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Research on investment risk and decision making in dry bulk ships: case study NIJIE Shipping World Limited

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Research on investment risk and decision-making in dry bulk ships

Case study: NIJIE Shipping World Limited

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Declaration

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

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

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Abstract

Title of Dissertation: **Research on investment risk and decision- making in dry bulk ships- Case study: NIJIE Shipping World Limited**

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In the context of economic globalization, the dry bulk shipping industry has become an important component of international trade. The dry bulk ship investment industry, due to its high investment amount, low return rate, and long fund recovery period, is prone to severe fluctuations in its ship price index when the market is impacted, bringing huge risks to dry bulk ship investors. Correctly measuring Value at risk, choosing the most appropriate time to enter the market, and avoiding investment risks have become the difficulties faced by investors in entering the dry bulk market.

The purpose of this research is to help NIJIE Shipping World Limited (NJS) to evaluate the Value at risk of dry bulk cargo ship investment and make scientific investment decisions. This research first discusses the five main factors that affect the investment risk of dry bulk vessels, and based on these five influencing factors, qualitative analysis is conducted on the internal and external environment of NJS's dry bulk vessel investment. Based on investment environment analysis, identify the investment risks of NJS, and divide the main risks faced by the company into investor risks, shipping market risks, financial market risks, policy risks, and ship technology risks. Then, it makes a quantitative analysis of the ship price in the shipping market risk and uses VaR model and GARCH model to evaluate the investment Value at risk. Finally, a combination of qualitative and quantitative analysis is used to provide the most suitable ship type decision for NJS's investment, and to provide risk control measures for dry bulk ship investment. On the one hand, it reduces NJS's investment risk, and on the other hand, it provides some suggestions and inspiration for other similar shipping companies.

KEYWORDS: dry bulk carrier, ship investment, risk management, Value at Risk, GARCH-GED model

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List of Abbreviations

ARCH	- Autoregressive Conditional Heteroscedasticity
BDI	-Baltic Dry Index
BSE	-Baltic Shipping Exchange
CNKI	-Chinese National Knowledge Infrastructure
COA	-Contract of Affreightment
DWT	-Deadweight tonnage
FFA	-Forward Freight Agreements
GARCH	-Generalized Autoregressive Conditional Heteroskedasticity
GDP	-Gross Domestic Product
GED	-Generalized Error Distribution
IMI	-International Maritime Information Network
ISM	-Integrated Service Management
LNG	-Liquefied Natural Gas
NJS	-NIJIE Shipping World Limited
ROI	-Return on Investment
SISI	-Shanghai International Shipping Institution
TMI	-Taylor Maritime Investments Limited
VaR	-Value at Risk
VLCC	-Very Large Crude Carrier

Chapter 1 introduction

1.1 Background and problem statement

The proportion of the shipping industry in the global economy is constantly increasing. The shipping industry accounts for over 80% of global trade. In China, the shipping industry is also one of the important economic pillars, accounting for over 7% of GDP (State Statistical Bureau, 2023). The future prospects of the shipping industry are very broad. With the continuous development of the global economy, trade volume and globalization trends will drive the further development of the shipping industry.

From the perspective of trade volume structure of dry bulk goods, the global dry bulk goods trade is mainly composed of small bulk dry bulk goods, iron ore, and coal, with trade volume accounting for 39.03%, 28.28%, and 22.95% in 2021, respectively (Ministry of Transport, 2022). While oil market, the second one, only takes 17% (Xia & Chen, 2022). As a major component of the international shipping industry, dry bulk shipping undertakes the task of transporting most of the raw materials internationally, becoming increasingly important in the world maritime trade market and becoming a pivotal transportation force in international shipping.

However, with the continuous expansion of China's shipping scale and the continuous development of world shipping, the international shipping competition has become increasingly fierce. The global economic downturn in recent years has also exerted great pressure on each shipping company in China. Greek dry bulk shipowners SEANERGY, Jinhui Shipping, and Taylor Maritime Investments Limited (TMI) have recently released performance or operational announcements for the first quarter of 2023 (IMI, 2023). As for the market outlook, the three companies

all said that the global economy is facing major uncertainties despite the impact of multiple factors such as geopolitical conflicts, repeated COVID-19 epidemic, inflation and interest rates. At the same time, the economic crisis has led to the Baltic index has been located at the bottom, and the profits of dry bulk shipping industry are meager, many large dry bulk shipping enterprises have sealed many ships, new ship orders have been reduced, and the investment risk of dry bulk ships has been increasing.

Shanghai International Shipping Research Center released the "2022 International Dry Bulk Market Annual Report", pointing out that after China's economy entered the new normal, the strength and duration of the rebound of the international dry bulk transport market were inhibited. The production side continued to be weak under the overall economic growth stabilization policy, with the year-on-year decline in power generation expanding and the capacity utilization rate continuing its downward trend, and the easing policy failed to effectively promote the improvement of the production side. Although the real estate sales area improved significantly, but the role of conduction to investment is not obvious, the growth rate of fixed asset investment remains weak, the economic downward pressure continues. Even if the infrastructure investment is obviously back on, the pulling effect on the downstream is affected by overcapacity, the support role of shipping is limited (SISI, 2023).

In the new situation of the international shipping market, the role of ship investment in shipping operations is more prominent. Ship investment is the foundation for forming the production and operation capabilities of shipping enterprises, determining their profitability and competitiveness, and is the key to their survival and development. Therefore, it is crucial to choose an optimization method that helps shipping companies make satisfactory and appropriate ship investment decisions. Ship investment decision-makers should look at the global economy, understand

market trends, master shipping dynamics, use scientific investment methods, grasp investment opportunities, predict and control investment risks, and maximize the scientific nature of decision-making. Whether investment decisions are correct or not is directly related to the development, profitability, and even survival of shipping companies. For this reason, shipping companies have always attached importance to the appropriateness of the method used in ship investment decision-making.

This article analyzes the investment problems of NIJIE Shipping World Limited (NJS) and summarizes the relevant issues faced by the shipping company's investment. Utilize quantitative models to formulate flexible investment strategies for different environments, providing reference and inspiration for investment strategies of other shipping companies.

1.2 Aim and Objective

The research aims to explain the way of dry bulk shipping companies in China avoid investment risks and make reasonable investment decisions. As for the objectives are proposed as follows:

1. To determine the current dry bulk ship investment environment accurately.
2. To analyze the risks of dry bulk ship investment Carefully.
3. To calculate Value at Risk of dry bulk ship investment.
4. To choose a dry bulk ship investment decision plan for NJS.
5. To developing dry bulk ship investment risk control measures for NJS reasonably.

1.3 Scope and limitation of the research

The scope of this research only to the investment risk and decision-making of dry bulk cargo ships in NJS and not include other types of ships, such as container ships, VLCC and LNG ships, etc. In the analysis of the investment environment, this research only includes the analysis of the internal and external investment environment of Chinese companies and does not include foreign shipping companies.

This research also has limitations. When evaluating the value at risk, it does not consider the price indexes of other ship types in the dry bulk market, and only studies four dry bulk ship types. When studying investment risk, only five aspects are studied: investor risk, shipping market risk, financial market risk, policy risk, and ship technology risk.

The risk investment value aspects considered only related to the impacts that occur due to the fluctuations in ship prices.

1.4 Structure of the research

This research consists of literature review, data and methodology, analysis and discussion, and is followed by a conclusion and recommendation. Chapter Two mainly analyzes the relevant theories of risk management, risk value, and risk assessment, as well as the overview of ship investment and dry bulk ship investment. Chapter Three discusses the research methodology used in Chapter Four and Chapter Five. Chapter Four mainly analyzes the investment environment and risk identification in dry bulk vessels of NJS. Chapter Five is the investment decision choice and risk management of NJS. Chapter Six is the conclusion and recommendations for relevant shipping companies regarding the dry bulk vessel investment.

Chapter 2 Literature Review

This literature review is conducted to review and understand concept of risk management, value at risk and characteristics of dry bulk vessel investment decision. The literature review focuses on the concept of risk management, value at risk and ship investment, main features of dry bulk vessel investment and the main factors affecting investment in dry bulk vessels.

2.1 Risk management theory

As early as 1921, the famous scholar Marshall elaborated on the handling methods of risk transfer and elimination in his book "Enterprise Management" and proposed the viewpoint of risk burden management (Stoneburner et al., 2002). In 1998, Professor M. Elisabeth, Pate Cornell, and Peter J. Regan of Stanford University established a set of methods for artificial intelligence and decision analysis through their research on dynamic risk management of rapidly time-varying systems, providing theoretical basis for decision modeling and risk prediction modeling (Power, 2004). In 2000, Zdogarmeal established a decision-making and planning process, and divided project risks into project risks, government risks, and national risks, basically improving project risk management theory (Zheng, 2022).

2.2 Value at risk theory

With the development of the world economy, behavioral finance theory is gradually emerging. According to this theory, the variance and standard deviation in traditional analytical methods cannot accurately measure investors' risk. Investors do not consider the investment results with net returns as risks, but only the results with losses as real risks. Therefore, investors often give greater weight to the negative utility caused by losses and less weight to the positive utility caused by returns in

their utility functions. If using variance to measure risk requires giving the same weight to the investment results of gains and losses, it is inconsistent with the fact. Therefore, the theory adopts Prob{x ≤ E(x)} (Arfaoui & Yousaf, 2022).

Value at Risk Model (VaR) is a quantitative model used to measure and control risk based on behavioral finance theory, which can describe the volatility of investment risk over time series as accurately as possible. It is a new tool for market risk measurement and management.

2.3 Concept of ship investment

Ship investment refers to the process of using certain valuable assets, such as capital, manpower and property rights, to invest in the shipping industry to obtain economic returns, which is one of the most basic links and most important elements of the economic activities of shipping enterprises. (Shao, 2003) Shipping enterprise gets the ownership and use right of ships through ship investment and thus becomes a participant of shipping market. Ship investment belongs to the fixed asset investment of shipping enterprise, is the basic investment that forms the production and transportation operation capacity of shipping enterprise, is the investment that directly decides the production and operation layout, operation direction and operation warfare of shipping enterprise, and is also the investment that has direct influence on the operation efficiency of shipping enterprise. Therefore, ship investment is the starting point of economic activities of shipping enterprises.

2.4 Main features of dry bulk vessel investment

Investment in dry bulk ships has the following main characteristics.

1. Taking shipping market and financial market as background

Shipping enterprises are the main body of the shipping market, and all investment decisions are decided by the shipping market, especially the decisions involving ships such as ship acquisition, elimination, fleet structure optimization, etc., are based on the supply and demand quotations of the shipping market. (Wang, 2022).

Meanwhile, as ship investment involves large amount of capital and long return cycle, shipping enterprises can hardly bear it by themselves and need to go to the financial market for financing, and the financial market has great influence on the shipping market, and a series of indicators such as ship price, freight rate and freight rate will fluctuate with the fluctuation of the financial market. Therefore, the changes of financial market also have profound influence on ship investment.

2. Large investment and long payback period

The order and purchase of a ship requires a few million dollars, or tens of millions of dollars, or even hundreds of millions of dollars. As the trend of ship enlargement intensifies, the amount of initial capital required for ship investment becomes larger and larger. With the huge amount of investment, the payback period is generally long. Operating a ship often takes several years or even a dozen years to recover its investment funds. At present, the shipping industry is in the trough, the freight rate is low, and the profit is at a lower level compared with other industries, so the payback period is longer. (Mittal, 2022).

3. Diversity of investment subjects

Due to the huge investment amount required for dry bulk cargo ships and the long investment payback period, the main body of ship investment is not only the shareholders of the company, but also two cargo owners and a trading company. The investment body is composed of several economic entities (Hao, 2005). Meanwhile,

with the development of international trade, the company also tries to cooperate with banks and financial entities to become the main body of ship investment together.

As for the investment subjects, new ships, chartered ships and second-hand ships are the objects of the company's investment. Used ships have been used for a period, with stable performance, and can be put into use immediately; new ships can be used for a longer period, and are technologically more advanced, with low maintenance cost; chartered ships have smaller initial investment, are easy to use, and are chartered in various ways. Each of the three investment objects has advantages and disadvantages, and companies can choose according to their needs.

4. Risky

Ship investment is usually accompanied by greater riskiness, and this greater riskiness is mainly caused by three reasons: one is because the international shipping market changes with the financial market and is cyclical. When the shipping market is in the trough, it will bring greater risk to investors; the second is caused by the long payback period of ship investment itself. (Pan, 2009). Due to its long payback period, it cannot guarantee the stability of investment return, and often due to some unexpected events, such as changes in international trade, various political, military, economic or other changes in countries or regions, and all these changes will bring various risks to the investment at any time; its third is the risk caused by changes in foreign exchange rates, because the amount of funds involved in ship investment is large, it will The foreign exchange risk may occur during the ship construction period and ship operation period.

2.5 Main factors affecting investment in dry bulk vessels

There are many factors affecting the risk of ship investment, which are not only

related to the investor's own ability, but also related to the financial market, shipping market, world politics and economy and shipbuilding technology. Moreover, each factor influences and interacts with each other, forming a comprehensive contradictory factor with complex structure level. (Banerjee, 2022; Bendell, 2022). According to the different influencing factors, the reference factors can be divided into five categories, namely, investor factors, shipping market factors, financial market factors, policy factors and shipbuilding technology factors.

2.5.1 Investor Factors

The influence of investors on investment risks is mainly manifested in two aspects: the speed of understanding and updating information and the degree of grasping the investment environment as well as environmental changes (Liao et al., 2014).

In terms of grasp of information, investors' ability to quickly understand and update information helps investors to make scientific predictions and judgments on the thousand-bulk ship investment market, thus reducing investment risks. The lag of information is one of the main factors that aggravate the risk. As for the degree of grasp of investment environment, the overall environment of dry bulk ship investment is complex, including domestic and international shipping market environment, financial market environment, national policies, etc. As far as possible, a comprehensive understanding of the overall environment of investment is beneficial for investors to make scientific investment decisions. Ignorance of any element of the environment may aggravate the investment risk. In addition, the changing investment environment requires investment decision makers to make scientific adjustments to the investment decision to adapt to the needs of the changing environment, otherwise the investment decision is not appropriate, which will certainly greatly increase the investment risk.

2.5.2 Shipping market factors

Shipping market is the main body of ship operation, which is the direct factor affecting the risk of ship investment. The supply of transportation in shipping market is the main basis of ship investment know-how, and the relationship between supply and demand is expressed through freight rates, which become the most important index for shipping enterprises' investment decision. When the shipping market is prosperous, the transport demand is larger than the supply, the freight price rises, the ship investment activity increases, the shipping enterprises have spent money to order new ships or buy second-hand ships, the competition between shipping enterprises intensifies, the risk rises. (Rokhayati, 2022).

When shipping market is in the trough, the supply is larger than the demand, the freight price falls, the investment risk increases greatly, so shipping enterprises have chosen to dismantle, seal the ship, the ship investment activity decreases. Therefore, shipping market factors have great influence on ship investment risk.

2.5.3 Financial market factors

Ship investment has the characteristics of large investment amount and long payback period, so that most shipping enterprises choose financing when making investment, financing, loans and other financial behaviors are quite common in the process of ship investment. And the shipping market is influenced by the financial market, and the changes in the financial market in terms of capital supply, interest rate and exchange rate will directly increase the investment risk and influence the investors' decision through the fluctuation of shipping price (Li & Shen, 2019)

For shipping enterprises, due to the huge investment amount, the small change of interest rate will lead to the huge difference of capital cost, and because of the

frequent change of interest rate, it is difficult for shipping companies to make accurate prediction of financing cost during project evaluation, which brings investment risk. The bank provides the shipping company with the payment, basically adopts the floating interest rate, which causes the investor to be very sensitive to the interest rate. It is easy to influence the decision because of the risk brought by the frequent changes of interest rate, which directly affects the ship investment.

