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Analyzing shipping cycles of dry bulk shipping market over the past 50 years

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Declaration

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

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

(Signature):

(Date): 2017-07-08

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Abstracts

In the past 300 years of the history of world shipping, the prosperity and decline of the shipping market has almost been the interpretation of the alternating cycle, which is called cyclical. The reason for this cyclical cycle is accompanied by the prosperity and depression of the world economy, or the process of war, scientific development and the development of human civilization.

The purpose of the paper is to analyze the dry bulk shipping market in last 50 years. Shipping cycles are divided within the basement of research and history. After that, each shipping cycle is analyzed independently. Modelling is related to the analysis of shipping cycles. Combined with the result of the modeling, shipping cycles can be shown in detail.

Shipping cycles possess the similarities and differences which are able to be displayed to shipping companies or investors as a historical relevant data. Thus, the analysis of shipping cycles is essential to the prediction of the future trend.

Content:

Chapter 1. Introduction

1.1 Background

In the past 300 years of the history of world shipping, the prosperity and decline of the shipping market has almost been the interpretation of the alternating cycle, which is called cyclical. The reason for this cyclical cycle is accompanied by the prosperity and depression of the world economy, or the process of war, scientific development and the development of human civilization. (Shipping Trade Bulletin, 2013)

Under the current situation of global integration, the shipping cycle has gradually replaced the agricultural cycle and some other traditional industry cycles on the whole world economy, and the degree of it is deepened. (Guan, 2009) For hundreds of years, the cycle of the shipping industry and the prosperity of this crisis basically occur once every 10 years, again and again, and follow a similar trajectory. Normally, according to the economics of the economic cycle stages, shipping cycle can be divided into four stages which are recovery, prosperity, recession and depression. (Huang, 2016)

The shipping cycles possess the similarities and differences which are able to be displayed to shipping companies or investors as a historical relevant data. Thus, the analysis of shipping cycles is essential to the prediction of the future trend. The potential reasons for the differentiation of shipping cycles over past 50 years is rarely analyzed by other scholars. The paper will analyze the differentiation according to economics, innovation and technology fields.

From all the perspectives above, the paper intends to analyze shipping cycles of dry bulk shipping market over the past 50 years. This study could be a reference to shipping companies and investors to make reasonable analysis and enhance the accuracy of prediction.

1.2 Objective of the Study

The first objective of the paper is to identify the division standard and divide the shipping cycles over the past 50 years. After determining the cycles, the second objective is to seek for the relationship between BFI and supply & demand in each shipping cycle from both quantitative and qualitative analysis sides. The third objective of the paper is to analyze the potential factors which influence the shipping industry in economics and innovation fields.

1.3 Methodology

The purpose of the paper is to analyze the dry bulk shipping sector in different shipping cycles in the past 50 years. To manage to the main research purpose, one method from Econometrics, called Time Series Modeling (TSM), is chosen to be the main analysis method. Econometrics is based on certain economic theory and statistical data, using statistical methods and computer technology, mathematics, to establish the econometric model as the main method. Furthermore, Econometrics is able to analyze quantitative analysis of economic variables with random characteristics.

Therefore, according to the chronological order, the process of the development of random events can be recorded into a time series. By observing and studying the time series, it is obvious to find the changing and development regulations and to predict the future trend. Under this premise, when meeting the similar problems in the future, the time series analysis of shipping cycles can be the solution of the same situation.

There is another method called Structural Equation Modeling (SEM) in Econometrics. SEM is able to deal with the relationship between multiple causes and multiple results, or is able to encounter the variables which are not observed directly. In this regard, SEM can be the method to analyze the different shipping cycles and bubbles. But compared with time series, the disadvantage of SEM is that many dependent variables are considered at the same time. But when calculating the influence or the relation to a dependent variable, the existence and influence of other dependent variables are ignored. Sometimes, SEM may ignore some main

factors which will affect the final result of the research. Therefore, SEM will not be chosen as the method of this research.

1.4 Outline of the paper

Chapter 2, literature review, overview related researches, reports and studies on shipping cycles. Many researches illustrate how to define the shipping cycles, which kind of market the author is focusing on, which kind of method the author trying to use and which kind of quantitative and qualitative analysis is using. **Chapter 3, the shipping cycles identified**, intends to divide each shipping cycles over past 50 years and elaborate the identified standard. This chapter is set as a basement of the paper which is able to help to analyze the mechanism of shipping cycles subsequently. **Chapter 4, quantitative and qualitative analysis,** which is to explore significant factors influencing each cycle from quantitative and qualitative parts. **Chapter 5, potential influencing factors in shipping cycles**, it is different from history angle in qualitative analysis and data angle in quantitative analysis. The factors such as technological innovation and capital promotion are analyzed in this part. **Chapter 6, conclusion and recommendation,** the results of the paper are explained again to show the shipping cycles of dry bulk market. And the shortage of the paper is pointed for other scholars who will read this paper.

Chapter 2. **Literature review**

After reading the recent research, there is a lot of information about shipping cycles.

2.1 Related researches

Definition of shipping cycles:

Research on the regular pattern of shipping cycles is abundant. One research introduced by Shipping Trade Bulletin says that in the past 300 years of the history of world shipping, the prosperity and decline of the shipping market has almost been the interpretation of the

alternating cycle, which is called cyclical. The reason for this cyclical cycle is accompanied by the prosperity and bubbles of the world economy, or the process of war, scientific development and the development of human civilization. For hundreds of years, the cycle of the shipping industry and the prosperity of this bubbles basically occur once every 10 years, again and again, and follow a similar trajectory. (Shipping Trade Bulletin, 2013) From the literature above, it is illustrated that the prosperity and decline of the shipping market has almost been the interpretation of the alternating cycle, which is called cycle.

According to the economics of the economic cycle stages, shipping cycle can be divided into four stages which are recovery, prosperity, recession and depression. (Huang, 2016) And the period of maximum is called peak value while the minimum value is called trough value. On the base of the length of the classification period, shipping cycle can be divided into three main types: short cycle called Kitchen cycle which has an average of 3 to 4 years, medium cycle called Juglar cycle which has an average of 9 to 10 years and long cycle called Kuznets cycle which has an average of 20 years. Generally speaking, it is more difficult to grasp and predict the long period of the shipping market. Thus, the shipping period should be divided into appropriate cycles.

Focus on dry bulk shipping market:

In Liu Zijian's paper, it is said that as an important part of the international shipping market, international dry bulk shipping market has different production cycle and transportation because of its many types of goods. It is affected by the world political and economic environment, economic geography, economic development level and industrial structure characteristics and other factors and it is a fully competitive market. Although in recent years the dry bulk freight index has always been in a severe fluctuation, the international dry bulk shipping market volatility is regular and cyclical. (Liu Z., 2009) Moreover, there is another paper written by Liu Jianming state his opinion that the international dry bulk shipping market is a fully competitive market, which is more competitive than the container liner market. Therefore, it is of great significance to study the characteristics of the dry bulk shipping market. And one of the important characteristics of the dry bulk shipping market is

cyclical characteristics. (Liu, 2009)

Importance of historical data:

In the paper of Shuo Ma, the shipping cycles will be divided by each historical stage. Why is it necessary to study historical data for the shipping market cycle? For it is impossible to conduct such research without the use of historical data. According to Dr. Stopford's research, the dry bulk shipping market has undergone 21 cycles of change during the period of 1741 to 2007. In addition, the average length of these cycles is 10.4 years. And there are 6 cycles over a period of 15 years, and there are 6 cycles last for 10 to 15 years while there are 9 cycles last for 3 to 7 years. (Ma, 2009) We can find that shipping cycles are related with historical data.

Quantitative and qualitative analysis：

Many scholars have done the quantitative and qualitative research on the periodic fluctuation of shipping. Qiang Li conducted that the current situation of China's dry bulk fleet management is analyzed to be combined with the actual situation of enterprises. The first analysis is the economic analysis of CAPESIZE while the other is the operation analysis of different types of ships. (Li, 2003) Cao Qianyi has analyzed the dry bulk shipping market inflection point over the years specifically, including short-term inflection point which is mainly the analysis of freight movements. (Cao, 2015) Cheng Zhang has done the quantitative research as well. Zhang has drawn the conclusion that the future of China has great influence on the international dry bulk shipping market. He tried to use the ranking of the development to change the data of China. (Zhang, 2006) Furthermore, Lin and Cheng tried to use spectral analysis method to measure cycle length of dry bulk shipping market. (Lin & Cheng, 2012)

Characteristics of price fluctuation in shipping cycle:

From He’s paper, we can find that under the action of the law of value, the price of the international dry bulk cargo transportation is still determined by the value of the goods. The market characteristics of complete competition makes the effect on various factors of affecting the level of international dry bulk shipping market which has been fully reflected in

the market. (He, 2002)

Factors leading to price fluctuations：

Song and Li conducted that the factors of supply and demand fluctuations of international dry bulk market are related to global economic development, oil price fluctuations, the development of steel industry, national policies and regulations, natural causes, etc. (Song & Li, 2015)

Analysis modeling and methods:

Some analysis methods and modeling have been introduced to analyze the shipping scenario. Such as, the method to analyze the relationships between the economic performance and technical specifications of dry bulk vessels built over the period 1970 to 2008 are investigated by S. Chen. The dissertation proposes strategies not only for modeling price behavior in the dry bulk market, but also for modeling relationships between economic and technical variables of dry bulk ships, by using modern time series approaches, Monte Carlo simulation and other economic techniques. (Chen, 2011) In addition, Hao Guan verified to use the rate of economic change tracking method for detection and analysis of the world economic growth rate and BDI index series. This method observed time series relationship between economic value through the sequence chart, and finally reaching the inflection point predicted in advance to the dry bulk shipping market. (Guan, 2009) Cheng Zhang has used the grey relational analysis model to analyze the two-main dry bulk which are iron ore and coal. The calculation has been done to analyze the development and change of various key areas in the global impact of international dry bulk cargo shipping market. (Zhang, 2006) Considering the interference of many external factors to the BDI index, Li tried to use the wavelet transform theory to process the signal, which can accurately extract the essential characteristics of the original freight rate index and improve the accuracy of the research. (Li Y. , 2014)

2.2 Existing problems

However, problem and weakness still exist.

