	2.42	0.00
2008-02	-2.00	4.22	-2116.00	-4140.00	60.00	-1.67	0.00	29.50	-2980.00	-4854.00	-296.00	-26000.00	0.98	14692400.00	-7624789.00	-912020.00	-10.50	140.70	3.25	1.80	0.00
2008-03	0.50	-0.93	4304.00	3941.00	165.00	-1.11	0.00	32.10	893.00	1583.00	77.00	16375.00	3.92	9105631.00	-301453.00	200241.00	1.50	24.10	4.35	0.89	0.00
2008-04	0.50	4.45	5792.00	6850.00	157.50	-0.18	0.00	13.00	1413.00	2286.00	144.00	7500.00	0.59	9173901.00	1533684.00	-134.00	5.50	-78.70	1.04	1.10	0.00
2008-05	0.00	2.80	1145.00	899.00	80.00	-0.06	0.00	20.70	2781.00	5556.00	416.00	18950.00	10.42	10707799.00	-384702.00	-172733.00	8.00	471.20	-0.48	1.33	0.00
2008-06	0.50	-5.28	2268.00	688.00	272.50	0.26	0.00	13.40	1958.00	3749.00	243.00	18812.00	11.01	10525866.00	-3940125.00	903940.00	8.00	428.00	-0.85	1.67	0.00
2008-07	1.50	0.74	-1127.00	-2018.00	270.00	0.38	0.00	-2.60	-1908.00	-3587.00	-246.00	1800.00	7.96	5681721.00	7643580.00	-84643.00	2.00	-574.70	0.07	2.61	0.00
2008-08	3.00	-0.16	-4376.00	-1144.00	50.00	0.01	0.00	-25.30	-2843.00	-4150.00	-278.00	-22712.00	16.50	13046547.00	11141.00	-556443.00	0.00	-549.50	0.24	3.26	0.00
2008-09	-1.00	-0.18	-5272.00	-193.02	100.00	0.27	0.00	-46.10	-3961.00	-6480.00	-479.00	-48000.00	0.97	13614131.00	-9596868.00	-2303.00	-21.00	691.90	-2.21	3.35	0.00
2008-10	-6.50	-6.73	-6667.00	4263.96	100.00	0.71	0.00	-70.60	-5594.00	-9175.00	-591.00	-92500.00	-54.48	4382963.00	-1145043.00	222213.00	-78.00	348.50	-9.75	3.34	0.00
2008-11	-7.00	-6.60	-4425.00	3344.02	0.00	-0.79	-0.05	-60.50	-4156.00	-5713.00	-323.00	-71500.00	-116.51	2117207.00	-3107567.00	543182.00	-86.00	-708.90	-5.94	2.40	0.00
2008-12	-4.50	3.84	1891.00	-724.92	0.00	-1.61	-0.20	-9.70	-1061.00	-1318.00	-53.00	-6850.00	-82.81	-2813542.00	-959420.00	281756.00	-30.00	-367.00	1.62	1.18	0.00
2009-01	-8.00	0.13	6003.00	653.00	0.00	-0.96	-0.23	9.50	86.00	748.00	68.00	5350.00	-84.91	-3336218.00	1981050.00	-485209.00	-3.00	2.00	-0.03	1.36	0.00
2009-02	-14.00	12.09	2630.00	-1706.60	-487.50	-0.43	-0.20	-2.50	1069.00	2007.00	164.00	10750.00	-125.64	-841959.00	1314845.00	-397008.00	3.50	145.75	0.52	1.21	-1.00
2009-03	-8.50	19.07	3909.00	3156.68	-665.00	0.18	-0.12	-14.90	1053.00	666.00	44.00	2150.00	-55.11	868894.00	-1619968.00	521914.00	3.50	37.90	1.30	2.53	-1.00