International shipping investment involves multiple countries and multiple currencies, therefore, when the exchange rate between different currencies changes, it may affect the actual payment of ship investors and increase the investment risk. Especially after the financial crisis, the foreign exchange rate fluctuation is more obvious and the investment risk is increased. If the exchange rate of foreign currency used for denomination on the investment settlement date rises against the national currency than the contract date, the actual payment of the shipping enterprise in the national currency will be more than the contract date, which will cause huge loss due to the huge amount of funds.

2.5.4 Policy Factor

Investment in any field cannot be made without the support of government policies, and changes in policies can affect investment risks, especially when there is a shift from supportive to unsupported policies, which can be significant. Dry bulk shipping market is subject to the influence and restraint of the country's politics and laws. When dry bulk ships shipping is valued by the country, the progress is smoother: on the contrary, it will be subject to various restrictions. (Mollaoglu, 2022). For example, the cancellation of some preferential policies for ship investment and the reduction of the degree of preferences, unfavorable tax policies, etc. will increase the investment

risk of dry bulk shipping.

2.5.5 Ship technology factor

The development of ship technology can promote the development of shipping industry and guide the direction of ship investment. With the maturity of ship manufacturing technology, the reduction of ship maintenance cost and the intensification of the trend of ship massification, many shipping companies have chosen to invest in building large ships. Therefore, when making investment decisions in ships, a series of technical net elements such as mainstream market ship type, changes in ship structure, ship development trend, ship reliability and ship capacity need to be considered.

2.6 conclusion

Based on the previous research, the investment decision of dry bulk cargo ships affects the entire process of enterprise management and is directly linked to operational efficiency. It is a major issue affecting the rise and fall of shipping enterprises and has great significance.

The scientific decision-making of investment in dry bulk ships is conducive to promoting the healthy and orderly development of international trade. In the context of economic globalization, the dry bulk shipping industry has become an important component of international trade, and the prosperity and development of dry bulk shipping strongly promote the prosperity of international trade.

Scientific investment decision-making for dry bulk ships is a prerequisite for international shipping companies to expand their reproduction. Ships are the cornerstone of the survival and development of international shipping enterprises.

Under market economy conditions, the expanded reproduction of shipping enterprises is achieved through investment in the construction, purchase, and technological transformation of ships. This requires investors to apply scientific methods to choose the best investment portfolio when making investment decisions.

The scientific decision-making of investment in dry bulk ships is conducive to promoting the rationalization of the enterprise fleet structure. When making new investment decisions, ship investors, based on the current situation of the original fleet structure, purposefully increase or reduce certain specific types of ships, forming a more reasonable fleet structure, improving the enterprise's risk resistance ability, and thereby improving the economic benefits of the enterprise.

The prerequisite for managing dry bulk ships during investment decision-making determines the goals and directions of future investment behavior of dry bulk shipping companies and has guiding significance for their development.

Based on the above literature, a research gap has been identified, which helps to focus the research goals and objectives on specific research areas. Research issues need to be used as a guiding framework for addressing this gap. The research questions are as follows.

1. What is the current investment environment for dry bulk ships?
2. What are the risks of investing in dry bulk cargo ships of NJS?
3. What is the risk value of each ship type?
4. How to make reasonable investment decisions for NJS on dry bulk ships?
5. How to reasonably avoid investment risks for NJS?

Chapter 3 Research Method

3.1 Research design

This research focuses on the dry bulk vessel investment decision, which its literature review is already described in the previous chapter. Knowing that the overall methodology of this study is a mixed method of qualitative and quantitative approaches, a case study approach is used to achieve the research objectives.

Qualitative analysis is first used to understand the main determinants of investment decisions in dry bulk vessels. Based on the literature review, qualitative analysis is used to determine the appropriate decision options for dry bulk investments.

To manage the rational aspects in decision-making, the results are quantified to determine the most important factors and decision options for dry bulk investments.

Through the analysis of the characteristics of dry bulk ship investments, we recognize that not only qualitative but also quantitative analysis is required in the process of investing in dry bulk ships.

This research studies the investment risks of dry bulk ships. Firstly, it uses basic methods such as literature collection, data statistical analysis, and survey analysis to understand and analyze the current situation of the dry bulk shipping market and the overview of ship development. Secondly, combining risk management theory, VaR theory, and risk assessment model, determine the VaR model for studying the dry bulk vessel trading market index, calculate the value at risk of each price index, and use EViews to verify the reliability and consistency of the data results, providing a theoretical basis for NJS investment in dry bulk vessels.

Apply relevant online literature databases such as Clarkson, CNKI, and Google Academic, school library literature databases, and related books to collect theoretical and practical data on risk management, risk value, risk assessment, investment decision-making, and other relevant theories. After sorting, classifying, and analyzing, extract available relevant theories, thereby laying a theoretical foundation for this article's writing.

Using EViews, classify and quantify a large amount of collected relevant data, and then systematically analyze this effective data to determine the current social, economic, and cultural background environment in the development process of dry bulk shipping enterprises. These objective data and practical experience can provide objective, accurate, and effective data support for the analysis and research of investment strategies of NJS.

Using the VaR model and GARCH-GED model of financial index series. Select the new ship price and second-hand ship price indexes of two main dry bulk cargo ship types as research samples, calculate the risk value of the four indexes, and conduct statistical description and analysis of the risk value to draw conclusions on the risk value of the four price indexes, providing conclusion support for the company's final investment strategy.

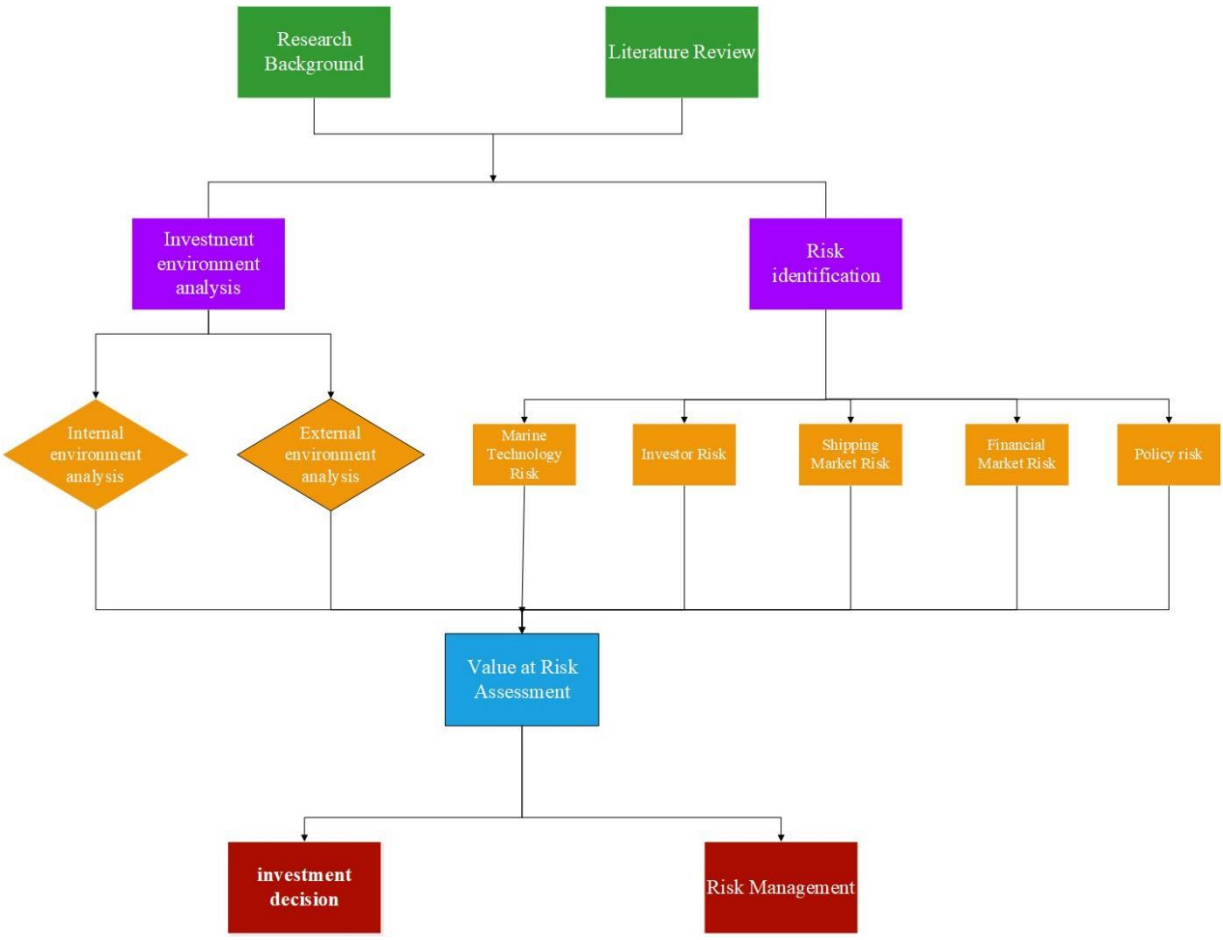


Figure 1 *Research flow chart*

3.2 Methodology

The observation is conducted by dividing it into two parts. The first part focus on examining the Internal and External Environment of Investment in Dry Bulk Ships and identification of investment risks. The second part analyzes the price of selected dry bulk ships using the VaR model and GARCH-GED model, and obtains the value at risk of each ship type.

3.2.1 VaR model

VaR model refers to the maximum loss that the value of a certain investment portfolio may suffer in the future for a period of time under a certain probability level (confidence level), expressed by the formula: (Juselius, 2006).

$$P_r(\Delta P > V_{aR}) = 1 - \alpha$$

Where:

P_r: The probability that the loss of investment value is greater than the maximum potential loss

ΔP: The amount of value loss of an investment within a certain period of time

V_{aR}: Value at risk at confidence level α (upper limit of potential losses that may occur)

α: Given confidence level

V_{aR} is essentially a statistical estimate of losses, which is determined by the selected portfolio data and its statistical methods. Therefore, it can be calculated using different statistical methods under different statistical assumptions (Lenza & Primiceri, 2020).

$$V_{aR} = E(\omega_0(1 + R)) - \omega_0(1 + R*) = \omega_0(R - R*)$$

Where:

ω_0: Initial Portfolio Value

$R*$: Minimum return rate of investment portfolio under confidence level α

R: Expected return on investment portfolio

If R follows a normal distribution with a mean and a variance of $R\Delta t$ and $\delta^2\Delta t$, respectively, and the yield is independent within a continuous time interval, the calculation formula for V_{aR} can also be:

$$V_{aR} = \omega_0 Z_\alpha \delta\sqrt{\Delta t}$$

Where:

Z_α: The upper number of the standard normal distribution at the confidence level

δ: Standard deviation of portfolio yield R

Δt: Duration of investment

This method can be extended from normal distribution to other cumulative probability distribution functions. For two numbers of probability distribution, all uncertainties are reflected in δ. The value of Z_α is determined by the distribution of the return on investment and the confidence level α.

Step 1: Calculate the rate of change in ship prices

The rate of change in the prices is the fluctuation degree of the price of financial assets. It is a measure of the uncertainty of return on assets and is used to reflect the risk level of financial assets. The higher the rate of change in the prices, the greater the volatility of financial asset prices, and the greater the uncertainty of return on assets; The lower the rate of change in the prices, the smoother the price fluctuation

of financial assets, and the stronger the certainty of return on assets. To calculate the rate of change in the prices of each ship type, the logarithmic rate of return of the ship's price is taken. Then calculate the quantile of the price change rate of each ship type.

Step 2: Calculate the Value at risk of the price change rate of each week

According to the formula VaR, take the confidence degree $1-\alpha=0.99$ as an example to calculate and analyze, and calculate the Value at risk of the price volatility of each week according to the following formula:

$$V_{aR}(P_t) = P_{t-1} \times r_\alpha$$

Where:

$V_{aR}(P_t)$: Value at risk of price volatility in week t

P_{t-1}: Price index for week t-1

r_α: The Value at risk of the price change rate of each week

Step 3: Accuracy testing

Due to the impact of estimation bias on the accuracy of the VaR model. To ensure the correctness of the VaR model, an accuracy test is conducted. Given the confidence level $\alpha = 0.01$, calculate the predicted upper limit of exponential change in sample size $\hat{P}_t = P_{t-1} + V_{aR}(P_t)$, and compare the predicted value of the upper limit with the actual price index.

Step 4: Determine VaR

After accuracy testing, the VaR value was determined. Analyze the maximum value, minimum value, mean value, variance, standard deviation of VaR and its proportion to the actual value, to obtain the Value at risk of various types of dry bulk cargo ships.

3.2.2 GARCH-GED Volatility Model

Empirical evidence shows that some types of time series fluctuations vary over time, with bands with larger fluctuations relatively concentrated in certain periods, while bands with smaller fluctuations concentrated in other periods. This phenomenon of volatility clustering is closely related to the phenomenon of thick tails, which often exhibits the characteristics of peaks and thick tails in the distribution of investment returns. For the dry bulk shipping market, this characteristic exists in the time series of many parameters, such as the dry bulk freight index, the new ship cost index, and the second-hand ship price index. The parameter error term has a conditional heteroscedasticity problem and Generalized Autoregressive Conditional Heteroscedasticity model (GARCH) well describes this time series with peak and thick tail characteristics (Bauwens & Rombouts, 2006). The mathematical description of GARCH (p, q) is:

$$y_t = \beta x_t + \varepsilon_t$$

$$\varepsilon_t | \Psi_{t-1} \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2$$

$$\mathrm{p} \geq 0, \mathrm{q} \geq 0; \alpha_0 > 0, \alpha_i \geq 0, \mathrm{i} = 1, 2, \ldots, \mathrm{p};\ \beta_j \geq 0, \mathrm{j} = 1,2, \ldots \mathrm{q};$$

$$0 \leq \sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j \leq 1$$

Where:

α: Return on Investment (ROI)

β: Hysteresis coefficient

p: Maximum Lag Order in the ARCH (Autoregressive Conditional Heteroscedasticity) Term

q: Maximum Lag Order of GARCH Term

The conditional variance of the GARCH model is not only a linear function of the square of the lag residual, but also a linear function of the lag conditional variance. When the initial data size is not very large, the GARCH process can conveniently describe the regression conditional heteroscedasticity, that is, the peak thick tail process, which is more applicable than the ARCH model. However, the GARCH model also has some shortcomings, such as it is difficult to explain the negative correlation between returns and earnings volatility. It is difficult to determine the persistent factors that cause the source of σ_t^2 fluctuations, etc (Bauwens & Rombouts, 2006).

In order to better grasp the peak and thick tail characteristics of investment time series, Generalized Error Distribution (GED) model is introduced. The most important feature of GED is that it can describe the distribution parameter d at the tail of the series, that is, the degree of freedom of GED (Vee & Sookia, 2011). By adjusting and changing the degree of freedom parameter d, it is possible to fit

sequential graphs of different probability distributions and handle different degrees of peak and thick tail phenomena. The thick tail characteristic of the investment return series described in GED is introduced, and its density function is:

$$f(\varepsilon_t) = \frac{d \exp(-\frac{1}{2}\left|\frac{\varepsilon_t h_t}{\lambda}\right|^d)}{\lambda 2^{\frac{d+1}{d}}\Gamma(\frac{1}{d})}$$

$$\lambda = (\frac{2^{-\frac{1}{d}}\Gamma(\frac{1}{d})}{\Gamma(\frac{3}{d})})$$

Where:

λ: tail-thickness parameter

When d<2, the GED is a thick tailed distribution, and the probability density has a thicker tail and finer peak than the normal distribution; When d=2, GED is a standard normal distribution; When d>2, the GED is a thin tailed distribution with a thinner tail than the normal distribution (Huang et al., 2021).