- ✧ **For hundreds of years, the cycle of the shipping industry and the prosperity of this bubbles basically occur once every 10 years, again and again, and follow a similar trajectory.**

The shipping industry are following a similar trajectory, but nobody is able to truly forecast the cycle. Only doing the research to divide the historical shipping cycles can analyze the situation and summarize the result which can be used as object of reference in the future problems. Although many researches on the regular pattern of shipping cycles are abundant, they lack of standard which can divide the shipping cycles the past 50 years.

- ✧ **Shipping cycle can be divided into four stages which are recovery, prosperity, recession and depression.**

As it is shown, the shipping cycles can be simply divided into four stages. There are many research papers discussing about the influence factors to shipping cycles. For instance, the paper written by a Chinese scholar is discussed about the analysis on the factors influencing the fluctuation of international dry bulk shipping market. (Yuan, 2013) But it still lacks of the initial reasons and the analysis about the similarity and difference of each cycle. And there are not many researches talking about shipping bubbles of each shipping cycle.

- ✧ **the factors of supply and demand fluctuations of international dry bulk market are related to global economic development, oil price fluctuations, the development of steel industry, national policies and regulations, natural causes, etc.**

The factors related to each cycle need to be paid attention to. Such as economics and innovation, these two factors are able to promote the shipping fields to be prosperity and play an important role in the shipping industry and history in recent years. In addition, we

need to figure out which factor leads to the fluctuation of shipping market in each divided shipping period.

- ✧ **Many scholars have done the quantitative and qualitative research on the periodic fluctuation of shipping.**

Many research papers are talking about the quantitative and qualitative research on the periodic fluctuation. The detailed research data should be decided and searched, such as seaborne trade volume, TC average, etc.

- ✧ **It proposes strategies not only for modeling price behavior in the dry bulk market, but also for modeling relationships between economic and technical variables of dry bulk ships, by using modern time series approaches, Monte Carlo simulation and other economic techniques.**

Also, S Jafar, M Hassanali and NA Saeed have written a book called 'Forecasting the Dry Bulk Freight Market in 2011 and 2012'. In this book, they use linear regression, multiple regression and time series analyses to analyze and forecast volatilities of dry bulk freight market. (Jafar, Hassanali, & Saeed, 2010) In addition, there is a study examines the considerable fluctuations of the world's dry bulk shipping market from November 1995 to September 2008. The major objective is to provide a forecasting model for the freight rate in relation to the second-hand ship price. The results indicate an acceptable level of prediction according to Mean Absolute Percentage Error (MAPE), with a value no more than 20%. (Chang, Hsieh, & Lin, 2012) Although there are many possible methods to analyze the shipping market, the results are related to the data within ten years and the results are not updated. In addition, there are many modeling method which can be utilized. In order to research the shipping cycles and bubbles over the past 50 years, an accurate and effective method should be chosen.

Chapter 3. The shipping cycles identified

3.1 Introduction

At the beginning of the paper, the shipping cycles should be identified as the basement of further data analysis. From the research in literature review, there are many standards to partition the shipping cycles. Combined with modern shipping history, the shipping cycles will be analyzed logically. In Chapter 3, how to divide the shipping cycles will be illustrated while the divided standard will be explained as well.

3.2 Origin of modern shipping history

In 60s, shipping industry was quite different from what it is today. The monarchy which has dominated the shipping industry for a century went to ruin rapidly. The European monarchy on the planet was retreating, and the shipping industry consisted of three major parts: liner, tramp, and passenger liner. This system was mainly used to meet the requirement of relatively centralized royal trade, which usually transported all kinds of groceries to the colonies and carried back semi-finished goods and small bulk cargos. Therefore, it required the ships to be versatile. Liner vessels and non-scheduled vessels were complementary to each other which operated the charter trades or transported bulk cargo such as grain. As it is mentioned, ships were versatile which shipping on traditional routes, but the system sacrificed efficiency and flexibility.

In fact, it was an intersection of economic development in 1957. There were many signs which showed the things were changing. The monarchy was on its way to extinction while a new era called ‘globalization’ was started. The world was moving towards to a new global free-trade economy.

The global free-trade policy was established by the Bretton Woods conference, which decided to replace the royal trade world with a free trade system. Th US Treasury Secretary, Henry Morgenthau, summed up the goal of creating a ‘dynamic world economy’. After that, the World

Bank, the International Monetary Fund and the general agreement on Tariffs and trade have been established. As one of the process of reforms, the monarchy in Europe went to ruin and the colonial system was doomed in 1957. And this situation opened up the trade and created opportunities. Oil trade and bulk trade have begun as well.

3.3 Divide shipping cycles

As a basement, the modern shipping history illustrated the shipping origin from 60s which started to open a new door to the world. The paper is explained the shipping cycles in dry bulk market from 1967 to now (about 50 years). After considering about both theories and histories, shipping cycles will be divided.

From the theories side, shipping cycles are divided as below:

There are many researches about the theory of market cycle. However, in the field of shipping theory, Dr. Martin Stopford from England is one of the experts who deeply study the theory of shipping cycle. In the publication of the "marine economics", it reviews the history of the global dry bulk shipping market in 260 years (1741~2008). And this period is divided into 3 times: sailing time (1741~1871), irregular (1873~1939) and bulk cargo ship era (1947~2008).

In this period of history, excluding some of the major historical events (such as war), the recovery, prosperity, recession and depression stage of each shipping cycle are obtained after collation and correction. In 1741~2008, the average cycle of volatility in the global shipping market is 10.3 years.

From the history side, shipping cycles are divided as below:

In 1967 to 1979, the prosperity and decline cycles of the global shipping market were short and the whole shipping market was in a low stage and turbulent consolidation stage in the middle and late 60s. Until 1967, the war of Arabia and Israel broke out, Israel occupied the Sinai Peninsula, so Suez Canal became the frontier. The canal was closed for 9 years. Therefore, the ship past the Suez Canal had to detour to Cape of Good Hope, which greatly stimulated the

shipping industry.

Focused on the seaborne trade, the growth trend of seaborne trade is much higher than that of GDP. This period coincided with the period in which Europe and Japan experienced a strong growth in raw materials.

In 1980 to 1989, the growth trend of seaborne trade is under that of GDP. It was caused by the oil-crisis, resulting in the pressure of resources and the inflation of commodity prices. The decline in trade coincided with the depression of the world economy.

In 1990 to 1999, the global shipping market in 90s seemed to be very disorderly and disorderly, and freight was in a turbulent consolidation period. In 1990, dry bulk market had no track of obvious recovery. Compared to tanker industry, the new-built tanker industry came to its peak with a steady pick-up in freight costs. However, the dry bulk market began to show signs of recovery in 1992, reaching a small peak in 1995. By early 2000, the world's industrial growth rate reached to 11% as a record. The global shipping market was beginning to show signs of recovery. Therefore, the next shipping cycle is beginning.

In 2000 to 2007, the growth trend of seaborne trade is higher than that of GDP. The world economy recovered from the economic crisis of 70s. From the beginning of 1960, the Four Asian Tigers which are China Hongkong, Taiwan, Singapore and South Korea carried out the export-oriented strategy, focusing on the development of labor-intensive processing industry. In a short period of time, Four Asian Tigers obtained the huge achievement and became the developed affluent areas. At the beginning of 2000, China caught up quickly. Since China has joined in the WTO association, the shipping tend was developed rapidly. It promoted the foreign trade development of China.

In 2008 to now, the inflection points of the recession seemed to come to the market overnight. Accompany with the global financial crisis, the shipping industry turned directly into recession in the fourth quarter of 2008. Before 2008, the supply and demand has already exceeded the market demand. But even the worse, ship-built factories were still running at full capacity. A large number of new orders delivered more pressure to let the market become fragile. In terms of shipping demand, the global economy was extremely weak under the influence of the financial

crisis. Moreover, imports and exports were dropping steadily. Container, dry bulk cargo, tanker capacity all showed a great surplus, and a large number of ships were idle. The situation was even worse that freight fell, ship prices fell and defaults and bankruptcy flooded the market.