2009-04	-2.00	9.90	2991.00	3652.56	-182.50	-0.10	0.00	-9.90	-157.00	-973.00	-98.00	-3438.00	-6.35	-380988.00	-1666667.00	312489.00	0.00	-0.05	-0.53	3.93	0.00
2009-05	-0.50	1.23	1359.00	555.32	-23.00	-0.44	0.00	-0.60	582.00	1283.00	96.00	5100.00	-9.84	-2899144.00	-361082.00	-169779.00	3.50	143.75	-1.93	3.05	0.00
2009-06	-3.00	-1.65	5896.00	1262.00	-30.00	-0.50	0.00	10.80	2164.00	5020.00	354.00	17000.00	-36.30	-3071447.00	2017239.00	811471.00	7.50	418.20	-0.31	2.91	0.00
2009-07	-7.00	4.53	4216.00	-422.00	-60.00	-0.39	0.00	19.10	822.00	1903.00	109.00	9385.00	-56.69	-2585679.00	4293914.00	2412803.00	7.00	131.70	0.32	3.69	0.00
2009-08	-8.00	-5.94	3018.00	850.00	-52.50	-0.33	0.00	4.70	-1138.00	-2826.00	-223.00	-6187.00	-39.87	-363568.00	-395112.00	-396357.00	2.00	-502.15	0.22	5.98	0.00
2009-09	-7.00	6.18	35.00	1969.00	-2.00	-0.30	0.00	-15.40	-1011.00	-2396.00	-166.00	-9735.00	-36.33	-677323.00	-4293914.00	-378921.00	-1.00	-219.35	0.65	6.20	0.00
2009-10	-4.50	-4.14	-580.00	4760.00	2.50	-0.24	0.00	-8.10	61.00	-237.00	6.00	-4825.00	-23.87	-4592316.00	1759615.00	745876.00	-5.50	-44.65	0.75	5.50	0.00
2009-11	-1.50	-13.23	-3449.00	1779.00	0.00	-0.15	0.00	8.40	1590.00	3386.00	252.00	10125.00	1.99	-4275577.00	3182144.00	-786124.00	-5.50	-79.30	0.65	6.03	0.00
2009-12	-0.50	16.76	-4083.00	-273.00	0.00	-0.12	0.00	11.40	826.00	1133.00	63.00	3325.00	3.17	-987309.00	-3381742.00	172319.00	2.50	34.90	0.56	5.51	0.00
2010-01	-0.50	-4.26	5273.00	111.00	0.00	-0.11	0.00	6.40	-773.00	-2577.00	-205.00	-5275.00	-2.34	-2429370.00	804618.00	907406.00	2.50	184.35	1.09	5.14	0.00
2010-02	0.00	-12.45	2693.00	-5966.71	0.00	-0.09	0.00	4.40	-894.00	-1929.00	-135.00	-2750.00	-1.09	-1852158.00	1155378.00	110368.00	1.50	154.23	1.25	5.63	0.00
2010-03	0.00	12.15	2433.00	2996.31	0.00	-0.03	0.00	24.40	39.00	-450.00	-10.00	-1100.00	2.97	-467148.00	-770481.00	1170002.00	7.00	-111.55	0.81	5.74	0.00
2010-04	1.50	5.49	5046.00	8819.71	150.00	0.07	0.00	29.20	365.00	-81.00	0.00	775.00	20.70	-2577631.00	1927558.00	-4757.00	5.50	26.74	0.83	6.90	0.00
2010-05	3.00	-7.23	1175.00	2497.69	150.00	0.26	0.00	-3.50	631.00	1035.00	65.00	2000.00	21.04	-645316.00	608684.00	-1580104.00	-2.00	-94.00	-0.84	6.89	0.00
2010-06	2.00	-8.18	-1637.00	-3203.00	0.00	0.29	0.00	-18.60	45.00	507.00	48.00	600.00	13.49	1536472.00	2152574.00	869424.00	-3.00	90.73	-1.49	5.45	0.00