Step 1: Calculate the results of GARCH-GED model and various statistics

If the time series satisfies $y_t = y_{t-1} + \varepsilon_t$(y is the value of the sequence at time t), perform a residual ARCH test and model correction on the simulation results, and finally use the GARCH model to transform it. Create GARCH-GED model statistics table.

Step 2: Calculate the Value at risk of the price change rate of each week

Analyze the statistical data of GARCH-GED model of each ship type to verify

whether ARCH effect exists in GARCH-GED model. If the GARCH-GED model does not have ARCH effect, the GARCH-GED model can be described as:

$$y_t = y_{t-1} + \varepsilon_t$$

$$\varepsilon_t = \sqrt{h_t v_t}$$

According to the VaR calculation formula in GARCH-GED model, the VaR calculation formula for a single week can be changed to:

$$V_{aR} = \omega_0 Z_\alpha \delta \sqrt{\Delta t} = P_t \varphi_\alpha h_t \sqrt{\Delta t}$$

Where:

P_t: Ship price in week t

φ_α: Upper quantile of GED under degree of freedom v, confidence level α

h_t: The t week conditional standard deviation of sequence ln C

Get the trend chart of Value at risk of each ship type.

Step 3: Accuracy testing

The Value at risk represents the maximum possible decline in the next time period. To ensure the accuracy of the model, an accuracy test is now conducted on its results. Given the confidence level $\alpha = 0.01$, calculate the predicted upper limit of exponential change in sample size: $\hat{P}_t = P_{t-1} + V_{aR}(P_t)$. Then draw a comparison chart between the predicted upper limit value and the actual situation.

Step 4: Determine VaR

After accuracy test, the VaR was determined. Analyze the maximum value, minimum value, mean value, variance, standard deviation of VaR and its proportion to the actual value, to obtain the VaR of various types of dry bulk cargo ships.

Chapter 4 Investment environment analysis and risk identification

4.1 Analysis of external investment environment

This research will analyze the external environment of investment in dry bulk vessels from the following aspects: market environment, finance market environment, policy environment and technical environment.

4.1.1 Analysis of Dry Bulk Shipping Market Environment

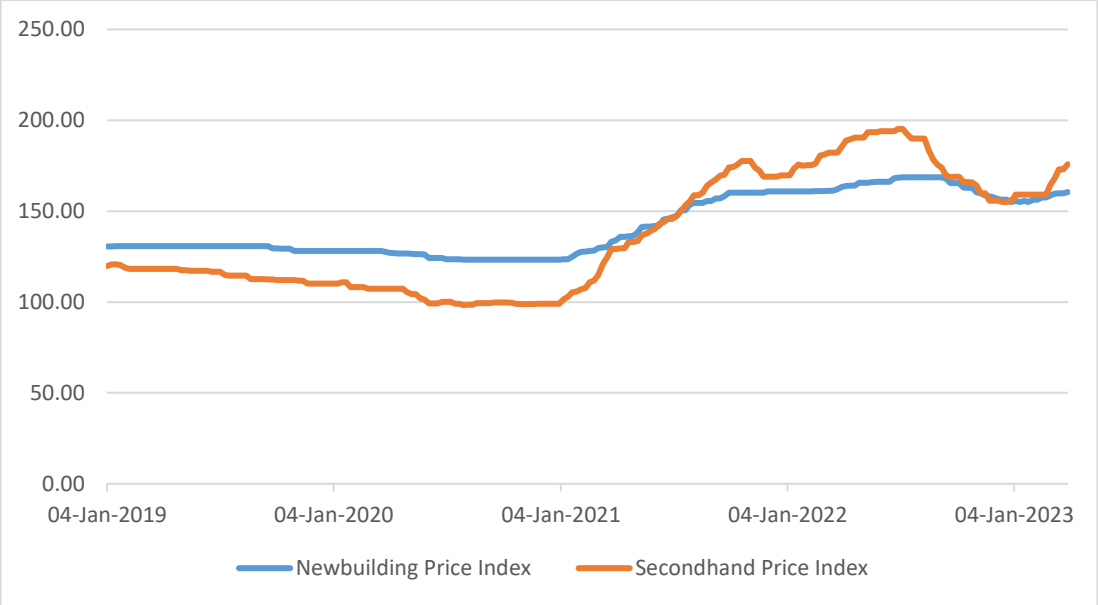
4.1.1.1Analysis of Dry Bulk Ship Price

The price of dry bulk ships is the most important factor affecting ship transactions, and it is also the most easily quantifiable factor among many factors. Through quantitative analysis of existing ship prices, establishment of decision-making models, risk value assessment, prediction of future ship price trends, and assistance to shipping companies in making scientific decisions, it is helpful to improve the reliability of business decisions and avoid market risks of ship trading in uncertain environments.

Therefore, through the analysis of new ship price indicators and second-hand ship price indicators, it is concluded that the price fluctuation of second-hand ships is relatively large, while the fluctuation of new ship prices is relatively stable.

In summary, the prices of various ship types in the international second-hand bulk carrier market are still in a downturn, but the decline rate has obviously improved. The second-hand ship trading market for dry bulk cargo is the most direct manifestation of the international market for dry bulk cargo. For investors, second-hand ship trading can directly enter the shipping market and participate in business

operations. It is an investment object that can generate benefits in a short time. Currently, the prices of used dry bulk ships continue to decline, which is conducive to investment in the second-hand ship market.



(Data sources: Clarkson SIN)

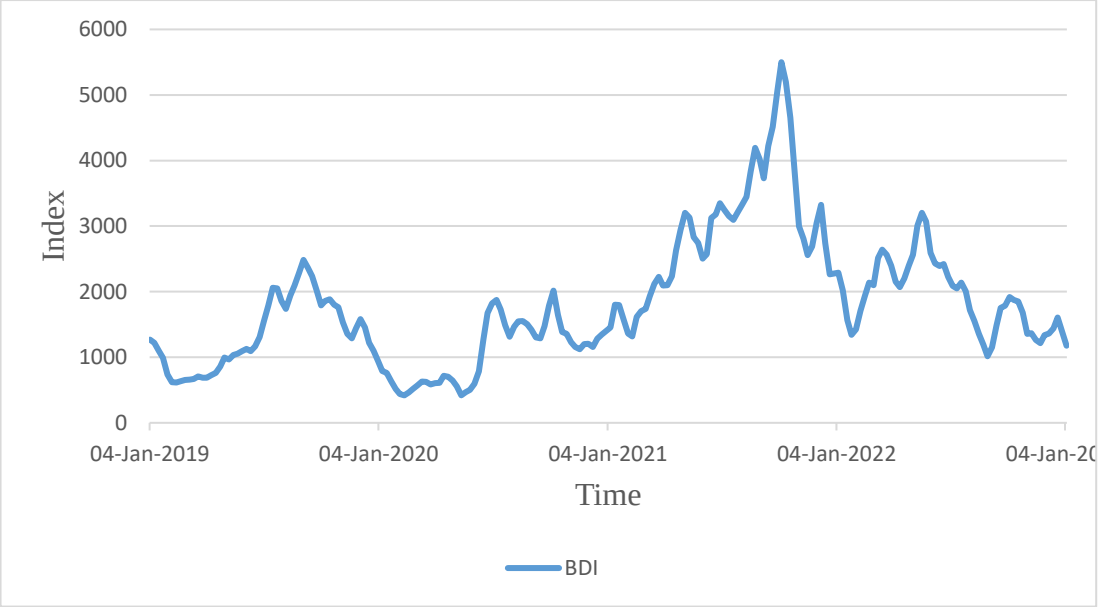
Figure 2 *New-building and secondhand price index of dry bulk ship*

4.1.1.2 Analysis of dry bulk freight rates

In international dry bulk shipping, the most authoritative dry bulk freight index is the Baltic Dry Index (BDI) published by the Baltic Shipping Exchange (BSE) in the UK. In 1999, the BFI was replaced by the Baltic Dry Index (BDI) as a barometer of the international dry bulk shipping market.

Figure 3 shows the trend of the Baltic Index from January 2019 to January 2023. It shows that dry bulk freight rates are volatile from January 2019 to January 2023, with rates currently low and market demand lacking, indicating that the dry bulk shipping market remains sluggish. On 7 October 2021, the BDI reached its highest

level since the previous decade at 5,650 and has since begun to show a decline. With global economic development gradually returning to normal, another significant increase is expected to be less likely in the future.



(Data sources: Clarkson SIN)

Figure 3 *The trend chart of BDI from 2019 to 2023*

4.1.1.3 Analysis of dry bulk cargo routes

The trade flows of the major cargo types determine the routes of international dry bulk sea transport. Iron ore, coal and grain are the three main dry bulk cargoes in international shipping, and their flow direction becomes the main route for international shipping.

In terms of the overall flow of international dry bulk trade, the main exporters of iron ore are Brazil, Australia, Canada, Sweden and South Africa, and the importers are Japan, the EU, China and South Korea; the main exporters of coal are Australia, South Africa, the US, Canada, Colombia and Indonesia, and the importers are mainly

Japan, South Korea and the EU; the five major regions for grain exports are the US, Canada, Argentina , Australia, and the EU, and the importing countries are Middle East countries, Russia, North Africa, Japan, South Korea, and China. As a result, important routes for dry bulk shipping are formed between these countries.

4.1.2 Analysis of the dry bulk ship finance market environment

The financial market has a huge impact on the shipping market as ship investments involve large amounts of capital and long payback periods, which are difficult for shipping companies to undertake on their own and require access to the financial market for financing. A range of indicators such as ship prices, freight rates and freight rates fluctuate with the financial markets. The prolonged downturn in the shipping market has created an urgent need for shipping companies to address the cash flow shortage in their operations.

The following are the main issues facing dry bulk shipping finance at present.

1. **Large financing gap.** The demand for and prices of China's competitive dry bulk carriers are running low, the ship market is in a buyer's market and shipowners are generally in a poor financial position.

2. **Banks are seriously reluctant to lend.** Due to their own risk considerations, commercial banks have listed the shipping industry as a "restricted entry" or "limited entry" industry. They are also cautious about the payment requirements of shipping enterprises, and the requirements for the completeness of risk compensation have increased, making it difficult to finance ships.

3. **Insufficient exchange rate risk precautions.** The frequent use and high proportion of foreign exchange funds and the long construction period of ships

determine the exposures of exchange rate risk of ship enterprises. Ship enterprises in China have limited means to avoid exchange rate risk, and usually only carry out forward settlement and sale of foreign exchange. In addition, the current foreign exchange management policy also restricts enterprises from carrying out hedging transactions without the background of actual transactions.

4.1.3 Analysis of the policy environment for investment in dry bulk vessels

Investment in any field cannot be separated from the support of government policies. Taking China as an example, during the planned economy period, China's policy formulation had historical limitations. The government directly manipulated economic activities, and private enterprise investment did not receive policy support. The shipping industry developed slowly, lacking competition and sound shipping policies. After the reform and opening, the government began to subsidize the shipping industry, and the independent financing of shipping enterprises increased. China's shipping industry flourished. The government has introduced a series of policies that guide the direction of the shipping market and have a significant impact on ship investment. In recent years, in both the shipping and shipbuilding industries, the state has issued a series of policies to support the development of shipping. In March 2016, Zhejiang Province issued the "Notice on the Implementation Plan for Ship Emission Control Zones in Zhejiang Province"; In June 2018, the "Hubei Province Ship Pollution Prevention and Control Work Plan" was introduced; In September 2019, Anhui Province issued the "Implementation Plan for Promoting the Intelligence of Ship Assembly and Construction and the Development of Intelligent Ships in Anhui Province (2019-2021)". These policies promote the intelligent transformation and upgrading of China's shipbuilding industry. In December 2022, the General Office of the State Council issued the "14th Five Year Plan" for the

development of modern logistics, which proposed cultivating competitive advantages in international shipping, encrypting international shipping routes, creating international shipping hub ports, enhancing international shipping service capabilities, strengthening international transit functions, and expanding comprehensive services such as international finance and trade.

At the same time, changes in the world political situation also affect investment in dry bulk ships. For example, in the first half of 2022, the conflict between Russia-Ukraine conflict triggered an energy crisis and a food crisis. Europe increased its demand for coal imports from Indonesia, Australia and other countries. Poor countries in the Middle East and North Africa, which rely heavily on Russia and Ukraine for food imports, had to turn to South American countries for imports.

4.1.4 Technical environmental analysis of dry bulk vessels

The technical environment analysis of dry bulk ships includes analysis of mainstream ship types in the market, analysis of ship development trends, analysis of ship reliability, and analysis of ship capacity.

4.1.4.1 Analysis of Main Types of Dry Bulk Ships

Dry bulk cargo ships include dedicated dry bulk cargo ships and dual-purpose ships. Most of the transportation tasks are carried by dedicated ships, with over 70% of dual-purpose ships engaged in bulk cargo transportation and not used as multi-purpose ships.

Handysize Bulk carrier: The draft of the ship is controlled between 9-10 meters, which is limited by the depth of the channel in a navigation area, such as Lawrence Waterway, the Yangtze River Estuary and the Pearl River Estuary in China.

Handymax bulk carrier: The draft of this type of ship is generally around 11 meters, which meets the needs of most large ports for full load entry and exit. The main cargo to be transported is grain, coal, and coke.

Panamax Bulk carrier: It is mainly limited by the Panama Canal and mainly meets the relevant regulations for the navigation of the Panama Canal, where the total length of ships does not exceed 274.32 meters and the molded width does not exceed 32.30 meters. It is the best ship type from the Atlantic Ocean to the Pacific Ocean through the Bama Canal and is a representative ship in the world fleet. It is widely used in dry bulk cargo such as coal, ore, grain, fertilizer, and container and oil transportation.

Capesize Bulk carrier: This ship type mainly transports iron ore. Due to size constraints, it is impossible to pass through the Panama Canal and the Suez Canal, and it is necessary to bypass the Cape of Good Hope and Cape Horn.

Based on the comprehensive market situation, transportation capacity, and capital situation of the company, GISML believes that the Panamax Bulk carriers and Capesize Bulk carriers have great investment value and has formulated four investment plans for these two ship types, respectively: new-building 82k dwt Panamax Bulk carrier, new-building 180K DWT Capesize Bulk carrier, 10-year-old 82k dwt Panamax Bulk carrier and 10-year-old 180K DWT Capesize Bulk carrier.

4.1.4.2 Analysis of ship development trends

The development trends of container ships and oil tankers are similar, and dry bulk ships also have the following trends: the trend of large-scale ships, structural changes and adjustments in ship types, etc.

1. Trend of ship enlargement

With the development of shipbuilding technology and the strengthening of shipbuilding capacity, the tonnage of ships built gradually increases. In order to pursue economies of scale and reduce unit costs, the shipping industry continues to place orders to build larger ships. In the field of dry bulk ships, the large-scale of ships is accompanied by the large-scale of terminals. Since the 1980s, the tonnage of ore and grain terminals in various countries has continuously increased. So far, there are more than 10 400000 tonnage ore terminals in the world. With the 400000 ton ore ship being put into use in Vale, Brazil, the development of ultra large bulk carriers has become a consensus among major shipping companies, and the trend of large-scale ships has become the main trend of development of mainstream dry bulk ship types in recent decades.

In general, the larger the ship, the lower the unit cost. However, the fewer ports to adapt to, the greater the likelihood of loss of load, which increases both operational profits and risks. Therefore, when selecting the tonnage of a ship, the shipowner should consider both the economies of scale brought about by large-scale ships and the potential risks.