Considering about the theories of Martin Stopford, the average cycle of volatility in the global shipping market is 10.3 years. Combined with the historical events, the shipping cycles are divided into 5 periods which are **1967-1979, 1980-1989, 1990-1999, 2000-2007 and 2008-2017**.

Chapter 4. Quantitative and qualitative analysis

Qualitative and quantitative method are employed in this paper. Quantitative research is to establish the research hypotheses, collect accurate data, and then conduct statistical analysis and inspection of the research process through statistical investigation or experimental methods. Qualitative analysis is a social science analysis method. It tends to collect data by means of interviews, observations and documentation, and conducts research on the basis of subjective and qualitative analysis. These two methods can comprehensively analyze the shipping cycles.

4.1 Qualitative analysis

In qualitative analysis, the shipping cycles are analyzed based on history. And the influence factors of shipping cycles are mentioned as well.

4.1.1 Description of different shipping cycles

In this part, the qualitative analysis based on the history is elaborated more detailed. Combined with the history events, the trend of the dry bulk shipping market in each decade is analyzed as well. However, little part of tanker market will be mentioned, for it is a comparison with dry bulk shipping market.

60s: prosperity

In 60s, the seaborne trade was on the rise trend. The demand for tankers was large, and the oil fleet grew at almost the same pace. Therefore, the market remained balanced. But the spot market did not suffer much during the ten years, for most of the tankers were ordered by time charter. Both the oil giants and Japan's trade partners hoped to reduce their shipping cost by outsourcing shipping. A new generation of shipowners obtained leases from rental customers, mainly about oil and steel businesses, secured by commercial banks. This period was prosperity, which resulted in the rising of the value of ships.

In the late 60s, the world trade and industry was in a period of prosperity. Moreover, the global maritime trade volume was growing rapidly during this period, from 1.81 trillion tons in 1966 to 3.23 trillion tons in 1973, which increased 78%. It meant that the demand of global shipping in seven years was bigger than the total demand of the 20 years after the 'World War II'. Despite the rapid expansion of shipbuilding capacity, the transport capacity was still in short supply. Many ship owners who have been on the verge of bankruptcy suddenly found that their freight revenue was able to repay all the debts. Under this situation, the shipping industry suddenly became the most promising and profitable industry, and many banks decided to devote themselves into the shipping industry. Therefore, the late 60s was called the golden age of global shipping market. However, this extreme rise also buried the market. In 1970 to 1971, a second-hand VLCC was about $26 million, but it rose to $61 million ~ $73 million in 1972. The crisis was self-evident, for the price went up 3 times than before.

70s: Disaster (1967-1979)

The shipping disaster in 70s began from oil shipping market. There were three main reasons: (1) the prosperity of the market in the late 60s led to an increase of about 60 million DWT in shipbuilding capacity each year. Although the demand for shipping was still rising, the demand growth rate lagged far behind the speed of the new shipbuilding. This situation continued until the middle of the 70s, when the global merchant shipping capacity experienced an excess of about 10 years. (2) From the beginning of the 70s, a large number of speculative investment leaded to serious excess oil tanker capacity in 1973, at the peak of the global operational tanker capacity up to 225 million DWT over the next two years. In addition, a large number new ship

delivery capacity reached to 320 million DWT in 1975, and excess capacity was about 100 million DWT. (3) oil prices increased and oil imports plummeted, which showed seaborne demand was slumped.

1973 was a very important year in the history of shipping in the world. The prosperity and the abyss were only in the twinkling of an eye. In the summer of 1973, VLCC freight rate was as high as 300WS in October 6th of that year. When the fourth Middle East War started, it became the last straw to overwhelm the oil market. The organization of Petroleum Exporting Countries in Arabia decided to start the oil embargo on Israel and the relevant countries, and sharply increased the price of crude oil. Thus, the price of crude oil rose to two times than before. And suddenly, it triggered a global economic crisis. For the demand of oil import decreased which let the tanker suffered a heavy blow, the freight instantly collapsed. VLCC freight rate plummeted to near the line 80WS in December, which declined nearly 75%. In addition, rising oil prices exacerbated the global recession, which affecting every corner of the shipping industry, including dry bulk market, container market, new shipbuilding and second-hand vessels market.

After that, the shipping market entered a long period of recession and recession. Although there was a brief recovery and recovery, the trend of the recession was not substantially alleviated. In the freight transportation cost, tanker idled up to about 10 million DWT while both volume and price of the second-hand ship was decreased at the same time. For instance, the price of 200 thousand tons oil tanker which was built in 1970 was $52 million, but it fell to $5 million in 1977, which was shrank in 90% in 4 years.

80s: Depression (1980-1989)

Despite the dry bulk freight market had a brief boom in the late 70s, it was just a short duration. The market freight began to decline substantially after March 1981, followed by a long, persistent downturn. The daily rental rate for Panama ships was $14 thousand in January 1981, which was down to about $4200 by December 1982, shrinking about 70%. The immediate trigger for a fall in market freight was the strike by the American coal miners, but the root reason was a severe recession in the world.

In 1983 to 1984, the world crude oil prices fell down which resulted in the stagnant of coal trade.

In addition, it made the global dry bulk market even worse. However, there was an interesting phenomenon in the new shipbuilding market of dry bulk from 1983 to 1984: the order of new shipbuilding increased by a counter trend. Firstly, the Japanese shipping companies Sanko secretly ordered 120 new dry bulk ships, and other international shipowners followed orders, especially the owner from Greece and Norway. This reverse cycle phenomenon was similar to the case of 1905 - 1906, but the explanation is very complicated. One is the shipowners has accumulated plenty of cash in dry bulk shipping market during a short period of prosperity in 1980. Secondly, banks held large dollar deposits of oil which could lend to the shipping industry. Thirdly, the shipping enterprises was overcapacity, so the building price of dry bulk vessels was relatively cheap. In addition, the new ships offered by the shipbuilders were more energy efficient than ever, which was attractive at the time of higher oil prices. And the Yen was weak at that time, it was cheaper to order ships in japan. However, the main reason was that shipowners predicted that the shipping market slump was only about 6 years, and the hunting mentality was very strong. But the market trend was clearly beyond the expected. The ship rent was always below the operating cost. Even the worse, the yen became strong in 1985, so the shipowners who paid by Yen or dollar should pay higher borrowing costs in shipbuilding. This situation resulted that many shipowners who borrowed the money from banks began to fall into serious economic difficulties. At the same time, a large number of new ship orders were cancelled. Many banks have decided to stop the loss and began to carry out the mortgage of a ship for getting compensation from the sale of the ship. Under this decision, the interests of both shipowners and banks have suffered a serious injury. Furthermore, the price of second-hand dry bulk vessels plummeted extremely. In 1980, the price of a new-built Panama ship was about $28 million, but in 1986, the price of 5 years second-hand Panama vessels was only about 6 million US dollars, shrinking about 80%. In the 80s, the oil market performance even worse, which was nearly in the great depression. Affected by the Iran-Iraq war, the oil crisis, economic recession and many other factors.

Generally speaking, the global shipping industry entered a very difficult period of depression in 80s. The basic reason was the decrease of the demand for seaborne trade and the increase of the supply of shipping capacity.

90s: shock (1990-1999)

From 1990 to 1999, the international shipping market was basically in the period of shock consolidation. And the market freight had no track of obvious recovery or decline. But in 90s, dry bulk shipping market and new-built tanker market performed differently. Start from 1990, the new-built tanker industry came to its peak with a steady pick-up in freight costs. There were about 55 million DWT new tanker orders during the period, but only about 24 million DWT were new orders for dry bulk carriers. There are three reasons of new-built tanker market prosperity: one is most tanker vessel were over 20 years of age. Second reason is the Middle East oil exports meet the growing demand for oil. Third reason is the investors expect the future oil market will be better. In 1992, there were 16 million DWT new tankers delivered, but only 4 million DWT dry bulk carriers were delivered. After that, with the delivery of a large number of new tankers, the freight began to decline until 1995. In contrast, the dry bulk market began to show signs of recovery in 1992, reaching a small peak in 1995. However, with investors entered, a large number of new shipbuilding began to delivery after 1996. The market will soon begin descending. The Asian financial crisis in 1997 broke out, which result to the market panic. Dry bulk shipping market and tanker shipping market are recession. Then the global shipping market went into a temporary crisis. However, the duration of the financial crisis was not long, and the impact on the shipping market was limited. By early 2000, the world's industrial growth rate reached to 11% as a record. The global shipping market was beginning to show signs of recovery. For instance, VLCC rent amounted to $80 thousand at the end of 2000. It shows the beginning of next shipping cycle.

On the whole, the global shipping market in 90s seemed to be very disorderly and disorderly, and freight was in a turbulent consolidation period. But it still showed the investor psychology, market expectations, market supply & demand, global economic and trade environment are still the main factors that affect the trend of the shipping market.