2010-07	0.50	-0.58	-4400.00	-5071.00	0.00	0.07	0.00	-7.20	-1928.00	-2657.00	-186.00	-8100.00	8.64	2299324.00	-1274126.00	1956606.00	-4.00	-20.50	0.28	6.44	0.00
2010-08	-0.50	-2.74	-2130.00	896.00	-50.00	-0.18	0.00	3.30	-656.00	-806.00	-57.00	-3750.00	-5.97	-5782700.00	-3827606.00	-1295425.00	-3.00	-279.10	1.46	7.66	0.00
2010-09	-1.50	1.40	-3798.00	1801.00	-50.00	-0.24	0.00	4.00	809.00	1640.00	123.00	3600.00	-9.55	-10399062.00	-1400681.00	-1077644.00	-1.00	76.00	0.75	6.38	0.00
2010-10	-1.00	1.15	-1332.00	7605.00	0.00	-0.12	0.00	0.60	261.00	1176.00	66.00	1250.00	-5.78	-5696066.00	-1051477.00	1514100.00	0.50	153.10	0.00	5.93	0.00
2010-11	-0.75	4.09	2228.00	2104.00	30.00	-0.03	0.00	2.90	-398.00	47.00	-19.00	-2250.00	-0.89	-6557114.00	1785768.00	-840905.00	0.50	115.50	0.89	7.04	0.00
2010-12	-1.00	12.71	1220.00	-2847.00	30.00	0.00	0.00	12.30	-662.00	-1452.00	-106.00	-6800.00	-1.18	-4468546.00	2011030.00	-75879.00	-6.50	-52.10	0.74	6.78	0.00
2011-01	-1.75	11.48	9698.00	36.00	0.00	0.01	0.00	16.80	-920.00	-2003.00	-144.00	-7812.00	-2.06	-1661687.00	-371178.00	3748737.00	-5.50	29.05	0.46	6.85	0.00
2011-02	-2.00	-9.10	2783.00	-5382.00	10.00	0.00	0.00	9.70	-850.00	-1336.00	-98.00	-5075.00	-5.21	-5841238.00	-1492635.00	-1504240.00	0.00	-84.35	0.10	9.64	0.00
2011-03	-1.50	-8.94	-455.00	6365.00	30.00	0.01	0.01	-4.00	92.00	29.00	6.00	-2438.00	-8.71	-5649633.00	-1816439.00	-2712105.00	-3.00	-142.55	0.45	7.23	0.00
2011-04	-1.00	3.39	4725.00	9974.00	90.00	-0.02	0.00	1.90	162.00	233.00	11.00	-2873.00	-6.70	-4694367.00	-160368.00	1134966.00	-3.00	-49.25	1.53	3.37	0.00
2011-05	0.00	-6.39	829.00	4353.00	100.00	-0.05	-0.01	5.20	-141.00	-80.00	-14.00	-3312.00	-1.43	-7633477.00	-338016.00	400039.00	-2.00	25.50	0.73	5.37	0.00
2011-06	0.00	-2.01	900.00	4294.00	50.00	-0.05	0.00	-6.00	90.00	268.00	19.00	-752.00	0.00	-7831132.00	1753307.00	336142.00	-3.00	32.20	-0.48	5.82	0.00
2011-07	-2.00	1.30	-945.00	-1618.00	20.00	0.00	0.00	-4.08	14.00	339.00	21.00	1182.00	-21.52	-4770101.00	47.00	-668954.00	-5.00	-70.50	0.49	4.65	0.00
2011-08	-2.50	8.04	-1180.00	-2399.00	-40.00	0.11	0.00	1.14	-46.00	178.00	19.00	1381.00	-32.78	-4101100.00	-844534.00	-698003.00	-5.00	68.80	0.51	5.15	0.00