2. Ship type structure change adjustment

With the development of international trade and the changes in shipping policies of various countries, the structure of dry bulk ships has continuously changed. In the early 1970s, due to the small cargo volume, the dry bulk fleet was dominated by handy size bulk carriers, with handymax bulk carriers and Panamax bulk carriers accounting for a certain proportion, while Capesize bulk carriers were fewer. By the 1990s, the number of Capesize bulk carriers had gradually increased, becoming the

main force of the dry bulk fleet together with Panamax bulk carriers, and the ratio of handymax bulk carriers and handysize bulk carriers had decreased. In the 21st century, the structure of the fleet continues to change.

Table 1 *Capacity size of all kinds type of dry type of dry bulk ship*

	Capesize Bulk carrier		Panamax bulk carrier		Handymax bulk carrier		Handysize Bulk carrier		Total	
	Ship	10K DWT	Ship	10K DWT	Ship	10K DWT	Ship	10K DWT	Ship	10K DWT
2022	1952	38482	3022	24477	4079	22946	3972	11157	13025	97062
Early 2023	1952	39162	3122	25260	4185	23121	3962	11282	13261	98825
Year-on-year growth		1.8%		3.2%		0.8%		1.1%		1.8%

(Data sources: Clarkson SIN)

From the data in the table, with the intensification of the trend of ship enlargement, the proportion of large ships occupying the tonnage of the fleet has increased, and this trend is still intensifying.

4.2 Analysis of the investment internal environment

This research will analyze the internal environment of investment in dry bulk vessels from the following aspects: company profile, operating conditions, investor analysis and investment content analysis.

4.2.1 Company profile

NJS has been engaged in the shipping industry for many years, mainly engaged in brokerage and chartering services for bulk carriers. In various ports in China, integrated operational services such as binding of goods on board, inspection of loaded goods, inland large cargo transportation, customs declaration, warehousing, and documentation can also be operated. The company has a youthful team, full of vitality and infinite passion, specializing in designing the best transportation solutions for various import and export enterprises, ensuring safety and thoughtfulness, improving transportation efficiency, and reducing transportation costs, to solve various global engineering project cargo transportation services.

NJS mainly engages in international chartering and ship brokerage business, with a tonnage range of typically 5000 to 80000 tons. The company has good experience and background in chartering ships, and has long-term cooperative relationships with many well-known international and domestic shipowners. It is able to provide timely updates on ship routes, ensuring reasonable cargo loading and timely arrival at the destination port. The company's main routes include transportation services from China (Far East) to India, Africa, the Red Sea, the Persian Gulf, the Central American Gulf, the US Gulf, Europe, the Black Sea, Southeast Asia, Australia, and other routes. Main carriers: various types of steel structures, major mechanical equipment, various engineering vehicles, various types of steel, wind power plant equipment, power station equipment, civil engineering complete sets of equipment, wind energy equipment, special unpowered barges, port cranes, offshore oil drilling platforms, locomotives (subway), yachts, as well as ultra wide and overweight large cargo, with a single load capacity of 20-2000 tons. At the same time, based on different types of bulk cargo, the main brokers and charterers of bulk carriers provide

transportation services for the import of iron ore, coal, wood, stone, and export of cement, fertilizers (bulk or ton bag chemical products), jade, and other bulk commodities.

4.2.2 Analysis of operating conditions

1. Fund Analysis of NJS

As of January 1, 2023, the total assets of NJS were 180 million yuan. The company has current assets of 83 million yuan, including monetary funds of 65 million yuan, accounts receivable of 23 million yuan, and a valuation of approximately 95 million yuan for fixed assets, including a valuation of approximately 80 million yuan for ships and a net worth of 15 million yuan for houses. The company's asset quality is good, mainly manifested in: monetary assets of 65 million yuan, with good cash paying ability and debt repayment ability; long-term operating assets consist of 14 ships, with a valuation of 80 million yuan, which can provide long-term stable cash flow. As of January 1, 2023, the company's total liabilities amounted to 7 million yuan, mainly composed of oil payable, ship repair fees, and ship rent.

Based on the above analysis, NJS has sufficient funds and long-term stable cash flow.

2. Analysis of NJS's Transportation Capacity

NJS has 14 self-owned ships, 6 long-term time charter ships, and 2 light charter ships, with a total carrying capacity of 460000 tons.

Among them, there are 6 small vessels owned by NJS, with a deadweight tonnage of 2000-3000 tons. They mainly operate the China Japan South Korea route, which is currently approaching saturation. At present, the profitability of this route is poor, but

due to the route segment and high frequency of voyages, which increases the company's management costs, the company has decided to abandon this route within two years.

NJS has 8 medium-sized ships with a deadweight tonnage of 6000 to 9000 tons, mainly operating the China Southeast Asia route. The route has stable cargo supply and good profits, and we continue to operate.

Six long-term time charter ships and two light charter ships are large ships with a deadweight tonnage of 30000 to 80000 tons. They mainly operate the Far East America and Far East Mediterranean routes. In recent years, through the company's efforts, they have become the company's pillar routes, creating the best profits for the company.

To sum up, NJS has sufficient transportation capacity in general, and the Far East America and Far East Mediterranean routes are booming, so the transportation capacity needs to be supplemented. Therefore, for this route, the company has signed a contract with three large international trade companies and signed a strategic cooperation agreement with one of them to introduce the company as an investor of the company, and plans to jointly invest in the purchase of Panamax or Capesize bulk carriers.

4.2.3 Investor Analysis

The continuous changes in the investment environment have a greater impact on investment in dry bulk ships, with adjustments in intervention time and intervention points (prices of new and second-hand ships). Investors' interpretation of the cyclical nature of the world economy and shipping market is an important factor affecting

investment decisions.

The investors of NJS are composed of three long-term professionals in the international shipping industry, one financial industry professional, and one industry professional who has been engaged in international bulk cargo trade for a long time. Due to the long-term involvement of investors in international shipping related businesses, they have rich experience, global control capabilities, and efficient information processing capabilities in the dry bulk shipping industry.

NJS has an advanced information management system to assist investors in collecting, organizing, and analyzing information. The information that investors pay attention to and analyze mainly includes the Baltic Dry Index, weekly reports on the international dry bulk transportation market, international commodity futures trends, domestic commodity prices (especially iron ore, coal, and finished oil prices), domestic dry bulk shipping sea freight prices, and information on the maritime financial supply chain. By comprehensively analyzing and comprehending the above information, investors can make reasonable judgments and speculations about the trend of the maritime market, which is helpful for scientific investment in dry bulk ships.

4.2.4 Investment content analysis

1. Selection of investment timing

Dry bulk shipping has the characteristics of high risk, large investment amount, and long return period, so it is particularly important to choose the right investment timing. Investors hope to expand their investment under high freight rates and low ship prices, thereby improving returns. Choosing to invest in ships at appropriate

freight and ship prices, that is, choosing the appropriate investment timing for ships, is an important aspect of investment decision-making for dry bulk cargo ships.

The current shipping industry is in a downturn, with both freight and ship prices maintaining low levels. The investment environment is not optimistic, and NJS needs to be cautious and seize specific investment opportunities to overcome difficulties in the macroeconomic environment of economic downturn. Although the macro situation is not optimistic, the Far East America and Far East Mediterranean routes under NJS are thriving and competitive. Currently, expanding the investment in ships on this route is conducive to expanding NJS's market share in the shipping industry, improving domestic and international competitiveness, and is a favorable opportunity for NJS to invest.

2. Selection of ship type

Ordering new ships or purchasing second-hand ships is the main investment content of the company. The focus of investment decisions is on which type of ship to order or purchase. The ship type decision mentioned in this article refers to the size of ships purchased by dry bulk cargo companies. The international shipping industry is a typical industry with economies of scale, where the larger the ship, the lower the unit transportation cost, which is the root cause of ship enlargement. However, in actual transportation, ships are constrained by factors such as route cargo sources, port handling capacity, and company funds, making it impossible for ships to be as large as possible. Therefore, choosing the optimal ship type is also an important aspect of ship investment decision-making.

There are three main types of ships invested by NJS, respectively 75000-ton Panamax bulk carriers, 180000-ton Capesize bulk carriers and 100000-ton Capesize

bulk carriers. NJS makes ship type choices by measuring the benefits and risks of different ship types.

3. Renewal and renovation of ship equipment

The optimal control problem of ship maintenance and update system is an important component of modern management of shipping enterprises. The correctness of ship maintenance and update decisions will directly affect the economic benefits of the enterprise. As the service life of ships increases, there may be problems with ship equipment, and the requirements of enterprises for ships may also change. Local equipment replacement or modification is an essential technical measure.

NJS needs to measure the economic benefits of the ship during its service life and the cost of updating and renovating the ship, while considering the safety of ship transportation, to determine whether the ship needs to undergo equipment updates and technical renovations, and if so, when. The update and technological transformation of ship equipment will directly affect the company's financial situation.

4.3 Risk identification

This research analyzes the internal and external environment of NJS and divides its investment risks into investor risk, shipping market risk, financial market risk, policy risk, and ship technology risk.

4.3.1 Investor risk

The ability of investors affects investment risks. For dry bulk shipping companies, investors' limited investment choices in the type, quantity, and route of bulk cargo

ships can cause huge economic losses to shipping companies.

The most important consideration for investors in investing in dry bulk cargo ships is risk assessment. Most private shipping companies decide whether to invest in new ships based on simple market analysis, lacking scientific and rigorous analysis and argumentation, leaving huge risks and hidden dangers for the later operation of ships and the development of the company.

4.3.2 Shipping market risk

The shipping market risk mainly refers to the uncertainty encountered by NJS in ship operation, including the uncertainty of operating costs (fuel fees), fluctuations in market freight rates, and fluctuations in freight volume.

1. Operating costs (fuel fees) risk

Fuel costs are currently the largest single expense in ship operations, with frequent and significant fluctuations. The fuel cost is mainly affected by the changes in the price of international crude oil market. In recent years, with the decline of oil reserves and the instability of the Middle East, the oil price is getting higher and higher. Although with the progress of science and technology, shipping companies use internal combustion engines with high fuel efficiency and strong fuel saving performance, the proportion of fuel cost in the variable cost of ships is still quite high. The fuel cost accounts for about 52.3% of the operating cost of dry bulk cargo ships, and fluctuates with the fluctuations of the international crude oil market. Shipowners are sometimes forced to charge additional fees for the gradual increase in fuel costs, leading to an increase in freight rates and affecting the actual returns of investors. The above phenomena indicate that the risk of fuel price fluctuations is an important

factor in investment decisions for dry bulk vessels, so NJS attaches great importance to it.

2. Market freight fluctuation risk

For NJS, the main benefit comes from the freight cost, which directly reflects the high or low freight cost. Market freight risk mainly refers to the risk brought by the unfavorable changes in freight costs. Sea freight is a kind of market price, which fluctuates up and down with the change of the supply and demand relationship of goods and ships. At the same time, sea freight will react on the supply and demand of goods and ships. For dry bulk shipowners, freight rates are a barometer of investment. When a certain type of dry bulk carrier has a higher freight rate, the returns are higher, and investors will compete to intervene in the market. As supply increases, demand will relatively decrease, leading to a decrease in freight rates. When the freight rate is at a low point, the benefits may not meet investors' expectations, and investors will seal up and dismantle ships, resulting in a relative decrease in supply and an increase in freight rates. In the cyclical fluctuations of the shipping market, changes in the power of both supply and demand parties (especially the shipment volume of the supplier) will directly affect the trend of freight rates, making the risks brought by freight rate fluctuations unpredictable, and this risk has a direct impact on the profits of shipowners. NJS needs to be familiar with the current supply and demand situation of the dry bulk cargo market and be able to choose the right timing for investment or ship processing in order to reduce the losses caused by this cyclical risk.

3. Route change risk

The supply and demand capacity of dry bulk shipping routes is one of the main

factors affecting the level of route activity. Scientific investment in different routes directly affects the profits of shipping companies. The rise and fall of shipping routes have a huge impact on investment enterprises. Accurately judging the development trend of the company's shipping area and flexibly formulating investment strategies for shipping routes can help reduce investment risks and seize investment opportunities. Since its establishment, NJS has mainly operated routes from China to East Asia and Southeast Asia. Currently, the operating ships in this navigation area have become saturated, and the company has developed liner routes from the Far East to the Americas and the Mediterranean, achieving great development. The company adheres to the principle of honesty and development, and has received long-term support from the cargo company. The board of directors has decided that the company's development direction is in the Far East to the Americas route.

4.3.3 Financial market risk

Due to the huge investment and high value required by ships themselves, a series of financial activities during the investment process can bring certain risks. In addition, the value of ships is also affected by financial market fluctuations, so the risks brought by ship capital cannot be ignored. The capital cost of ships mainly includes interest rate risk, exchange rate risk, and inflation risk.

1. Interest rate risk

Due to the large amount of funds involved in ship investment, most enterprises find it difficult to bear it alone and need to borrow from banks. Loans involve interest rates, which can be divided into fixed and floating rates based on whether they can be adjusted during the credit period. Fixed interest rate refers to the interest rate that remains unchanged during the loan period, which is a relatively traditional

calculation method. However, due to the significant impact of inflation, implementing a fixed interest rate will bring significant losses to long-term lenders. At present, mainstream commercial banks generally use floating interest rates for loans provided to shipping companies. Floating interest rates refer to the interest rates adjusted during the loan period, usually adding a certain interest margin on top of LBIOR. Floating interest rates can to some extent resist the risks brought by inflation, but due to frequent and significant changes in interest rates, they can bring additional risks to enterprises. Investors need to carefully consider the impact of floating interest rates.

2. Exchange rate risks

Ship investment often comes with a large amount of foreign exchange, and most of the income and expenses in the international shipping industry are settled in foreign exchange, which inevitably leads to risk issues caused by exchange rate fluctuations. In the purchase and sale of ships, the capital cost of the ship is usually paid in the currency of the country where the shipyard is located, and port charges outside of the country are paid in the currency of the port country or in US dollars. There are many other expenses, such as demurrage and dispatch, which involve foreign exchange. Therefore, changes in foreign exchange rates will directly affect the profits of shipping companies and affect the cost of ship capital. If shipping companies raise funds by issuing stocks or bonds, they will also encounter the issue of inconsistency between the fundraising currency and the final payment currency, which involves foreign exchange risk. Therefore, NJS needs to pay attention to exchange rate changes during the process of ship investment and try to ensure that the payment time is consistent with the payment time.

3. Inflation risk

Given the long payback period of ship investment funds, the funds recovered after the investment is completed may have lower purchasing power than the invested funds, and the risk brought by this reduction in purchasing power is called inflation risk. Inflation risk will directly reduce investors' actual returns and have an impact on shipping operations. Due to inflation occurring in any region, investors are almost unable to avoid it and need to adjust their required minimum yield appropriately to reduce losses.

4. Lease risk

Ship investment has the characteristics of large investment amount and long payback period. Some shipping companies, considering their own financial situation and investment risks, choose to charter ships to reduce operating costs. However, it also brings corresponding risks, such as reducing shipping control rights, increasing operational risks, and reducing enterprise competitiveness.

4.3.4 Policy risk

For ship investors, policy risks mainly include two aspects: on the one hand, the risk of political environment factors, that is, the impact of social and political factors such as political conflicts, wars, social unrest, and worker strikes in a country or region on shipping investment, which is mainly related to the stability of the country; on the other hand, it is related to the shipping policies formulated by the government, The government's support or regulation of the shipping industry can not only directly affect the shipping market, but also change people's expectations of the shipping market. The benefits of policies are often the beginning of a new round of rise in the shipping market. In the current volatile shipping investment market and imperfect investment system, the benefits or risks brought by policies need to be widely

concerned by investors.

4.3.5 Ship technology risk

Ship technology risks mainly refer to the risks brought about by changes in mainstream ship types, ship development trends, and ship capacity.