21 centuries: Myth (2000-2007)

In the new century, the shipping industry ushered in rare period of prosperity after undertaking the long depression. No matter which segment of the market, after 2003, especially after 2005, freight basically soared. In 2008 May, freight of iron ore from Brazil to

China Qingdao reached 100 U.S. dollars / ton. The freight is higher than its offshore trading price. Furthermore, the rent of vessels was straightly up. For example, renting a Capesize ship in 2003 was only about $10 thousand while it was more than $100 thousand in 2007. The rent of part of the routes were even as high as 200 thousand dollars in 2008. Ship capacity seemed to be tight, and the shipping industry seemed to be "overnight" to become the world's best profit margins in the industry. ‘Shipping myths’ have stimulated most of the outside market investors, and more and more people begin to put money into the shipping industry. It seems that the whole world wants to make a big profit in this ‘shipping myth’. The financial markets were more attractive to the shipping industry, with the forward freight contract (FFA) market hitting a record $150 billion in 2007. Of course, the birth of the ‘shipping myth’ had the reason of internal growth of world shipping demand, especially when China ushered in rapid development period after entering the 21 centuries. Following the "world factory", big country of iron and steel, infrastructure and real estate and other positive things maximumly stimulated the seaborne volume. Therefore, it can be said without doubt that the influence of ‘China factor’ was playing an important role in the shipping boom and development of this period.

After 2008: crisis (2008 to now)

The inflection point of recession seems to come to market overnight. Along with the global financial crisis, the shipping industry turned directly into recession in the fourth quarter of 2008. In fact, the supply and demand has far exceeded the market demand before the early 2008, But even worse, shipbuilding enterprises was still running at full capacity. A large number of new shipbuilding orders delivered more pressure to let the market become fragile. In terms of shipping demand, the global economy was extremely weak under the influence of the financial crisis, and imports and exports were dropping steadily. Container, dry bulk, tanker capacity all showed a great surplus, and a large number of ships were idle. The development afterwards gave no chance to the market. This crisis seems to continue until now that freight fell, ship prices fell, industry losses, defaults and bankruptcy flooded the market.

4.1.2 Influencing factors

From the above historical data, it can be concluded that there are many factors affecting marine demand, including global economy, seaborne commodity trade, route layout, transportation cost and financial environment. The factors that affect shipping supply are also complex, including the size of the global merchant fleet, the efficiency of the ship, the delivery of new ships, the dismantling of new ships, shipping revenue and so on. In addition, the shipping market will be affected by the factors of politics, war, science and technology. And the short-term market fluctuation will even be affected by complex factors such as market psychology and exchange rate.

There are three influence factors summarized as below:

(1) New marine transportation system. One of the main strategies for reducing transportation costs is to subcontract transportation to other low-cost shipping managers. For the royal service shipping company has maintained a highly conservative mentality, their eyes are locked in trade and fleet. They thought these were the only true things. However, this new world for free trade was completely wrong. The tonnage of bulk carriers has been expanding, and container shipping has made revolutionary changes in liner shipping. In April 1956, the first container transportation began, and the shipping industry changed dramatically in these 70 years. A new generation of ship owners has taken advantage of the newly developed flag of convenience ship (FOCs) to reduce costs and enable them to provide long-term leases for rental homes, which rates are beyond the expectations of multinational companies. As a result, FOCs expanded rapidly.

(2) Global materials and market supply. Oil trade is the dominant commodity and has proved unstable. The process of transporting such goods has been the process of trying to reduce costs. With the mechanization of cargo handling and large-scale of vessels, the distant regions like Brazil and Australia have become the major suppliers of oil, iron ore, coal and bauxite. Thus, it contributed to the rapid growth of oil, coal and iron ore trade

in 60s. However, this is an unstable process of development, the pressure of oil resources which were caused by high growth caused the oil crisis in 70s and the period of extreme chaos after that.

(3) The imbalance between supply and demand may be the most direct cause of any cycle of shipping booms and recessions. But the incentives for such imbalances can vary widely. Therefore, the analysis of the supply and demand situation is the best way to study when the shipping cycle appears inflection point. For example, the current cycle began in 1999 and began to decline in 2007, but the imbalance between supply and demand began in 2005. At that time, the market was rising inertia, and our country was the world's largest shipping demand country which had sufficient energy. Both inside and outside the industry was booming. Until 2008, the imbalance phenomenon was revealed. After that, the growth rate of market demand has almost been below the capacity growth rate.

4.2 Quantitative analysis

In quantitative analysis part, the independent variables and dependent variable will be identified. After illustrate the justification of each variable, the correlation relationship of each shipping cycle is shown and explained. Then, the data of each variable will be test by software – Eviews. After doing a few tests, the result will be shown and the equation of each shipping cycle will be found. In addition, the result will be compared with the correlation relationship in theory to check if the relationship is still positive or negative. Finally, the relationship between independent variables and dependent variable will be analyzed in detail.

4.2.1 Independent variables and dependent variables

The analysis from 1967 to 1985 is shown in the qualitative analysis which will not be modeled in this part. The reason will be explained in 4.2.1.1.

4.2.1.1 Dependent variable

At the beginning, BDI is chosen to be the dependent variable. But after searching the data, the Baltic Dry Index is started from 1999. By doing the research, the reason is got that the Baltic Dry Index (BDI) replaced the Baltic Freight Index(BFI) in 1999. For the BDI data is limited, BFI will replace it to be the dependent variable. However, BFI is started from 1985 which means that the shipping cycles can be only analyzed from 1985 to now.

Baltic Freight Index (BFI) is a leading indicator of spot dry bulk cargo rates. It is not a shipping index, but an indicator of the bulk cargo market. It is calculated by the Baltic Exchange, based in London, a key market for the global shipping business. BFI is a weighted average based on 11 international ship routes and three commodities - coal, iron ore and grain. It reflects on the freight and charter rates of these commodities on these routes. The index uses January 4, 1985 equals 1,000 as base. BFI earlier represented all freight rates for all the vessels. It was split in late 1996, to represent only Panamax vessels (70 per cent) and Capesize vessels (30 per cent) on a weighted average basis.

BFI is now used for bigger ships such as Panamax and Capesize vessels. A Panamax vessel is a vessel that is capable of navigating through the Panama Canal and has a 50,000-80,000 tonnage, while Capesize vessel means the vessel can navigate through the Cape of Good Hope and carries 1,00,000-1,30,000 tonnage.

4.2.1.2 Independent variables

Independent variables are analyzed from two angles which are demand and supply. In order to find the relationship between BFI and demand & supply, the modeling will be set by Eviews.

BFI index= a * Demand + b * Supply + c

- Y variable: BFI
- X variables:

X1: Total Bulk-carrier Fleet Development-Million DWT (Supply)

X2: Total World Seaborne Trade Volume (Demand)

The chart 1 is the justification of each variable:

	Justification
X1	Total Bulk-carrier Fleet Development-Million DWT means the loading tonnage of the vessel (D.W.T). It represents the capacity of bulk-carrier that can be used in operation. D.W.T can be divided into gross deadweight tons and net deadweight tons. Tonnage of ships can be used to calculate the statistics of the goods; as the basis of period charter rate; the capability of the vessel; a new computing unit cost of the ship and the old ship price. This may have some relationships to BFI, especially the bulk vessel market. Global shipping tonnage supply is not necessarily positive correlated to BFI, because nowadays supply is more than demand. After the calculating, it can be known how close the BFI and shipping tonnage supply is.
X2	As it is mentioned before, Baltic Freight Index is the bulk shipping freight index and bulk cargo shipping mainly transport steel, grain, coal, and iron ore and so on. These are all included in the seaborne trade volume. Thus, total world seaborne trade volume has close relationship to BFI. When the demand of iron ore, coal, steel and grain increases, BFI will increase too. They have positive correlation relationship.

Table 1 The justification of each variable

The chart 2 is the correlation relationship from theory analysis between dependent variables and independent variable according to each shipping cycle:

	Sign (1985-1990)	Sign (1990-1999)	Sign (2000-2007)	Sign (2007-2017)
X1 (S)	Negative	Negative	Positive	Negative
X2 (D)	Positive	Positive	Positive	Positive

Table 2 The correlation relationship according to each shipping cycle

According to the qualitative analysis results, the sign of X1 and X2 should be identified before modelling in Eviews. Then, these will be compared with the results of the modelling to find the reason why it is the same or not. BFI reflects the market situation in the spot market which means they have positive correlation. As is explained in qualitative analysis part, the shipping industry entered a very difficult period of depression in 80s. Thus, BFI was depressed as well. The basic reason was the decrease of the demand for seaborne trade and the increase of the supply of shipping capacity. That means X1 is negatively related to BFI while X2 is positively related to BFI. In 90s, the global shipping market was shocked and fluctuated. With investors entered, a large number of new shipbuilding began to delivery after 1996. The market will soon begin descending. It means that X1 and BFI have negative correlation. Demand in 90s was followed the trend of shipping market which means X2 is positively related to BFI. In 2000 to 2007, the shipping industry ushered in rare period of prosperity after undertaking the long depression. There is no doubt that demand arrives to the top level which is positively related to BFI. Moreover, 'Shipping myths' have stimulated most of the outside market investors which investing in shipbuilding. Therefore, the supply increased to show a positive correlation with BFI. From 2008 to now, the inflection point of recession seems to come to market overnight. The global shipping market fall down rapidly. The demand was down to the lower point as well which shows that X2 is positively related to the market(BFI). But shipbuilding enterprises was still running at full capacity. Thus, X1 has negative correlation with BFI.