2011-09	-1.00	5.91	-2600.00	-568.00	-40.00	0.11	-0.06	-4.91	474.00	1187.00	95.00	3480.00	-19.56	-4247721.00	-410340.00	2323969.00	-1.00	135.00	-0.62	5.64	0.00
2011-10	-2.00	-8.86	-4079.00	4100.00	-60.00	0.09	-0.04	-19.31	685.00	1337.00	110.00	3494.00	-27.60	-7325779.00	-1269227.00	424356.00	1.00	102.80	-0.33	7.99	0.00
2011-11	-2.50	3.72	-6817.00	1402.00	-90.00	0.15	0.06	-17.19	-5.00	-63.00	-5.00	-850.00	-25.24	-9370962.00	382000.00	-1609074.00	1.00	-30.00	-0.13	8.85	0.00
2011-12	-1.00	13.00	-2509.00	-919.00	-30.00	0.18	0.04	-5.17	-203.00	125.00	17.00	-75.00	-5.94	-7036139.00	1691500.00	-210286.00	-4.00	-180.10	-0.08	7.36	0.00
2012-01	-0.50	-4.51	6850.00	2957.00	-20.00	0.12	0.00	-1.42	-796.00	-1219.00	-106.00	-2750.00	-5.43	-6657953.00	1826939.00	962722.00	-2.00	-119.85	-0.28	8.19	0.00
2012-02	-1.50	1.65	3719.00	-4361.00	-70.00	-0.02	0.00	3.28	-1166.00	-2048.00	-180.00	-5300.00	-12.69	-6924774.00	-1298718.00	313217.00	0.50	-3.70	-0.53	8.85	0.00
2012-03	-1.00	3.35	4848.00	5086.00	-30.00	-0.06	0.00	7.34	-180.00	-396.00	-25.00	-2250.00	-8.93	-6838700.00	-1647067.00	-729485.00	-3.00	76.45	-0.57	7.20	0.00
2012-04	-0.50	-6.93	4692.00	8784.00	20.00	-0.03	0.00	3.36	318.00	51.00	7.00	375.00	-2.26	-9265820.00	-746782.00	1379225.00	-1.50	163.60	0.35	5.78	0.00
2012-05	-0.50	1.00	-347.00	-201.00	0.00	-0.01	0.00	-9.97	242.00	86.00	20.00	750.00	-0.59	-11574636.00	-561872.00	-143744.00	0.00	-48.10	-0.78	6.67	0.00
2012-06	0.00	0.39	-362.00	1865.00	-10.00	0.01	0.00	-11.53	-84.00	-332.00	-3.00	-75.00	-2.97	-11872188.00	1050575.00	1799837.00	0.00	-118.55	-2.67	5.81	0.00
2012-07	0.00	-5.99	459.00	-1741.00	-10.00	0.00	0.00	-16.40	-45.00	-220.00	-9.00	1281.00	-4.40	-12262269.00	207000.00	-986857.00	-2.00	130.00	-0.57	8.11	0.00
2012-08	0.00	3.87	-1510.00	-2159.00	-5.00	-0.02	0.00	-22.79	-176.00	-33.00	-19.00	-2125.00	-12.25	-8727266.00	116016.00	-5000267.00	-2.00	-1.40	0.96	7.85	0.00
2012-09	-0.50	7.49	-3747.00	726.00	-20.00	-0.06	0.00	-4.63	-349.00	26.00	1.00	-2031.00	-14.93	-3730988.00	-207000.00	446166.00	-0.50	603.60	-0.39	3.20	0.00
2012-10	-0.50	-6.00	393.00	5119.00	-15.00	-0.13	0.00	6.75	191.00	950.00	80.00	3325.00	-7.99	-5015922.00	-1062391.00	617000.00	-0.50	15.85	0.16	2.88	0.00
2012-11	0.00	-0.72	-475.00	-1882.00	-10.00	-0.14	0.00	4.78	318.00	938.00	69.00	1800.00	-5.54	-7759489.00	0.00	-2141501.00	0.00	-599.60	0.30	3.12	0.00