The mainstream ship types will not undergo significant changes in the short term. When new ship types emerge and some old ship types are phased out, technical risks arise. The fleet structure of shipping companies needs to be adjusted accordingly to adapt to the trend of ship development.

The transportation capacity of ships is mainly influenced by the overall environment of the shipping market. When supply exceeds demand, the transportation capacity is surplus, and shipping companies may face the option of reducing their fleet; On the contrary, when the transportation capacity is insufficient, the shipping company needs to consider purchasing more ships to supplement the transportation capacity. Especially when the company's operational strategy undergoes significant changes, the transportation capacity will also change, resulting in risks.

Chapter 5 Analysis and Finding

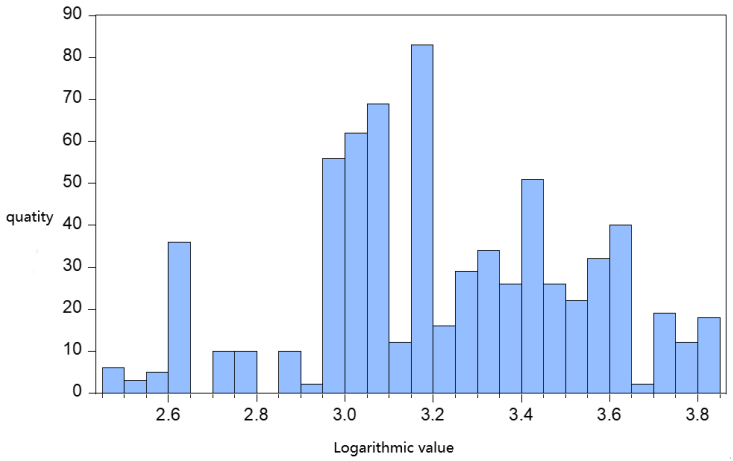
In Chapter 4, this research conducts a qualitative analysis of the investment risk of NJS from five factors: investor factors, shipping market factors, financial market factors, policy factors, and ship technology factors, both internally and externally.

Since the price of dry bulk vessels is the main factor affecting vessel transactions. This chapter conducts quantitative analysis on the price of existing ships, evaluates the Value at risk of investment, establishes a decision-making model, and forecasts the trend of future ship prices to assist NJS to make scientific decisions, improve the reliability of business decisions, and avoid the market risk of ship trading in uncertain environments.

Considering the funds that the company can raise and the prices of various ship types, the company mainly considers the following four candidate investment plans: newbuilding 180K DWT Capesize bulk carrier, second-hand 10-year-old 180K DWT Capesize bulk carrier, newbuilding 82K DWT Panamax bulk carrier and second-hand 10-year-old 82K DWT Panamax bulk carrier.

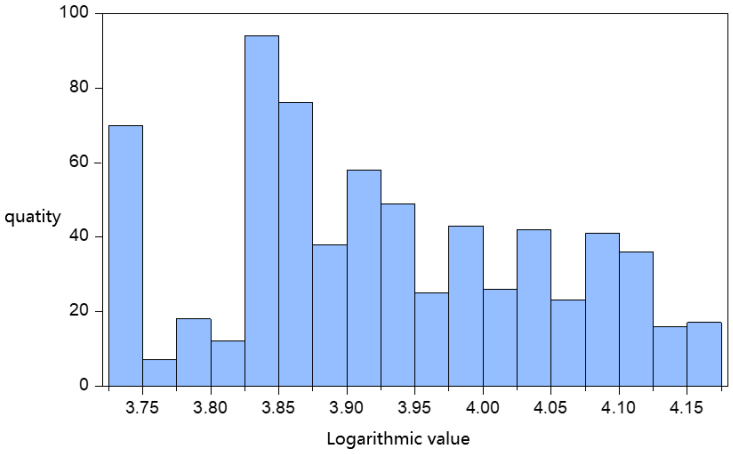
5.1 Investment risk assessment

The data selected in this research are the prices of four types of ships, sourced from Clarkson SIN. The sample interval is from the first week of 2010 to the fourth week of March 2023, with a sample size of 691. The natural logarithm lnC is taken for the new ship price and the second-hand ship price to make the order of magnitude smaller and the series more stable, and this series can be regarded as the change rate of investment price. To test the rate of change of the inspection data, this article first conducts a statistical analysis of its logarithm. The following figure shows the histogram distribution of the time series of four ship types' prices.



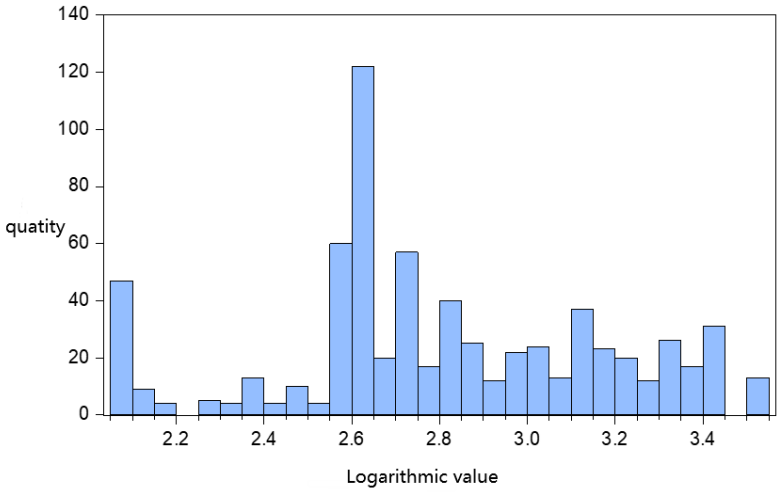
(Data sources: Clarkson SIN)

Figure 4 *The histogram distribution of the time series of second-hand 10-year-old 180K DWT Capesize bulk carriers*



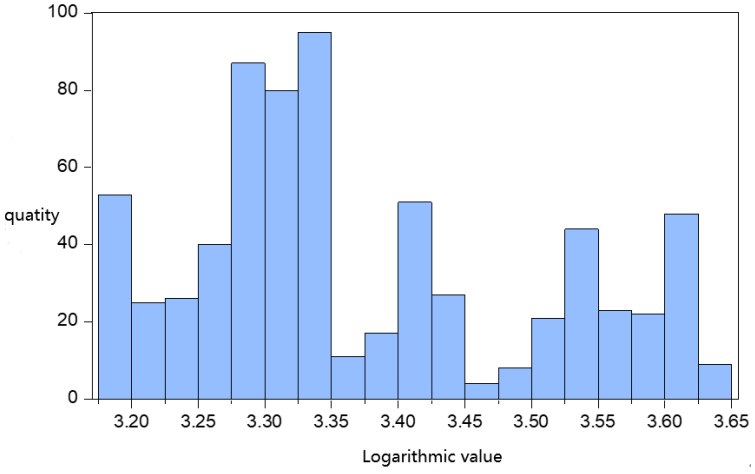
(Data sources: Clarkson SIN)

Figure 5 *The histogram distribution of the time series of newbuilding 180K DWT Capesize bulk carrier*



(Data sources: Clarkson SIN)

Figure 6 *The histogram distribution of the time series of second-hand 10-year-old 82K DWT Panamax bulk carrier*



(Data sources: Clarkson SIN)

Figure 7 *The histogram distribution of the time series of newbuilding 82K DWT Panamax bulk carrier*

The description and statistics are as follows:

Table 2 *Description statistics table of the ship prices*

	Secondhand Capesize bulkcarrier	Newbuilding Capesize bulkcarrier	Secondhand Panamax bulkcarrier	Newbuilding Panamax bulkcarrier
Mean value	3.228192	3.926351	2.805511	3.374029
Median	3.198673	3.912023	2.74084	3.332205
Maximum value	3.806662	4.166665	3.540959	3.637586
Minimum value	2.484907	3.731699	2.079442	3.188417
Standard deviation	0.305317	0.117072	0.366989	0.129896
Skewness	-0.16588	0.240453	-0.03417	0.597033
Kurtosis	2.637772	2.098316	2.495822	2.157226
Sample size	691	691	691	691

According to descriptive statistics and histograms table and figures, the logarithmic series mean of newbuilding capesize bulkcarrier's index price is the largest, reflecting that its price is the largest among the four price indices, followed by newbuilding panamax bulkcarrier, secondhand capesize bulkcarrier, and secondhand panamax bulkcarrier, respectively. The sequence skewness of secondhand capesize bulkcarrier and secondhand panamax bulkcarrier are less than zero and the sequence skews to the right, while the sequence skewness of newbuilding capesize bulkcarrier and newbuilding panamax bulkcarrier are greater than zero and the sequence skews to the left, which does not conform to the characteristics of normal distribution. The standard deviation is relatively large, indicating significant price fluctuations. The kurtosis of each ship type are greater than zero, indicating severe price fluctuations.

5.1.1 Value at Risk Assessment Based on VaR Model

To calculate the rate of change in the prices of the four types of ships mentioned above, take the logarithmic rate of return of their ship prices. The logarithmic returns of the four ship types are shown in Figure 8, Figure 9, Figure 10, and Figure 11.

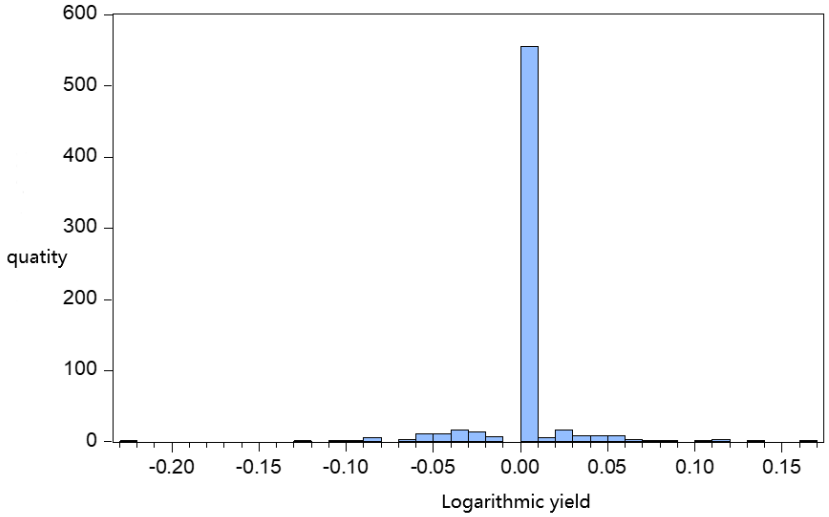


Figure 8 *The logarithmic yield of secondhand 10-year-old 180K DWT Capesize bulk carriers*

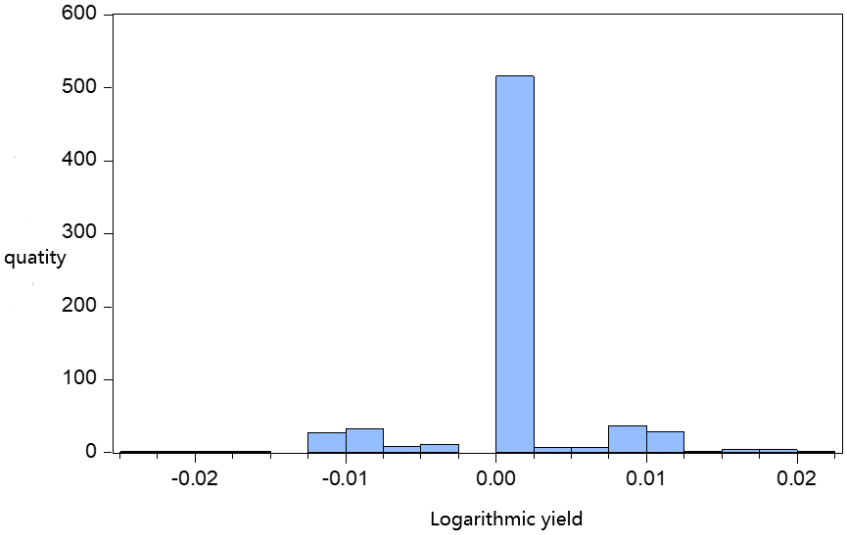


Figure 9 *The logarithmic yield of newbuilding 180K DWT Capesize bulk carriers*

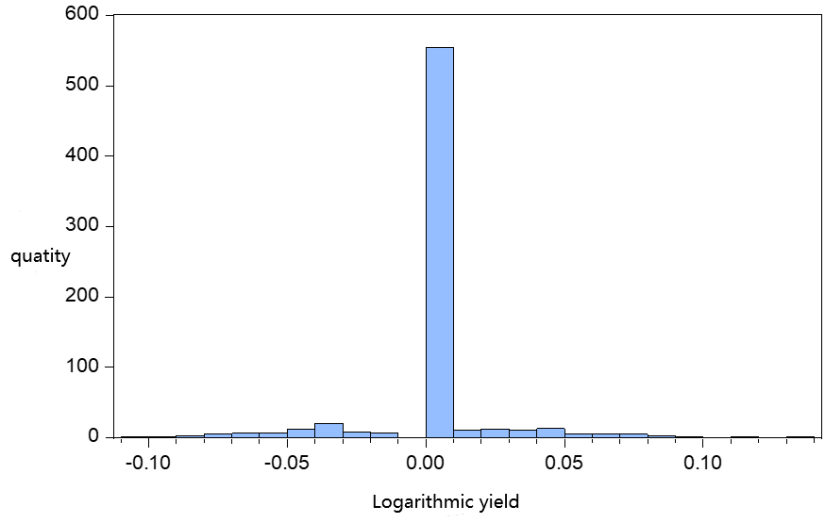


Figure 10 *The logarithmic yield of second-hand 10-year-old 82K DWT Panamax bulk carrier*

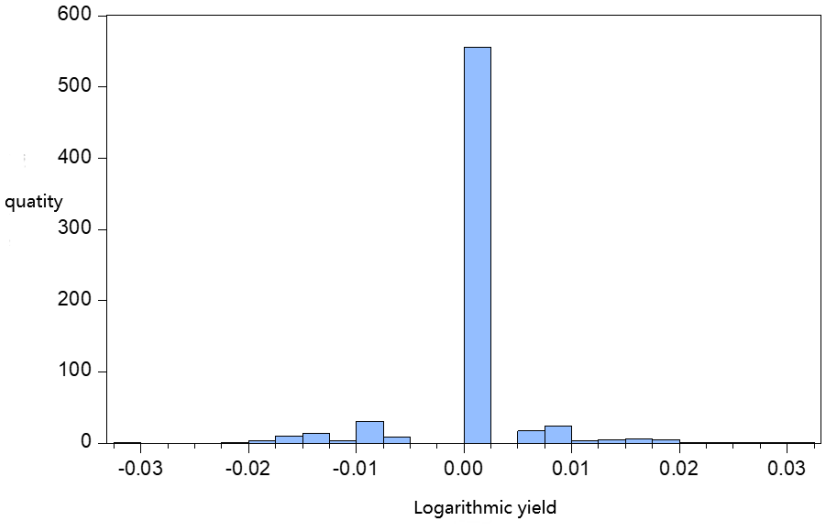


Figure 11 *The logarithmic yield of newbuilding 82K DWT Panamax bulk carrier*

The sample size of price change rate is 690, and the sample size is large enough to sort the price change rate from largest to smallest. Assuming given α= 0.01, find n*α= 6.9, take the 7th data. The quantile of the price change rate of the four ship

types is shown in Table 3:

Table 3 ***Quantile of historical price change rate of four price indexes***

price index	quantile
Secondhand Capesize bulk carrier	0.087011377
New-building Capesize bulk carrier	0.011834458
Secondhand panamax bulk carrier	0.077558234
New-building panamax bulk carrier	0.017391743

According to the VaR formula, with a confidence level of 1- α =0.99 is taken as an example for calculation and analysis, and the Value at risk of price volatility of each week is calculated according to the formula. The trend of its Value at risk is shown in Figure 12, Figure 13, Figure 14 and Figure 15.