4.2.2 Time series modeling based on Eviews

To make theory into practice and measure whether the independent variables do have influence on the dependent variables, Eviews is chosen to be the software to do the time series modeling. The detailed procedures are listed below.

4.2.2.1 Test steps

The shipping cycles will be tested from 1985 to 2017. There are three steps T-test, F-test and

breakpoint test which is necessary and suitable for the shipping cycles.

In general, in order to determine the probability of making a mistake from the statistical results of a sample to the population, statistical methods are used to developed by statisticians to perform statistical tests. By a statistical test to the values obtained with statisticians established the probability distribution of random variables were compared, it is known that how many percent of chance can get the results. If, by comparison, the probability of this result is very few, it shows that this is not a coincidence. In addition, it is statistically significant. On the contrary, it is not uncommon to find that the probability of occurrence is relatively high. The F and T values are the statistical test values, and the corresponding probability distributions are the F distribution and the t distribution. Statistical significance (SIG) is the probability of the outcome of the present sample.

Professionally, the p value is a decreasing indicator of the credibility of the results. The greater the p value, the less that the correlation of variables in the sample is a reliable index of the correlation of variables in the population. The p value is the probability that the observation is valid, such as the overall representation of the error probability. Moreover, 0.05 of the P values are generally considered acceptable error boundary levels.

Step 1: T-test

The T-test takes the t distribution as the theoretical foundation, which assumes the hypothesis test of the numerical variable data of one or two samples, and it belongs to the parameter test. When doing T-test in Eviews, the P value should be checked to be lower than 5%. For the p value is a decreasing indicator of the credibility of the results. The purpose of T-test is to test the significance of the regression parameter.

Step 2: F-test

The F-test is a test of the significance of the regression equation. The significant of a variable means the single variable follows T-distribution and how the independent variable changes will actually affect the changed of dependent variable, vice versa. Then, each variable is done the T-test again to check whether all the p-value is over 0.05. The purpose of F-test is to test

the significance of the regression equation.

Step 3: Breakpoint

In order to check the regression is holistic or segmented, the graph of CUSUM of squares test is used to search for breakpoints. After the breakpoints being found, the shipping cycles will be divided. In addition, the P values should also be checked.

4.2.2.2 Test result

After importing the data, the test should be run in Eviews.

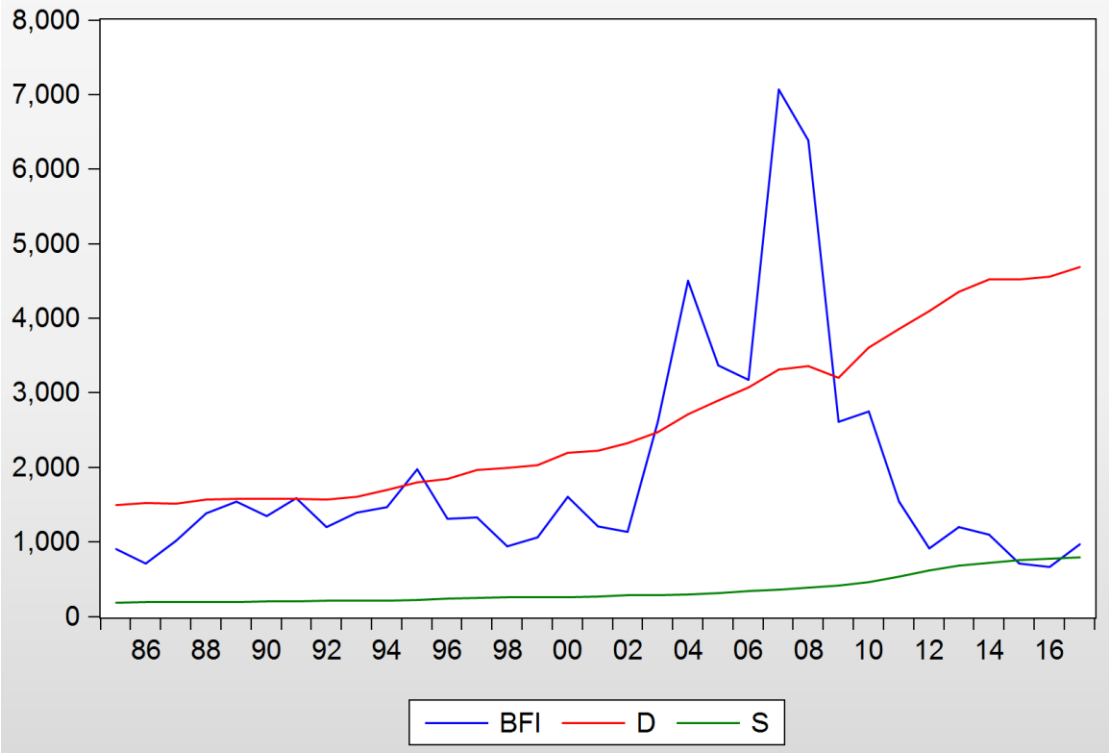

Figure 1 The trend of BFI, demand and supply

In figure 1, red line is represented to the demand trend while green is represented to the supply trend. Blue line is showing the fluctuation from 1985 to 2017.

Step 1: T-test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.554564	1.833834	-5.210157	0
LGS	-4.918035	0.494462	-9.946225	0
LGD	5.806473	0.577126	10.06102	0
R-squared	0.772049	Mean dependent var		7.349913
Adjusted R-squared	0.756852	S.D. dependent var		0.592245
S.E. of regression	0.292036	Akaike info criterion		0.46263
Sum squared resid	2.558554	Schwarz criterion		0.598676
Log likelihood	-4.633394	Hannan-Quinn criter.		0.508405
F-statistic	50.80365	Durbin-Watson stat		0.813372
Prob(F-statistic)	0			

Table 3 Result of T-test

LGS=log (supply) LGD=log (demand)

As is shown in the chart, the name of variables is changed into LGS and LGD. The reason is that it allows data to reduce volatility and reduce the error after logarithm. At the beginning, the P value of supply and demand are even bigger than 0.05 which shows a high volatility. Therefore, logarithm is a good way to solve this problem. The significant of a variable means the single variable follows T-distribution and how the independent variable changes will actually affect the changed of dependent variable, vice versa. Luckily, both LGS and LGD pass T-test.

Step 2: F-test

Test Statistic	Value	df	Probability
F-statistic	50.80365	(2, 30)	0
Chi-square	101.6073	2	0
Normalized Restriction (= 0)		Value	Std. Err.
C (2)		-4.918035	0.494462
C (3)		5.806473	0.577126

Table 4 Result of F-test

F-test should be based on the T-test and it's the analysis of variance whether the combination of variables follows F-distribution or lie in the rejection area. From the observation, it shows that the overall fitting is good. The F test is a test for the whole model, which shows that the model is overall significant If the p-value is less than 5%, then it will pass the F-test in the confident level of 95%. In this case, it can be found in blue color lump that the p-value is 0. Thus, it exactly passes the F-test.

Step 3: Breakpoint

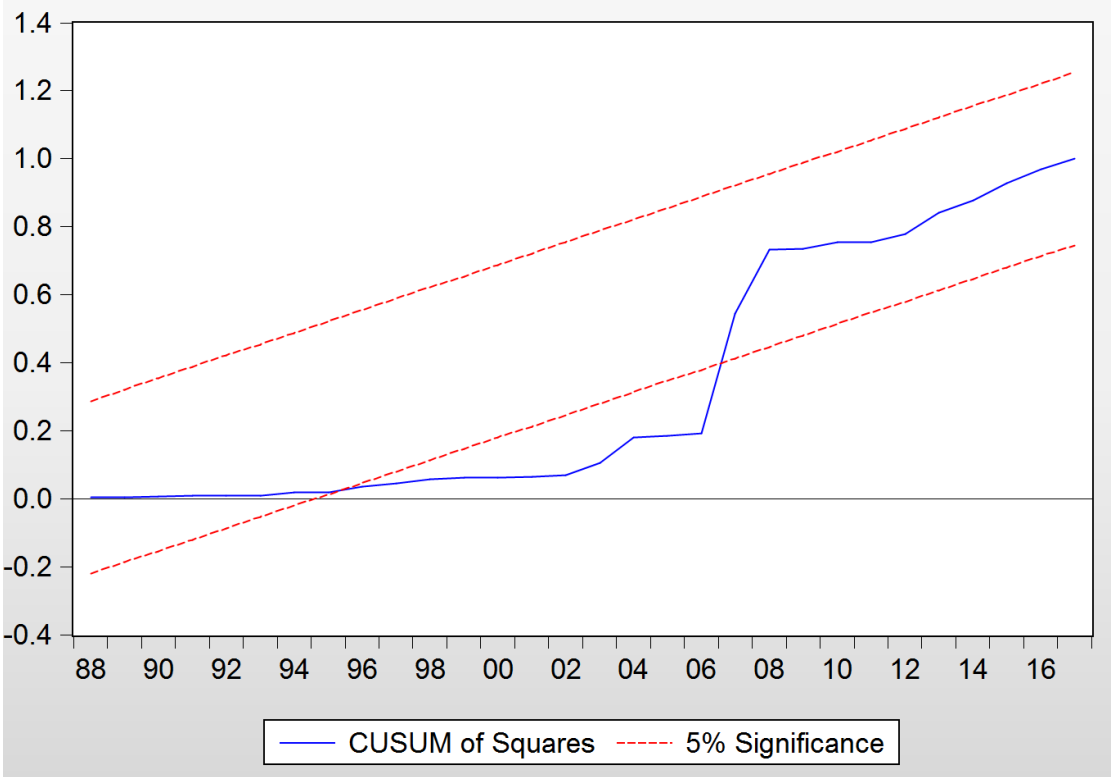

Figure 2 Breakpoint view

To find the exact month of the breakpoint, we use Chow test to find. Finally, we find the P-value for 1990, 1999, 2007 are smaller than 0.05 and these points are the breakpoint. After identifying the breakpoint, it can be split the time line into 4 parts, 1985-1990, 1990-1999, 1999-2007 and 2007-2017. Furthermore, the regression for each part should be figured out respectively.