2012-12	0.00	14.65	-1440.00	-3578.00	-10.00	-0.07	0.00	5.41	-96.00	-520.00	-53.00	-1812.00	-1.66	-5167366.00	615800.00	-919897.00	0.00	-21.20	-0.46	1.80	0.00
2013-01	0.00	0.16	6151.00	3742.00	-30.00	-0.04	0.00	9.91	-254.00	-839.00	-69.00	-988.00	0.00	-2567619.00	2172000.00	2066751.00	0.50	51.30	0.68	1.75	0.00
2013-02	0.00	-13.92	4174.00	-2947.00	-30.00	-0.05	0.01	8.29	-111.00	-186.00	-4.00	312.00	0.00	-2102370.00	904000.00	44947.00	1.50	-6.40	0.14	3.50	0.00
2013-03	0.50	-0.40	2671.00	6674.00	0.00	-0.04	0.00	-3.72	105.00	-166.00	-6.00	-162.00	0.58	-1478272.00	1950000.00	-125458.00	1.00	-231.80	-0.31	2.49	0.00
2013-04	1.00	9.36	3820.00	8465.00	-10.00	-0.03	-0.01	-9.06	129.00	-161.00	-5.00	-156.00	2.05	417186.00	1966000.00	880506.00	-1.00	21.90	0.53	2.82	0.00
2013-05	1.00	3.56	741.00	438.00	-10.00	-0.03	0.00	-10.69	-25.00	72.00	8.00	200.00	4.36	1441508.00	-630680.00	-2090940.00	0.00	78.96	-0.25	4.11	0.00
2013-06	0.50	-4.02	-986.00	3049.00	0.00	-0.02	0.00	-8.80	66.00	400.00	34.00	656.00	2.89	3080648.00	-2388000.00	-457188.00	1.00	-4.50	-0.69	2.07	0.00
2013-07	0.50	4.72	-1564.00	-3358.00	0.00	-0.02	0.00	1.29	272.00	639.00	38.00	1400.00	5.66	1566913.00	1457308.00	397862.00	0.00	-78.96	-0.35	2.12	0.00
2013-08	1.50	6.28	1613.00	-6568.00	0.00	-0.02	0.00	4.66	148.00	432.00	20.00	3800.00	10.50	2621151.00	592100.00	-715930.00	0.00	97.20	-1.11	2.83	0.00
2013-09	2.00	1.64	-50.00	-8717.00	0.00	-0.02	0.00	-3.93	558.00	1481.00	125.00	6188.00	6.02	3929181.00	-3120728.00	-257451.00	4.00	81.80	-0.03	1.69	0.00
2013-10	3.50	-1.29	-1196.00	-13352.00	0.00	-0.03	0.00	-7.66	795.00	1225.00	99.00	1950.00	10.72	720232.00	3298800.00	510563.00	6.00	124.00	1.09	1.53	0.00
2013-11	3.50	2.85	-4541.00	-20117.00	-10.00	-0.04	0.00	-2.53	-122.00	-973.00	-79.00	-2038.00	13.81	3184569.00	4619700.00	426252.00	6.00	-81.80	0.56	2.35	0.00
2013-12	1.00	5.63	-2731.00	-17193.00	-10.00	-0.02	0.00	2.49	295.00	549.00	56.00	3375.00	6.36	5296917.00	-337900.00	-1012672.00	4.00	50.00	0.26	1.91	0.00
2014-01	2.00	9.55	7848.00	-1382.00	0.00	-0.01	0.00	1.06	-87.00	-323.00	-19.00	1438.00	21.13	5695589.00	842400.00	884881.00	2.00	271.40	0.36	0.82	0.00

Appendix III

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