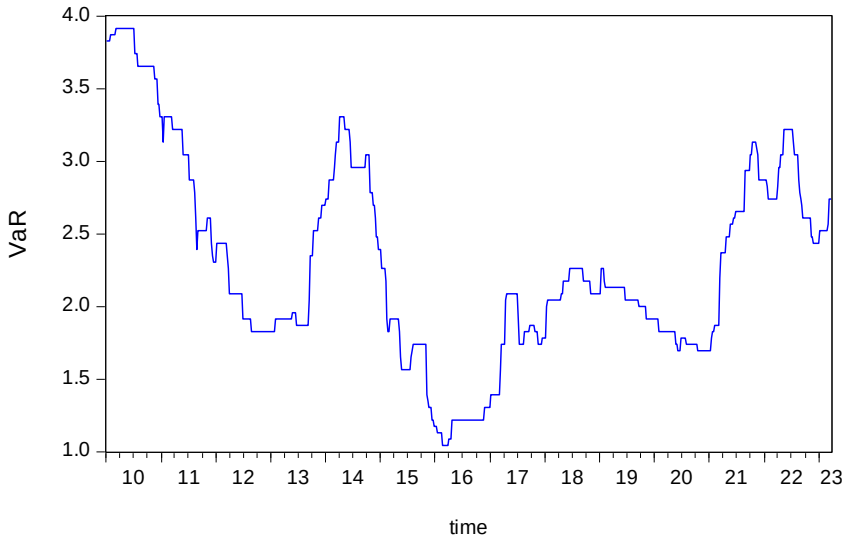


Figure 12 *The movement of value at risk of secondhand 10-year-old 180K DWT Capesize bulk carriers*

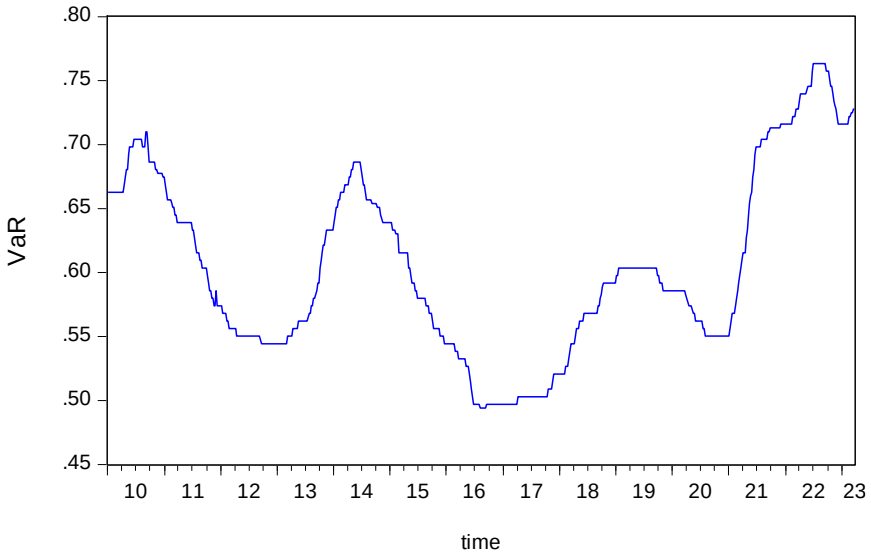


Figure 13 *The movement of value at risk of newbuilding 180K DWT Capesize bulk carriers*

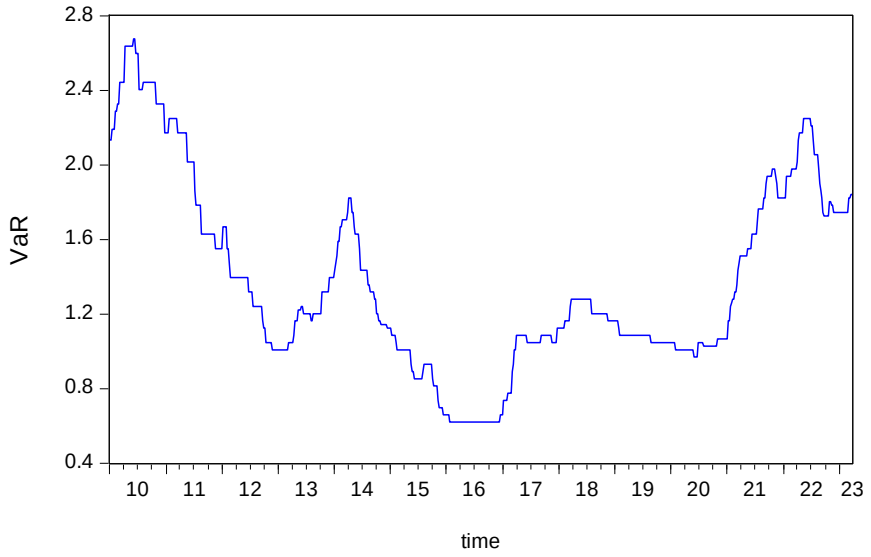


Figure 14 *The movement of value at risk of second-hand 10-year-old 82K DWT Panamax bulk carrier*

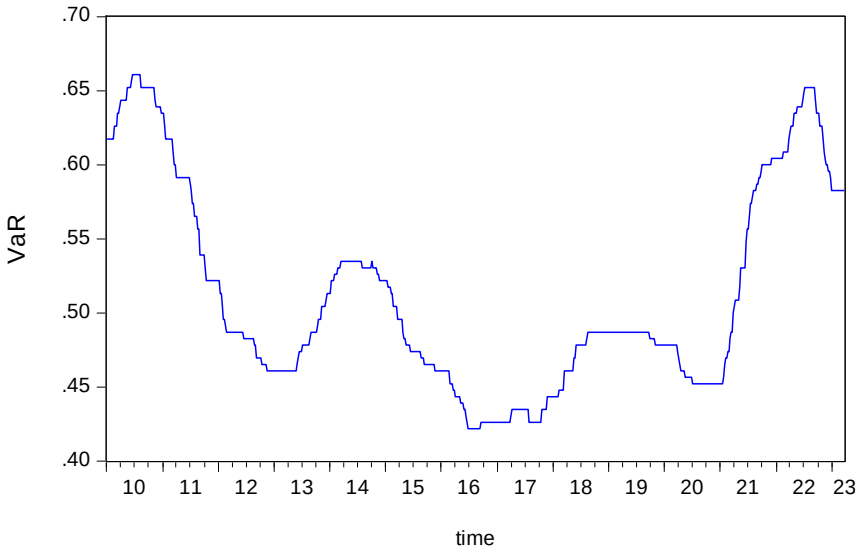


Figure 15 *The movement of value at risk of newbuilding 82K DWT Panamax bulk carrier*

According to its Value at risk of one week, the price index value of the next week can be predicted. For example, the price index value of secondhand 10-year-old 180K DWT Capesize bulk carriers closed at 19.5 in the first week of 2021, and its corresponding Value at risk is $V_{aR}(P_t) = 1.6967$. According to this result, there is a probability of $1 - \alpha = 0.99$ to determine the price of secondhand 10-year-old 180K DWT Capesize bulk carriers in the second week of 2021 will not be higher than $P_t = P_{t-1} + V_{aR}(P_t) = 21.1967$.

In fact, in the second week of 2015, the price of secondhand 10-year-old 180K DWT Capesize bulk carriers closed at 19.5, less than the forecast upper limit of 21.1967. Due to the impact of estimation bias on the accuracy of the VaR model, an accuracy test is conducted to ensure its correctness.

Given a confidence level of $1 - \alpha = 0.99$, calculate the predicted upper limit of exponential change in sample size $\widehat{\mathrm{P}_t} = \mathrm{P}_{t-1} + \mathrm{V}_{aR}(\mathrm{P}_t)$, and compare the predicted

upper limit with the actual price index. The comparison trend images are shown in Figure 13, Figure 14, Figure 15, and Figure 16, and the detection results are shown in Table 4.

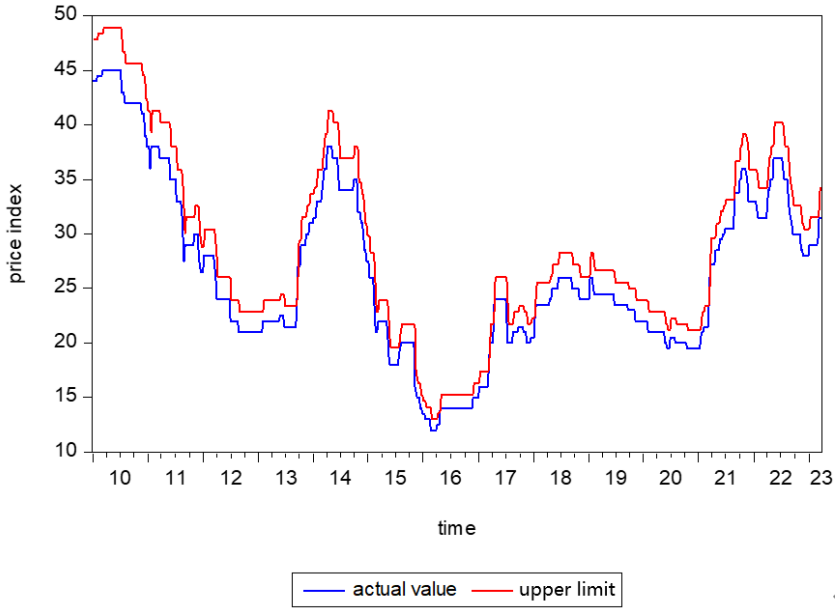


Figure 16 *Actual price index and forecast on the risk threshold of secondhand 10-year-old 180K DWT Capesize bulk carriers*

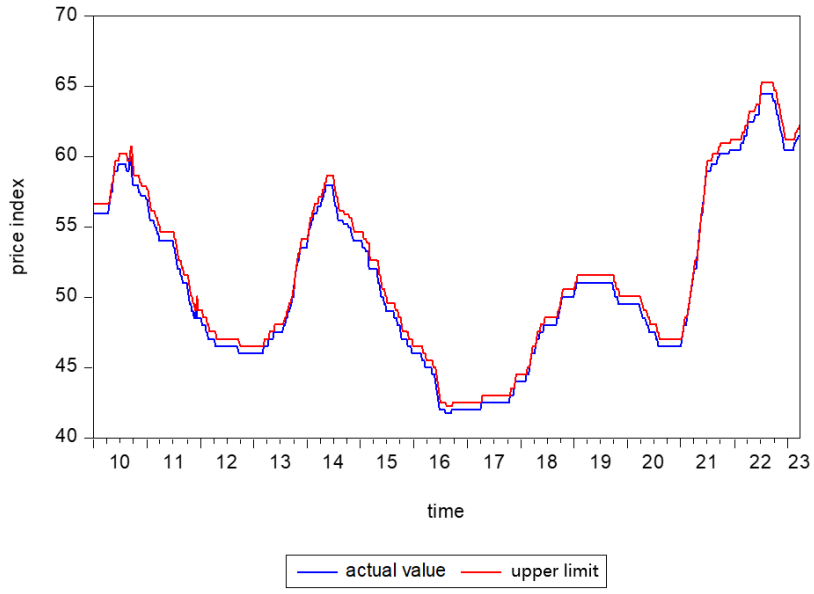


Figure 17 *Actual price index and forecast on the risk threshold of newbuilding 180K DWT Capesize bulk carriers*

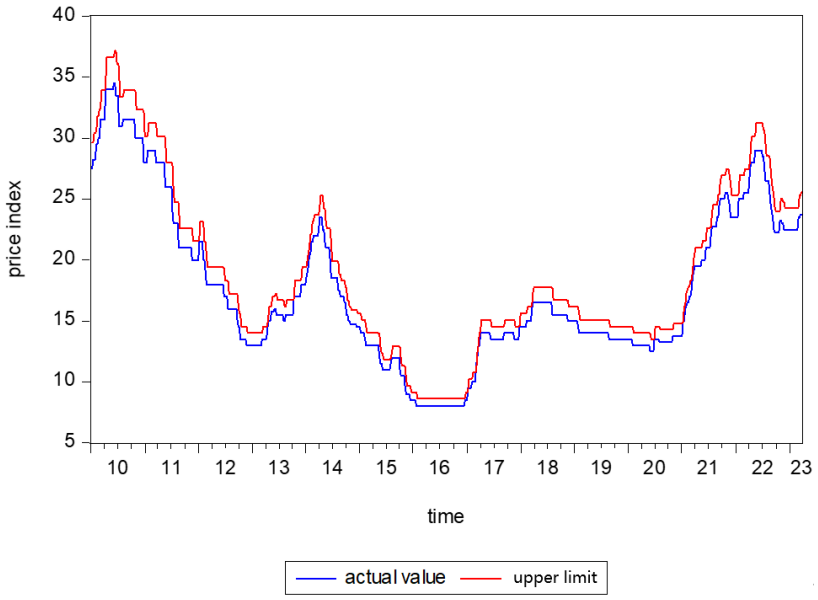


Figure 18 *Actual price index and forecast on the risk threshold of second-hand 10-year-old 82K DWT Panamax bulk carrier*

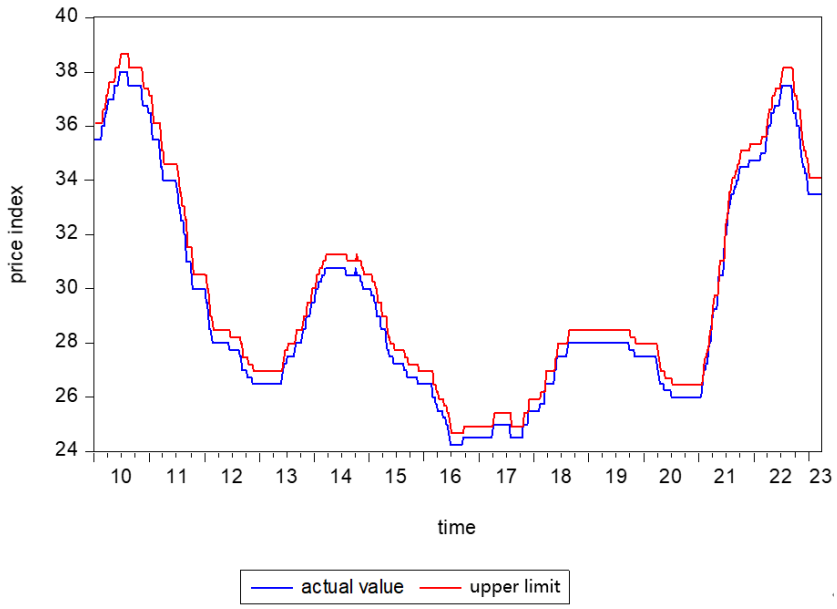


Figure 19 *Actual price index and forecast on the risk threshold of newbuilding 82K DWT Panamax bulk carrier*

Based on the comparison between the actual data and predicted data above, the following statistical table can be summarized

Table 4 *VaR test results based on failure rate*

Data	Confidence level	VaR quantity	Number of failures	Failure Rate	proportion	success or failure
Secondh and capesize	99%	690	4	0.58%	1%	YES
Secondh and capesize	95%	690	30	4.35%	5%	YES
New-building capesize	99%	690	5	0.72%	1%	YES
New-building capesize	95%	690	32	4.64%	5%	YES
Secondh and panamax	99%	690	2	0.29%	1%	YES
Secondh and panamax	95%	690	29	4.20%	5%	YES
New-	99%	690	5	0.72%	1%	YES

building panamax							
New-building panamax	95%	690	25	3.62%		5%	YES

From Table 4, it can be seen that at a 99% confidence level, four actual values of Secondhand capesize bulk carriers are higher than the upper limit, five actual values of New-building capesize bulk carriers are higher than the upper limit, two actual values of Secondhand panamax bulk carriers are higher than the upper limit, and five actual values of New-building panamax bulk carriers are higher than the upper limit. It can be also seen that at a 95% confidence level, 30 actual values of Secondhand capesize bulk carriers are above the upper limit, 32 actual values of New-building capesize bulk carriers are above the upper limit, 29 actual values of Secondhand panamax bulk carriers are above the upper limit, and 25 actual values of New-building panamax bulk carriers are above the upper limit. These values are all within the trusted range, so the VaR model established in this research is valid.