1985-1990				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-63.69334532	0.041136	7.28218	0.2923
LGS	-5.872286993	1.971697	-8.416723	0.0138
LGD	13.85539119	1.843068	-1.416438	0.0183
R-squared	0.97293	Mean dependent var		0.080425
Adjusted R-squared	0.945861	S.D. dependent var		0.260395
S.E. of regression	0.060588	Akaike info criterion		-2.485719
Sum squared resid	0.007342	Schwarz criterion		-2.720056
Log likelihood	9.214297	Hannan-Quinn criter.		-3.114657
F-statistic	35.94174	Durbin-Watson stat		1.572386
Prob (F-statistic)	0.02707			

Table 5 Regression model in 1985-1990

LGS=log (supply) LGD=log (demand)

Equation：LGBFI = -63.6933453222 - 5.87228699268*LGS + 13.8553911853*LGD

From 1985 to 1990, three parts should be focused on which are P value of LGS, P value of LGD and value of R-squared. The p value of LGS and LGD are less than 0.05, which means the regression model is more significant. Therefore, the regression model can explain enough variability sources in this shipping cycle.

Moreover, R-squared represents the fitting degree between the model and the sample. Thus, the better the fitting degree, the more likely the model represents the trend of the sample observations. R-squared is better to be close to 1. In 1985-1990, the value of R-squared is 0.97293 which shows a great fitting degree. In conclusion, the regression model in 1985-1990 is significant.

1990-1999				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.814347	4.822621	0.998284	0.3514
LGS	-6.257838	2.311553	-2.707201	0.0303
LGD	4.875943	2.173732	2.243121	0.0598
R-squared	0.604221	Mean dependent var		7.200565
Adjusted R-squared	0.491141	S.D. dependent var		0.205888
S.E. of regression	0.146868	Akaike info criterion		-0.755233
Sum squared resid	0.150992	Schwarz criterion		-0.664458
Log likelihood	6.776167	Hannan-Quinn criter.		-0.854814
F-statistic	5.34332	Durbin-Watson stat		1.934126
Prob(F-statistic)	0.039002			

Table 6 Regression model in 1990-1999

LGS=log (supply) LGD=log (demand)

Equation: LGBFI = 4.8143472829 - 6.2578377401*LGS + 4.87594252639*LGD

From 1990 to 1999, three parts should be focused on which are P value of LGS, P value of LGD and value of R-squared. The p value of LGS is less than 0.05 while the p value of LGD is 0.0598 which is little higher than 0.05. The regression model is basically significant. Moreover, R-squared represents the fitting degree between the model and the sample. Thus, the better the fitting degree, the more likely the model represents the trend of the sample observations. R-squared is better to be close to 1. In 1990-1999, the value of R-squared is 0.604221 which shows a good fitting degree. In conclusion, the regression model in 1990-1999 is significant.

1999-2007				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.37114	4.932846	-3.724248	0.2249
LGS	-5.989615	4.42806	-1.35265	0.0098
LGD	7.687941	3.045908	2.524022	0.045
R-squared	0.871613	Mean dependent var		7.758574
Adjusted R-squared	0.828818	S.D. dependent var		0.671269
S.E. of regression	0.277732	Akaike info criterion		0.536881
Sum squared resid	0.46281	Schwarz criterion		0.602622
Log likelihood	0.584037	Hannan-Quinn criter.		0.395011
F-statistic	20.36693	Durbin-Watson stat		1.89857
Prob(F-statistic)	0.002116			

Table 7 Regression model in 1999-2007

LGS=log (supply) LGD=log (demand)

Equation: LGBFI = -18.371143158 - 5.98961497011*LGS + 7.68794055438*LGD

From 1999 to 2007, three parts should be focused on which are P value of LGS, P value of LGD and value of R-squared. The p value of LGS and LGD are less than 0.05, which means the regression model is more significant. Therefore, the regression model can explain enough variability sources in this shipping cycle.

Moreover, R-squared represents the fitting degree between the model and the sample. Thus, the better the fitting degree, the more likely the model represents the trend of the sample observations. R-squared is better to be close to 1. In 1999-2007, the value of R-squared is 0.871613 which shows a great fitting degree. In conclusion, the regression model in 1999-2007 is significant.

2007-2017				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.191916	0.179533	1.068971	0.3163
LGS	-8.862409	2.42414	-3.655899	0.0064
LGD	9.648096	2.335875	4.130399	0.0033
R-squared	0.716642	Mean dependent var		-0.107225
Adjusted R-squared	0.645803	S.D. dependent var		0.483369
S.E. of regression	0.287674	Akaike info criterion		0.573026
Sum squared resid	0.662053	Schwarz criterion		0.681543
Log likelihood	-0.151644	Hannan-Quinn criter.		0.504621
F-statistic	10.11644	Durbin-Watson stat		1.542239
Prob(F-statistic)	0.006447			

Table 8 Regression model in 2007-2017

LGS=log (supply) LGD=log (demand)

Equation: LGBFI = 0.1919160306 - 8.862409079*LGS + 9.64809600375*LGD

From 2007 to 2017, three parts should be focused on which are P value of LGS, P value of LGD and value of R-squared. The p value of LGS and LGD are less than 0.05, which means the regression model is more significant. Therefore, the regression model can explain enough variability sources in this shipping cycle.

Moreover, R-squared represents the fitting degree between the model and the sample. Thus, the better the fitting degree, the more likely the model represents the trend of the sample observations. R-squared is better to be close to 1. In 2007-2017, the value of R-squared is 0.716642 which shows a good fitting degree. In conclusion, the regression model in 2007-2017 is significant.

4.2.2.3 Conclusion

1985-1990	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 9 Comparison in first period

The sign of X1 and X2 are the same in the first period.

1990-1999	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 10 Comparison in second period

The sign of X1 and X2 are the same in the second period.

1999-2007	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Positive	Negative
X2	World seaborne trade volume	Positive	Positive

Table 11 Comparison in third period

The sign of X2 is the same in the third period while the sign of X1 are different. As is mentioned before, 'Shipping myths' have stimulated most of the outside market investors which investing in shipbuilding. But the new ships are lagging behind. The ships in the shipping market are still limited. For the supply is not enough, BFI is increasing.

From my perspective, although supply is increasing after the investors continually invested in shipbuilding during 1999 to 2007, the new ships are still being built. Thus, Total Bulk-carrier Fleet Development is negatively related to BFI in this shipping cycle.

2007-2017	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 12 Comparison in third period

The sign of X1 and X2 are the same in the fourth period.

4.2.3 Further discussions

4.2.3.1 Significant variable - Total Bulk-carrier Fleet Development (Million DWT)

Total Bulk-carrier Fleet Development (DWT) has a negative effect on BFI, which means when the global shipping tonnage supply goes up, BFI would go down. If the DWT increases, the vessels have to carry more cargo. It is a problem of oversupply while there is not enough cargo for all those vessels. What's more, this increase may lead to the increasing cost on bunker and water. Thus, the freight would go down which causes BFI goes down. For example, shipping industry bloomed in the year 2007 and 2008, investors are willing to invest in the industry which result in a large number of vessels built. However, financial crisis broke out at the end of 2008, shipping market was reversed. Although demand slightly increased, transport capacity was high beyond the demand. Taking Capesize bulk carrier as an example, Capesize bulk carrier occupies a large part of global dry bulk market. The fluctuation has impact on the state of the whole dry bulk market, especially for trend of BFI. Due to the financial crisis, the demand of transporting iron ore and coal is increasing while growth of supply has sharply slowed down, which leads to unbalance between supply and demand. What’s more, Capesize dry bulk carriers are mainly quite young. Those are older than 20 years only occupy less than one tenth of the whole amount, while news vessels that are younger than 5 years occupy nearly to 56%. It fully indicates that transportation was in high frequency, demolishing old vessels cannot control capacity scale of this type of vessel. It is a trend that Capesize dry bulk carriers are getting bigger and bigger. A mining company in

Brazil designed an extremely big carrier, which is 4 million DWT for export of iron ore. The safety was not confirmed. Many ship owners deny carrier of this size because it would be a shock on such severe market. Therefore, the conclusion is that the larger shipping tonnage supplies, the lower the BFI. Because market demand is relative low, there has no adequate cargo which can fit in carrier with large DWT. And operating cost of large DWT carrier must be very high, such as high bunker cost and operating risk would be relatively high. Large dwt would not work in the market downturn. Carrier with smaller dwt would be welcomed. Ship owners are trying to reduce costs rather than make profit. No matter for ship owner or for cargo owner, especially ship owner, it would be a very hard time to digest those newly built vessels. Combining test results from Eviews with reality, Total Bulk-carrier Fleet Development (DWT) has a negative correlation with BFI. And this variable is significant.