Y		-0.13	-0.03	-0.04	0.43	0.26	0.53	0.28	0.28	0.25	0.22	0.35	0.86	0.38	0.18	-0.07	0.43	0.06	0.20	-0.25	0.46
X1	-0.13		0.08	-0.09	-0.31	-0.05	-0.15	0.18	0.12	0.08	0.07	0.11	-0.07	0.03	-0.02	0.11	0.17	0.08	0.20	-0.12	-0.20
X2	-0.03	0.08		0.31	-0.07	-0.08	-0.07	0.46	0.29	0.22	0.19	0.30	0.03	-0.06	0.20	0.25	0.28	0.03	0.31	-0.09	0.00
X3	-0.04	-0.09	0.31		0.08	0.02	0.08	0.03	0.08	0.06	0.05	-0.02	-0.01	-0.11	-0.05	0.12	-0.09	-0.03	-0.06	0.08	0.09
X4	0.43	-0.31	-0.07	0.08		0.03	0.29	0.09	-0.15	-0.11	-0.13	-0.10	0.40	0.22	0.05	-0.02	-0.07	0.01	-0.07	-0.07	0.57
X5	0.26	-0.05	-0.08	0.02	0.03		0.26	-0.25	0.02	0.00	-0.02	-0.01	0.30	-0.11	0.11	0.03	0.08	0.10	-0.29	0.00	0.02
X6	0.53	-0.15	-0.07	0.08	0.29	0.26		0.10	0.11	0.08	0.04	0.14	0.55	0.17	0.18	-0.01	0.25	0.07	0.03	0.01	0.56
X7	0.28	0.18	0.46	0.03	0.09	-0.25	0.10		0.48	0.43	0.41	0.56	0.35	0.11	0.18	0.07	0.61	-0.01	0.65	-0.05	0.08
X8	0.28	0.12	0.29	0.08	-0.15	0.02	0.11	0.48		0.97	0.96	0.92	0.28	-0.02	0.27	-0.01	0.72	0.16	0.42	-0.13	0.00
X9	0.25	0.08	0.22	0.06	-0.11	0.00	0.08	0.43	0.97		0.99	0.89	0.21	-0.03	0.25	-0.02	0.65	0.16	0.36	-0.14	0.01
X10	0.22	0.07	0.19	0.05	-0.13	-0.02	0.04	0.41	0.96	0.99		0.86	0.17	-0.05	0.24	-0.02	0.60	0.15	0.33	-0.14	-0.01
X11	0.35	0.11	0.30	-0.02	-0.10	-0.01	0.14	0.56	0.92	0.89	0.86		0.37	0.02	0.31	-0.01	0.85	0.08	0.57	-0.10	0.04
X12	0.86	-0.07	0.03	-0.01	0.40	0.30	0.55	0.35	0.28	0.21	0.17	0.37		0.38	0.13	-0.05	0.57	0.05	0.28	-0.20	0.38
X13	0.38	0.03	-0.06	-0.11	0.22	-0.11	0.17	0.11	-0.02	-0.03	-0.05	0.02	0.38		-0.13	0.07	0.15	0.02	0.03	-0.63	0.09
X14	0.18	-0.02	0.20	-0.05	0.05	0.11	0.18	0.18	0.27	0.25	0.24	0.31	0.13	-0.13		0.09	0.28	-0.21	0.10	-0.06	0.21
X15	-0.07	0.11	0.25	0.12	-0.02	0.03	-0.01	0.07	-0.01	-0.02	-0.02	-0.01	-0.05	0.07	0.09		-0.02	0.16	-0.08	-0.13	0.01
X16	0.43	0.17	0.28	-0.09	-0.07	0.08	0.25	0.61	0.72	0.65	0.60	0.85	0.57	0.15	0.28	-0.02		0.06	0.64	-0.10	0.05
X17	0.06	0.08	0.03	-0.03	0.01	0.10	0.07	-0.01	0.16	0.16	0.15	0.08	0.05	0.02	-0.21	0.16	0.06		-0.04	-0.06	0.11
X18	0.20	0.20	0.31	-0.06	-0.07	-0.29	0.03	0.65	0.42	0.36	0.33	0.57	0.28	0.03	0.10	-0.08	0.64	-0.04		-0.03	-0.04
X19	-0.25	-0.12	-0.09	0.08	-0.07	0.00	0.01	-0.05	-0.13	-0.14	-0.14	-0.10	-0.20	-0.63	-0.06	-0.13	-0.10	-0.06	-0.03		0.00
X20	0.46	-0.20	0.00	0.09	0.57	0.02	0.56	0.08	0.00	0.01	-0.01	0.04	0.38	0.09	0.21	0.01	0.05	0.11	-0.04	0.00	