Table 5 *Statistical Data Table for VaR Results of Four Ship Types*

	mean value	median	Maximum value	minimum value	standard deviation	Proportion to actual value
Secondhand capesize	2.298152	2.131779	3.915512	1.044137	0.69187	8.70%
New-building capesize	0.604418	0.591723	0.763323	0.494089	0.07173	1.18%
Secondhand panamax	1.370738	1.202153	2.675759	0.620466	0.50498	7.76%
New-building panamax	0.512169	0.486969	0.660886	0.42175	0.069041	1.74%

From Table 5, the VaR values of the four ship types selected in this research have significant differences compared to their actual values, with the average values being 8.70%, 1.18%, 7.76%, and 1.74% of the actual values, respectively. This indicates that under the perfect competition market mechanism, the VaR value of secondhand 10-year-old 180K DWT Capesize bulk carriers is higher than that of the other three

ships, and accounts for a large proportion of the actual value. This indicates that investors should pay special attention to its historical market risk when buying it.

5.1.2 Value at Risk Assessment Based on GARCH Model

The stability test of the secondhand 10-year-old 180K DWT Capesize bulk carriers' logarithmic sequence showed that the sequence was a single integer sequence. Perform ARCH test and model correction on logarithmic returns, and finally use GARCH model to do model reduction. Table 6 show the GARCH model results.

Table 6 *GARCH-GED Model Results*

variable	coefficient	error	Z statistic	Significance P
C	3.89E-06	9.22E-07	4.21724	0
RESID(-1)^2	0.494865	0.128589	3.848412	0.0001
GARCH(-1)	0.165922	0.020294	8.175936	0
GED PARAMETER	0.01748	2.22E-05	785.9977	0

The GARCH-GED model can be described as follows:

$$y_t = \varepsilon_t = \sqrt{h_t v_t}$$

$$h_t = 3.89\text{E} - 06 + 0.494865\varepsilon_{t-1}^2 + 0.165922h_{t-1}$$

Take the confidence level according to the previous text α= 0.01. The upper quantile under the confidence level of 0.99 is 2.58. According to the calculation formula of VaR under the GARCH model described in Chapter 4 and the VaR calculation formula for a single week can be changed to:

$$V_{aR} = \omega_0 Z_\alpha \delta\sqrt{\Delta t} = P_t \varphi_\alpha h_t \sqrt{\Delta t}$$

Where:

P_t: Ship price in week t

φ_α: Upper quantile of GEM under degree of freedom v and confidence level α

h_t: Standard deviation of conditions in week t

Value at risk trend chart of these four types of ship are as follows:

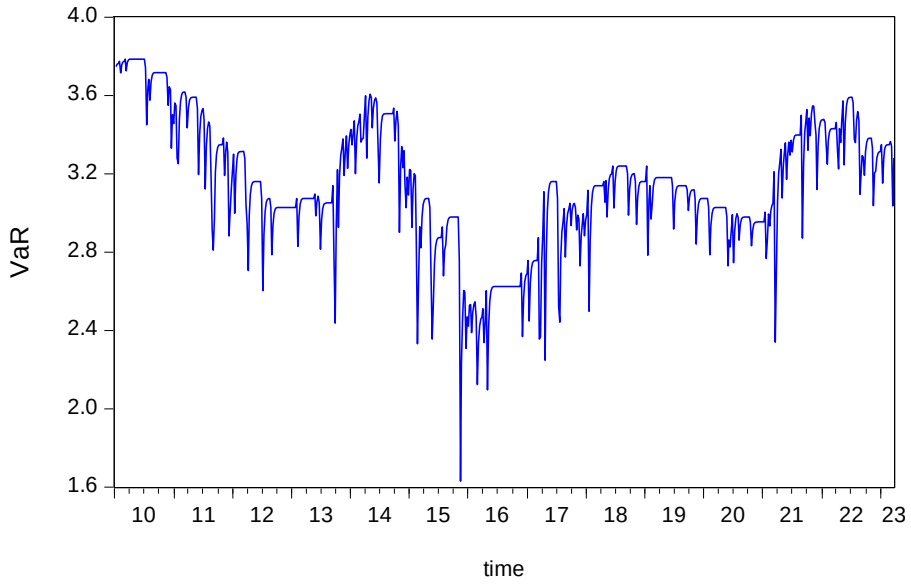


Figure 20 *The movement of value at risk of secondhand 10-year-old 180K DWT Capesize bulk carriers*

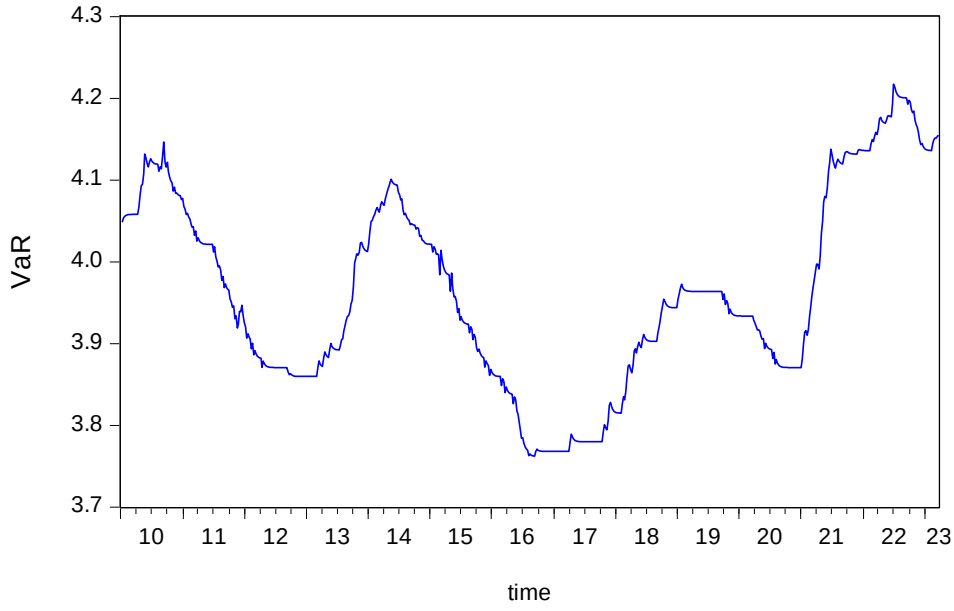


Figure 21 *The movement of value at risk of new-building 180K DWT Capesize bulk carriers*

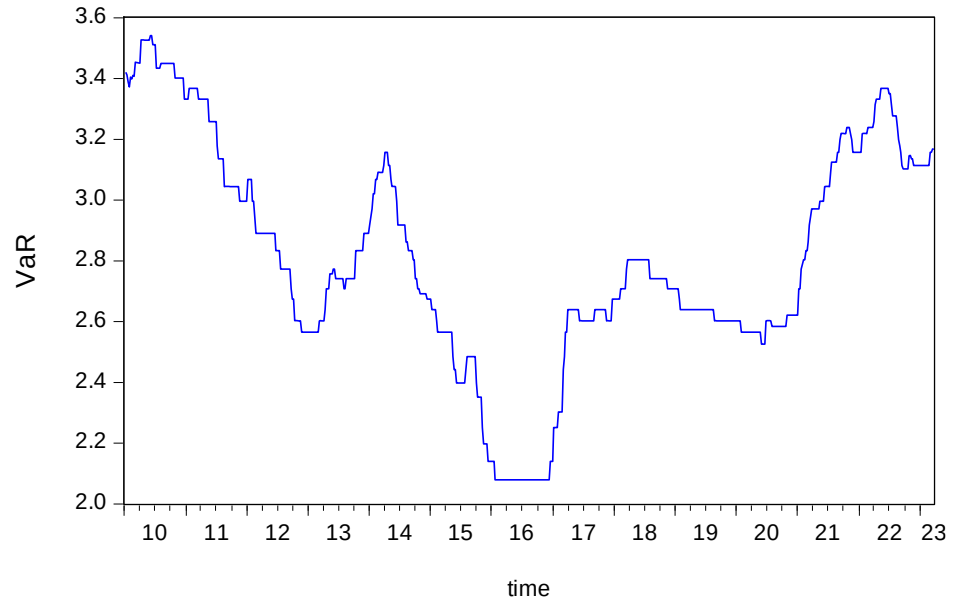


Figure 22 *The movement of value at risk of second-hand 10-year-old 82K DWT Panamax bulk carrier*

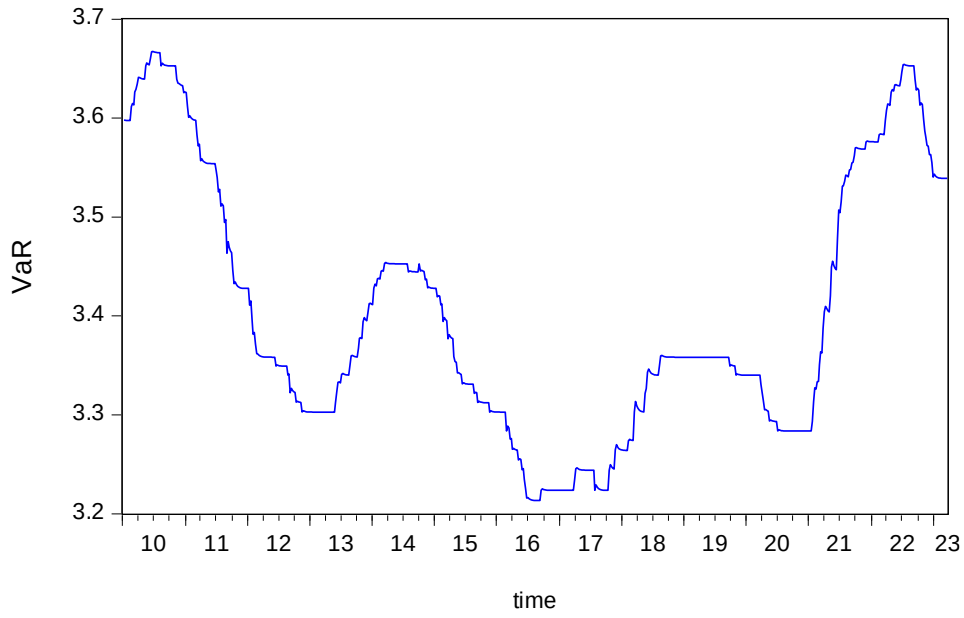


Figure 23 *The movement of value at risk of new-building 82K DWT Panamax bulk carrier*

VaR represents the maximum possible decline in the next time period. To ensure the accuracy of the model, an accuracy test is now conducted on its results. Given a confidence level of $\alpha = 0.01$, calculate the predicted upper limit of exponential change in sample size. The comparison between the predicted upper limit value and the actual situation is shown in the following figures.

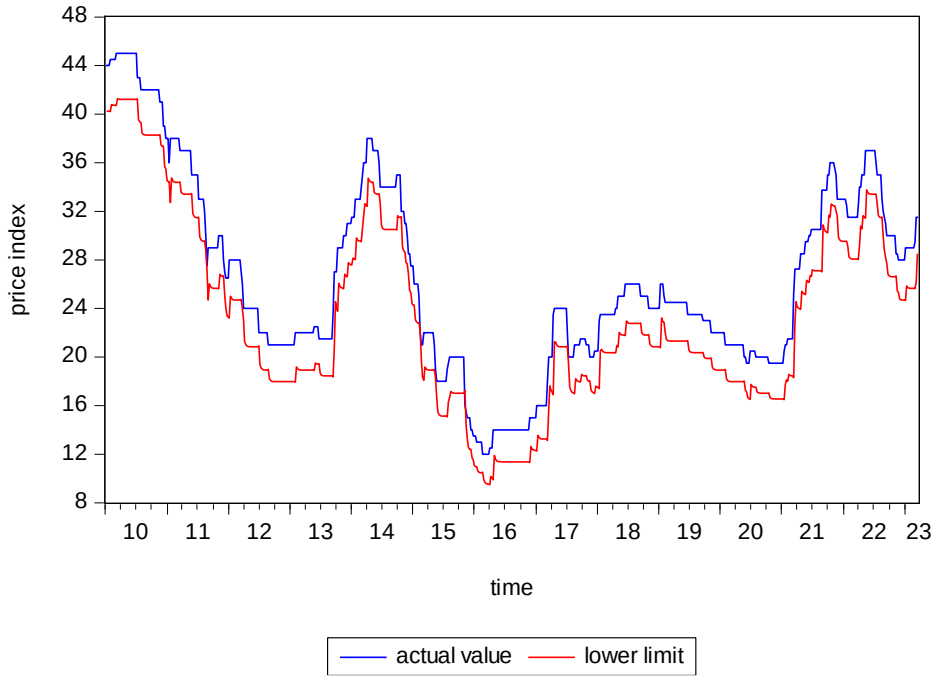


Figure 24 *Actual price index and forecast on the risk threshold contrast of secondhand 10-year-old 180K DWT Capesize bulk carriers*

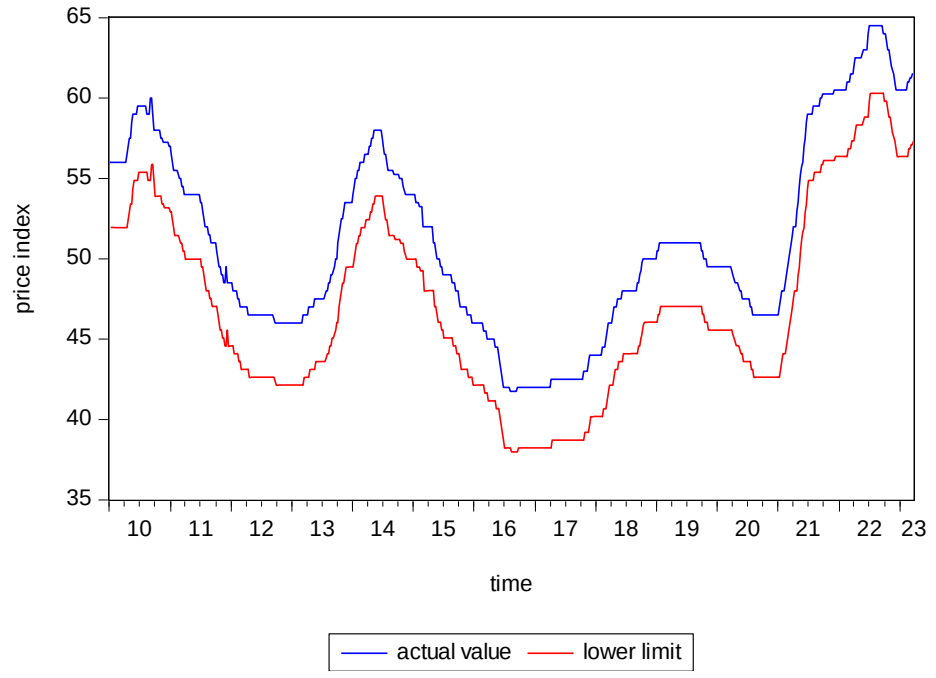


Figure 25 *Actual price index and forecast on the risk threshold contrast of new-building 180K DWT Capesize bulk carriers*