4.2.3.2 Significant variable - Total World Seaborne Trade

Total world seaborne trade has a positive effect on BFI, which means which means when the world seaborne trade goes up goes up, BFI would go up as well. The world seaborne trade originates from the world cargo trade, and the development of world trade is decided by the development of the world economy. Therefore, the factors that influence the development of the world economy will also affect the demand of the world shipping market. In addition to economic factors, international politics, the level of science and technology development, and the natural environment also affect the seaborne trade in the world. After that, BFI is affected by the world seaborne trade in the same reasons.

1. World economic development

The development of economy is the most important factor that influences the world seaborne trade. With the rapid growth of the world economy, international trade is showing a trend of growth correspondingly, and then there is a huge demand for dry bulk shipping. On the contrary, when the world economy turns into recession and international trade shrinks, the supply of goods is insufficient which is result to the drop of volume of dry bulk seaborne trade. At the same time, the shipping market falls into depression. Thus, world

seaborne trade has been changing with the world economy and maintaining the same trend.

2. Changes in the structure of commodity trade

In 1970s, the growth of world shipping demand has been faster than the growth of the world economy. However, from the beginning of 70s, the world's major industrial countries started to use foreign resources instead of domestic resources. This led the growth of country import to be faster than economic growth. With the demand of industrial countries, the foreign resources need to be transport. Thus, the world seaborne trade increased at that time. In addition, the needed foreign resources helped the industrial countries developed as well. In this context, the increase of the world seaborne trade led to the development of the world economy.

3. The economic impact caused by unexpected events

Unlike the cyclical economic fluctuations, economic shocks are sudden and have a more serious impact on each industry. For example, the economic crisis in 2008 led to a world recession. Accordingly, the world's dry bulk shipping demand is also seriously inadequate and a large number of ships are idle. The economic crisis has led to a fall in demand of goods. After that, a serious shortage of demand led to a depression in shipping industry. Therefore, the world seaborne trade controls the shipping economy. When the world seaborne trade decrease, the BFI will be effected to decrease.

Combining test results from Eviews with reality, total world seaborne trade has a positive correlation with BFI. And this variable is significant.

Chapter 5. New elements in dry bulk shipping industry

There are many potential factors influenced the shipping market which are result from human factors. Different from history angle in qualitative analysis and data angle in quantitative analysis, the factors such as technological innovation and capital promotion are analyzed in this part. These factors can be used as reference for the study of shipping market and shipping enterprises.

5.1 Technological innovation

The world is changing with each passing day, and advanced technology is constantly being developed. Even the technological innovation being developed, the shipping industry will be influenced in a certain extent.

5.1.1 Big Data Era

Firstly, as shippers in the shipping industry, it is often necessary to obtain the sluggish and fragmentary cargo information indirectly from the agency. Every link of the whole chain of shipping needs tardy asking and checking. This is often plagued by opaque information, cumbersome query process, low efficiency and many other problems. During the internship in the Zhonggu Shipping Logistics Company, writer has learnt and understood the importance of shipping big data. It provides tracking solution of shipping logistics visualization, which can help the enterprises to supervise the effective of shipping logistics transportation node and predict the transportation risk accurately. It can ensure the goods to reach the destination on time in accordance with the plan of transportation. In addition, it uses multidisciplinary and iterative method to be combined with the shipping schedule, real-time position, port planning, container transport plan, shipping routes, port data and multidimensional data. They have Built a stable and reliable maritime logistics solutions to help customers improve transparency in logistics information.

Secondly, big data in shipping industry can reduce the operating cost and protect the

environment. According to the study, a huge container ship can release almost the same amount of chemicals as 50 cars that cause cancer and asthma. Therefore, Shipping companies can find the way to use shipping big data and plan the port affiliation and route distribution reasonably. It can reduce unreasonable fuel consumption and emissions. For example, big data is connected with a few shipowners. The shipowners will share the remaining capacity to the public transportation system. And there are not only the different types of ships in the public transportation system, the ship also has a large amount of data to integrate the use of large data analysis, which can understand the goods and the advantages and disadvantages of the ship. So that, the cargo owners can be more convenient to find the most suitable and high-quality ship. This kind of system will greatly enhance the efficiency and quality of production logistics bidding link. At the same time, company can take in charge of the situation of ports and other lakes, and adjust the logistics plan in time through the connection port. Moreover, it can reduce transportation cost and decrease pollution emissions. (Lin, 2016)

Thirdly, big data in shipping industry is of great significance to shipping finance. There is no doubt that the shipping market is a huge database. Nearly 100 container terminals, hundreds of shipping companies, more than thirty thousand freight forwarders, and more than 100000 fleet together build a market of ten billion dollars. Refer to Zhonggu Shipping Logistics, Zhonggu Shipping always finds customer demand deeply. They select customer from collaborative platform cumulative data. In addition, they identify the drawing amount based on the receivable amount. The risk of whole platform control is based on the strict and diverse accumulated data and based on the transaction data in the collaboration platform to verify the authenticity of the transaction documents. Furthermore, Zhonggu Shipping makes two checks with data platform to verify the real occurrence of logistics business. The most important thing is they can verify the credibility level of the actual controller of small logistics enterprises from many angles and dimensions relying on the national credit information system.

In fact, the charm of shipping data is more than that. Just imagine, there are millions of liner

shipping information, the corresponding dynamic ship location information, real-time information of nearly twenty million TEU containers, international trade related customer information, goods information and cash flow information. These data are beyond imagination of the human beings. It can be said that the person can control and make good use of "big data" will lead the industry in the future.

5.2.2 Door to door service

In this shipping cycle, the important point of the shipping industry has shifted from port to port transportation services to door-to-door transportation services. Because of the high risk and low return rate of shipping, the operators are forced to rely on their advantages in shipping, port management and other links to develop modern logistics services and integrate them along the upstream and downstream of the supply chain. The goods are sent directly to the users from the manufacture, and further strengthen the logistics related business within the group. These include the establishment of freight stations, container yard, storage and truck transport services. By providing more value-added services to shippers, shipping company can increase the added value and establish a win-win relationship with the shipper. Furthermore, the shipping company can block the more business of owner as well.

5.2 Capital operation

In the past 50 years, the international shipping industry has developed rapidly. But it undergoes the ups and downs of shipping, and often face the challenges of excessive transport capacity and rising costs. The international shipping industry has shown the trend of scale, integration and globalization. The trend of the new industry determines the competition of the shipping industry which is changed from the competition of the routes, prices and services to the competition of capital. The shipping myth of 2000 is not only because of the strong supply demand, but also with the help of capital promotion.

The capital operation of shipping enterprises is mergers and acquisitions within the industry.

Through the acquisition, shipping companies can access to ultra-conventional customers, transportation resources and other competitive resources in the short term. This can solve the problem of excess capacity and rising costs better. Shipping enterprises can reduce costs by scale effect, and cost advantage will squeeze more competitors out of the market. It can be concluded that the shipping enterprises have expanded exponentially by means of capital operation. This has indirectly promoted the development of the shipping market, and the capital operation has become an important factor that cannot be ignored in the shipping cycle.

The capital market has effectively promoted the development of the industrial platform. It is the trend of the shipping industry development to provide customers with door-to-door logistics services. Enterprises began to intervene as much as possible in the terminal, logistics and other services to provide customers with simple and fast service. Like Zhonggu Shipping Logistics has their own fleet team in the service agreement which prove the time and service. Therefore, the overall logistics service driven by capital promotion is an important factor in the current shipping cycle as well, and it is also the most competitive point.

Chapter 6. Conclusion and recommendation

6.1 Conclusion

First of all, the purpose of this paper is Analyzing shipping cycles of dry bulk shipping market over the past 50 years. In this paper, the author first reviewed a large number of literature reviews to understand the subject, and summarized the problems that need to be solved. Then, according to the content of the literature review and history, the shipping cycle is divided into 5 periods: 1967-1979, 1980-1989, 1990-1999, 2000-2007 and 2008-2017.

In addition, each shipping cycle is analyzed from quantitative analysis and qualitative analysis sides. In quantitative analysis, a large number of histories are cited to analyze the rise and fall of each cycle. In qualitative analysis, because the paper studies the dry bulk market, BFI and supply demand have been chosen as the main analysis target. Total world seaborne trade is chosen to be the variable of demand while total bulk-carrier fleet development (Million DWT). After that, each variable has been elaborated and defined, and the correlation analysis has been carried out theoretically. After large amounts of data are searched, these data are used to model in EVIEWS. Because the purpose of modeling is to analyze the relation between BFI and supply demand, the operation of T-test, F-test and breakpoint is adopted only. There is no doubt that these are the steps that are done under the time series model.

The model is proved to be low volatility by T-test, and the goodness of fitting degree of the model is proved by F-test. Then, after the search for the breakpoint, the shipping cycles are divided in qualitative terms. Furthermore, the formulas for each cycle are explicitly listed. The name of Supply and demand are changed into LGS and LGD. The reason is that it allows data to reduce volatility and reduce the error after logarithm.

LGS=log (supply) LGD=log (demand)

In 1985-1990:

Equation：LGBFI = -63.6933453222 - 5.87228699268*LGS + 13.8553911853*LGD

In 1990-1999:

Equation: LGBFI = 4.8143472829 - 6.2578377401*LGS + 4.87594252639*LGD

In 1999-2007:

Equation: LGBFI = -18.371143158 - 5.98961497011*LGS + 7.68794055438*LGD

In 2007-2017:

Equation: LGBFI = 0.1919160306 - 8.862409079*LGS + 9.64809600375*LGD

In the formula, the correlation between dependent variable and independent variable is clear. After that, the correlation obtained by modeling will be compared with the theoretical correlation and analyzed in the next step.

1985-1990	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 13 Result in first period

The sign of X1 and X2 are the same in the first period.

1990-1999	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 14 Result in second period

The sign of X1 and X2 are the same in the second period.

1999-2007	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Positive	Negative
X2	World seaborne trade volume	Positive	Positive

Table 15 Result in third period

The sign of X2 is the same in the third period while the sign of X1 are different. As is mentioned before, 'Shipping myths' have stimulated most of the outside market investors which investing in shipbuilding. But the new ships are lagging behind. The ships in the shipping market are still limited. For the supply is not enough, BFI is increasing.

From my perspective, although supply is increasing after the investors continually invested in shipbuilding during 1999 to 2007, the new ships are still being built. Thus, Total Bulk-carrier Fleet Development is negatively related to BFI in this shipping cycle.

2007-2017	Justification	Sign (A priori)	Sign (A posteriorly)
X1	Total Bulk-carrier Fleet Development	Negative	Negative
X2	World seaborne trade volume	Positive	Positive

Table 16 Result in fourth period

The sign of X1 and X2 are the same in the fourth period.

Finally, the technological innovation and capital promotion reasons are illustrated. These potential factors influenced the shipping market which are result from human factors. Moreover, these factors can be used as reference for the study of shipping market and shipping enterprises. And it is totally different from history angle in qualitative analysis and data angle in quantitative analysis.

6.2 Existing problems

6.2.1 Data selection

In the paper, BFI is selected to be the dependent variable to show the trend of dry bulk market. But the data of BFI is only found from 1985 to 2017 while the title of the paper is to analyze the dry bulk market in the past 50 years. However, the data of BFI cannot be found between 1967 to 1985, for BFI is started from 1985. This is the problem for analyzing the shipping cycle from 1967 to 1985 which can be only divided in qualitative analysis.

6.2.2 Variable selection

In the paper, total world seaborne trade is chosen to be the variable of demand while total bulk-carrier fleet development (Million DWT). These two variables all pass the T-test and F-test. But there is a small problem that DWT of bulk-carrier fleet cannot show the supply of the shipping market completely. For DWT of bulk-carrier fleet cannot be fully used in the recession of some shipping cycles. Therefore, DWT of bulk-carrier fleet can represent the supply accurately in most of the shipping cycle.

6.2.3 Further research

For the DWT of bulk-carrier fleet is not the best variable being chosen, the number of bulk-carrier fleets can be used to represent the supply of dry bulk market. In addition, variables can be selected as many as possible to find the most suitable variable for modeling. For further study, technological innovation part can be well explained according to each shipping cycle. Many factors such as capital promotion can be classified in details.

Working plan

Task	Deadline	Remark
1. Research methodology workshop	2017.1.12	Finished
2. Deciding on dissertation topics, submitting the Research Topic Selection Form	2017.2.17	Finished
3. Meeting with supervisors to discuss on dissertation outline and research paper proposal	2017.3.11	Finished
4. Submission of drafts of research proposal and literature review to supervisor for approval	2017.3.20	Finished
5. Send the finalized research paper proposal and literature review in e-version	2017.3.30	Finished
6. Presentation of research proposal	2017.4.1	Finished
7. Revision of research proposal and literature review according to the comments and suggestions assessors gave during the presentation	2017.4.19	Finished
8. Submission of revised research proposal	2017.4.20	Finished
9. Interim report on the writing of integrative paper	2017.5.13	Finished
10. First draft	2017.5.26	Finished
11. Second draft	2017.6.16	Finished
12. Third Draft	2017.7.6	Finished
13. Research Paper Defense	2017.7.8	
14. Submission of final version of dissertation for assessment	2017.7.20	

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Appendix

Date	World Seaborne Iron Ore Trade	World Seaborne Coking Coal Trade	World Seaborne Steam Coal Trade	World Seaborne Bauxite / Alumina Trade	World Seaborne Phosphate Rock Trade	World Seaborne Minor Bulk Trade	Total World Seaborne Trade
	Million Tonnes	Million Tonnes	Million Tonnes	Million Tonnes	Million Tonnes	Million Tonnes	Million Tonnes
1990	359.71	158.17	172.37	55.00	37.37	798.37	1581.00
1991	365.78	162.43	188.51	52.50	31.47	783.78	1584.47
1992	344.69	158.25	198.18	47.60	29.51	796.63	1574.86
1993	361.24	160.19	197.31	50.80	26.75	811.06	1607.35
1994	386.51	161.52	208.53	49.30	29.23	869.40	1704.50
1995	407.71	164.03	236.48	51.70	30.35	911.27	1801.54
1997	429.04	173.97	273.74	55.00	31.59	1005.98	1969.31

1998	426.44	171.07	279.68	54.50	31.38	1033.58	1996.64
1999	401.58	161.22	297.82	53.50	32.78	1083.86	2030.75
2000	450.17	173.55	337.91	54.00	30.18	1150.65	2196.46
2001	452.27	171.83	377.71	51.50	30.83	1146.19	2230.33
2002	480.20	166.64	393.77	56.27	30.17	1199.19	2326.24
2003	515.71	168.37	435.51	59.73	29.19	1269.88	2478.39
2004	592.46	172.75	471.94	64.60	30.90	1389.34	2721.99
2005	661.98	180.99	494.13	70.29	30.83	1466.19	2904.42
2006	713.06	180.84	536.19	78.24	29.67	1536.23	3074.23
2007	776.96	198.30	574.97	94.22	31.31	1637.16	3312.91
2008	840.94	203.09	594.05	95.19	30.60	1602.13	3366.00
2009	898.16	190.56	617.59	74.62	19.59	1402.29	3202.83
2010	991.18	236.77	695.29	85.45	23.40	1577.94	3610.02

2011	1052.48	226.12	774.96	92.39	29.20	1682.37	3857.53
2012	1109.90	232.55	887.35	107.03	29.50	1736.20	4102.53
2013	1189.30	263.57	918.39	140.05	28.10	1823.54	4362.95
2014	1337.57	262.08	953.18	106.81	29.50	1840.86	4530.00
2015	1363.56	249.18	892.36	126.28	29.80	1861.88	4523.06
2016	1410.48	249.88	890.52	116.03	30.10	1861.58	4558.59
2017	1488.58	254.59	916.33	111.56	30.21	1893.03	4694.30

Clarkson's Shipping Intelligence Network 2017 Unit: Million tones

Date	Total Bulkcarrier Fleet Development	Total Bulkcarrier Fleet Development
	Number	Million DWT
1985	4,921	192.40
1986	4,923	197.40
1987	4,799	196.81
1988	7,717	196.11
1989	4,703	197.96
1990	4,762	203.78
1991	4,817	211.50
1992	4,846	214.89
1993	4,838	215.08
1994	4,860	219.52
1995	4,954	228.04
1996	5,175	243.71
1997	5,287	253.87
1998	5,417	264.91
1999	5,360	264.14
2000	5,337	267.15
2001	5,376	274.87
2002	5,481	286.93
2003	5,547	294.62
2004	5,600	301.85

2005	5,845	322.40
2006	6,132	345.37
2007	6,405	368.54
2008	6,728	393.11
2009	7,061	419.68
2010	7,476	462.60
2011	8,399	541.30
2012	9,215	621.89
2013	9,835	687.72
2014	10,199	726.95
2015	10,494	758.63
2016	10,716	776.56
2017	10,866	793.73

Date	Baltic Exchange Freight Index (BFI)
	Index
1985	906
1986	715
1987	1,018
1988	1,385
1989	1,543
1990	1,355
1991	1,591
1992	1,201
1993	1,400
1994	1,476
1995	1,981
1996	1,315
1997	1,336
1998	945
1999	1,063
2000	1,608
2001	1,217
2002	1,137
2003	2,617
2004	4,510

2005	3,371
2006	3,180
2007	7,071
2008	6,390
2009	2,617
2010	2,758
2011	1,549
2012	920
2013	1,206
2014	1,105
2015	718
2016	673
2017	978