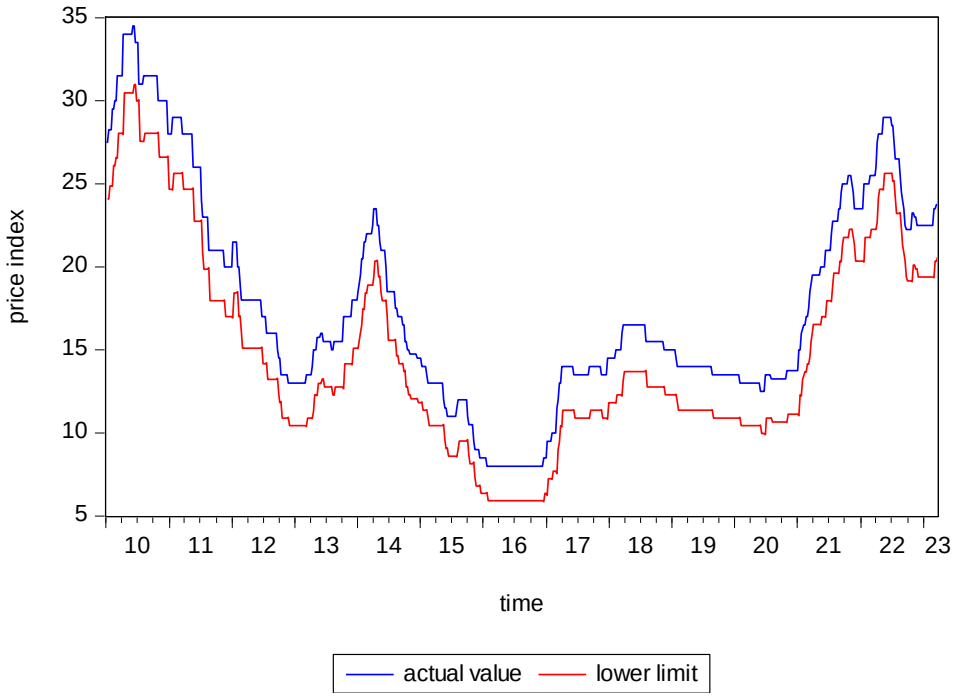


Figure 26 *Actual price index and forecast on the risk threshold contrast of second-hand 10-year-old 82K DWT Panamax bulk carrier*

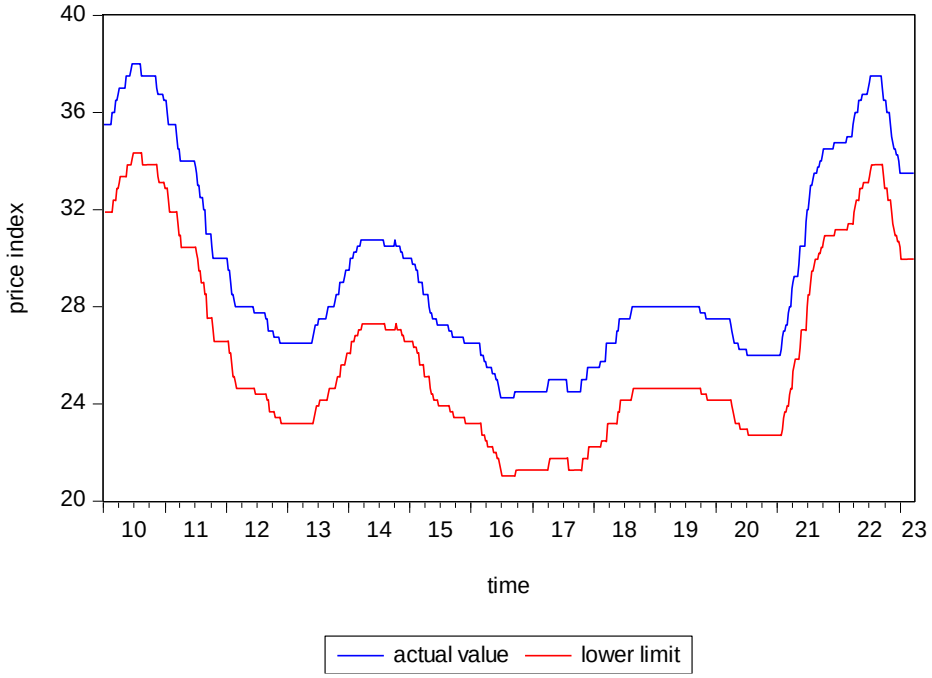


Figure 27 *Actual price index and forecast on the risk threshold contrast of new-building 82K DWT Panamax bulk carrier*

Based on the comparison between the actual data and predicted data above, the following statistical table can be summarized

Table 7 ***VaR test results based on failure rate***

Data	Confidence level	VaR quantity	Number of failures	Failure Rate	proportion	success or failure
Second hand capesize	99%	690	1	0.15%	1%	yes
Second hand capesize	95%	690	1	0.15%	5%	yes
New-building capesize	99%	690	0	0%	1%	yes
New-building capesize	95%	690	0	0%	5%	yes
Second hand panamax	99%	690	0	0%	1%	yes
Second hand panamax	95%	690	0	0%	5%	yes
New-building panamax	99%	690	0	0%	1%	yes
New-building panamax	95%	690	0	0%	5%	yes

Compared to the data, only one actual value of Secondhand capsize bulk carrier exceeded the predicted upper limit, with an actual value coverage rate of 99.85%, greater than $1-\alpha=0.99$, indicating high model accuracy. In order to further analyze the actual Value at risk of each ship type, VaR is statistically analyzed as follows.

Table 8 ***Statistical Data Table for VaR Results of Four Ship Types***

	mean value	median	Maximum value	minimum value	standard deviation	Proportion to actual value
Secondhand capesize	3.136891	3.139303	3.785458	1.630715	0.3331	11.88%
New-building capesize	3.961897	3.944175	4.217413	3.762304	0.118842	7.76%
Secondhand panamax	2.805285	2.740876	3.541012	2.079458	0.367463	15.87%
New-building panamax	3.401225	3.358281	3.667377	3.213377	0.131038	11.55%

From the data in the figure, the VaR value of second-hand 10-year-old 82K DWT Panamax bulk carrier accounts for 15.87% of the actual value, which means that during severe market fluctuations, the maximum loss within a week is 15.87% of the investment amount for purchasing ships, reflecting its volatility and high risk.

5.2 NJS's investment decision on dry bulk ships

Through the study of VaR model and GARCH model values, the following conclusions can be drawn:

The average VaR value of secondhand 10-year-old 180K DWT Capesize bulk carrier is relatively large, and the ratio to the actual value is also large, indicating that in the same investment environment, secondhand 10-year-old 180K DWT Capesize bulk carriers' investment risk value is relatively high. When the market fluctuates violently, the maximum loss that occurs within a week may reach 11.88% of the investment amount for purchasing ships. Unless the market situation is good and the transportation capacity is severely insufficient, purchasing can be considered.

The average VaR value of new-building 180K DWT Capesize bulk carrier is larger than that of Panamax bulk carrier, and its proportion to the actual value is small, indicating that the investment risk value of this type of ship is relatively small. When

the market fluctuates violently, the maximum loss that occurs within a week does not exceed 7.76% of the investment amount for purchasing ships. However, due to the high ship price, it is necessary to consider the financial situation when purchasing. If there are sufficient funds, consider investing in it.

The average VaR value of second-hand 10-year-old 82K DWT Panamax bulk carrier is relatively large and accounts for a large proportion of the actual value, indicating that the investment risk value of this type of ship is relatively high. When the market fluctuates violently, the maximum loss incurred within a week shall not exceed 15.87% of the investment amount for purchasing ships. Moreover, due to the low price of the ship, there is no need to consider the financial situation when purchasing. If the transportation capacity is insufficient, we can consider investing in it.

The average VaR value of new-building 82K DWT Panamax bulk carrier is small and accounts for a small proportion of the actual value, indicating that the investment risk value of this type of ship is relatively low. When the market fluctuates violently, the maximum loss incurred within a week shall not exceed 11.55% of the investment amount for purchasing ships. Moreover, due to the low ship price, its VaR value is also small. The ship type can be given priority consideration when purchasing.

From the data point of view, the Value at risk of the price index of new and second-hand Panamax bulk carriers is significantly lower than that of new and second-hand Capesize bulk carriers. The reason is that Panamax bulk carriers have small tonnage, many berths to call, strong adaptability, strong resistance to risks, and small losses in the market downturn. In terms of the selection of new ships and second-hand ships, the data shows that the risk resistance of new ship prices is stronger. However, due to the higher capital ratio required for new ships to be put into use and the time required for them to be put into use, new ships are more suitable for investment in times of

market downturn.

Chapter 4 provides a detailed analysis of the market environment for investment in dry bulk vessels, as well as the capital and transportation capacity of NJS. At present, the dry bulk shipping market is in a downturn. The self-raised funds of NJS are enough to purchase Panamax ship types, but not enough to purchase Capesize ship types. If it wants to purchase Capesize ship types, it must use other means of financing. Under the downturn of the financial market, capital risk will increase. The company is fully exploring routes from the Far East to the Americas and the Far East to the Mediterranean, and the purpose of purchasing new ships is to expand the capacity of the new routes.

Therefore, NJS should appropriately purchase new Panamax ships, then Panamax second-hand ships, and then Capesize new ships and Capesize second-hand ships.

5.3 NJS dry bulk ship investment risk management

Investors face multiple risks when choosing investment opportunities. This article mainly summarizes these risks as investor risk, shipping market risk, financial market risk, policy risk, and ship technology risk.

Among them, shipping market risk, ship technology risk, financial risk, and policy risk are external risks. NJS should strengthen prediction and prepare for emergencies in advance; Investor risk is an internal risk, and NJS should actively carry out prevention and control to avoid and reduce internal risks.

This section mainly proposes relevant control measures for controllable risks.

5.3.1 Investor risk control measures

Strengthen company information management and standardization construction. At present, NJS adopts Integrated Service Management (ISM) management information software, which integrates multiple business processes and service elements to enable the system to effectively manage services. The internationalization level of this system is not high and its universality is not strong. Therefore, NJS should keep up with the times, continuously update and upgrade its enterprise information management system, and even adopt more advanced world management systems to provide support for dry bulk investment decisions. Emphasize the construction and development of information systems to provide necessary information integration for dry bulk cargo operations. Furthermore, NJS should strengthen the coordination and organization of standardization work, standardize transportation facilities and equipment with strong universality such as pallets and barcodes, and align with international standards.

Guide investors to strengthen their learning of risk assessment knowledge and improve their investment judgment ability. Companies should focus on cultivating investors' relevant abilities, apply scientific investment evaluation methods, conduct rigorous analysis and argumentation, formulate scientific and reasonable investment decisions and risk control strategies, and lead enterprises towards the correct development direction.

5.3.2 Shipping market risk control measures

The shipping market risk mainly refers to the uncertainty encountered by NJS in ship operation, including the uncertainty of operating costs (fuel fees), fluctuations in market freight rates, and fluctuations in freight volume. The main risk control strategies are as follows.

1. Using Forward Freight Agreements

FFA is a combination of financial markets and shipping markets, and is a financial derivative based on freight rates. Specifically, it is a forward freight rate agreement reached between the buyer and seller, which specifies the determined route, price, quantity, etc. Both parties agree to collect or pay the difference between the actual Baltic Sea freight index and the contract price at a certain time point in the future, which is an effective freight rate risk avoidance tool. Due to the influence of the financial market on the shipping market, the freight index fluctuates frequently and has a large amplitude. This freight-based hedging can provide investors with a certain degree of insurance for their operations and enhance their risk resistance to the shipping market. At present, dry bulk forward freight contracts have become volatile, liquid, and tradable financial commodities.

NJS uses FFA for hedging, transferring the risk of freight changes to speculators willing to bear the risk, which is beneficial for operators to concentrate on operating the enterprise.

2. Exponential floating method

The index floating method is mainly used as a risk avoidance method for COA (Contract of Affreightment) transportation, which is usually a long-term contract with the freight rate fixed at the agreed price for a long time. Due to the long execution time of COA, which is usually more than a year, the market may rise and shipping companies may lose money; If the market drops, shippers will incur higher transportation costs compared to the future market. So sometimes when signing a COA contract, both parties will use the floating index method, which means that the COA freight rate changes from a fixed price to a floating price linked to the market

index, to avoid this risk. For example, it is stipulated that the average value of the corresponding route freight index in the first few days of cargo promotion is the freight rate of the cargo, which is to obtain a freight rate that meets market expectations; Or in the COA for several years, the freight price of each year is linked to the average index value of the previous year, so that both parties will not cause huge losses or opportunity cost due to market fluctuations, but at the same time, both parties in the COA will not generate huge profits due to market changes.

5.3.3 Financial market risk control measures

Financial market risks mainly include interest rate risk, exchange rate risk, and inflation risk. The controllable measures for financial risks mainly include the following.

1. Combining Own Ships and Charter Ships

Based on changes in the market environment and predictions of the development trend of dry bulk shipping, adjust the proportion of owned and leased ships to effectively avoid and reduce operational risks. Owning a ship is beneficial for strengthening enterprise control over shipping, reducing operational risks to a certain extent, but at the same time increasing enterprise costs. Ship leasing involves cooperation issues with leasing companies, increasing operational risks. NJS currently leases 8 dry bulk vessels and expects to purchase 2 vessels; NJS is gradually exploring the best ship combination method based on its own specific situation and drawing on the relevant experience of advanced enterprises in the same industry.

2. Observing changes in the foreign exchange market

When signing the terms of the intervention foreign exchange contract, choosing a favorable currency can be achieved through foreign exchange trading methods such as forward foreign exchange trading, forward foreign exchange trading, and currency futures trading. Adopting reasonable financial tools to avoid risks and accelerate capital turnover.

5.3.4 Policy risk control measures

1. Establish a policy risk management mechanism

NJS should establish a sound policy risk management mechanism, formulate corresponding policy risk management systems and processes, clarify the responsible persons and work processes for policy risk management, timely identify and evaluate policy risks, and develop response measures.

2. Diversified business strategy

NJS should adopt a diversified business strategy to reduce their dependence on a certain industry or product and minimize the impact of policy risks on the enterprise. At the same time, enterprises should actively expand domestic and international markets to reduce the risk of a single market.

5.3.5 Ship technology risk control measures

By participating in various ship type markets, it is possible to effectively reduce ship technology risks. Due to the extremely uneven fluctuations in freight rates of various ship types in the international dry bulk market, the daily rental levels of various ship types may sometimes differ significantly. Due to the different requirements for ship types on different routes and the different influencing factors of various ship types'

freight rates, changes in some local markets often lead to sharp changes in some ship types' freight rates, while ship types that are not on their routes are less affected. The potential market risks brought by these routes and ship types often have a huge impact on investors who operate relatively single ship types. Therefore, NJS can choose several different ship types according to its own needs and participate in different route competitions to minimize risks.

Chapter 6 Conclusion and Recommendation

6.1 Conclusion

This research elaborates on the concept and characteristics of ship investment, introduces relevant theories on investment risk assessment, summarizes the five main factors that affect the investment risk of dry bulk ships, and based on these five influencing factors, conducts a qualitative analysis of the internal and external environment of NJS's dry bulk ship investment. Based on investment environment analysis, identify the investment risks of NJS, and divide the main risks faced by the company into investor risks, shipping market risks, financial stock market risks, policy risks, and ship technology risks.

In addition, it makes a quantitative analysis of the ship price in the shipping market risk and uses VAR model and GARCH model to evaluate the investment Value at risk. Finally, a combination of qualitative and quantitative analysis is used to provide the most suitable ship type decision for NJS's investment, and to provide risk control measures for dry bulk ship investment. On the one hand, it reduces NJS's investment risk, and on the other hand, it provides some suggestions and inspiration for other similar shipping companies.

By using the VAR model and GARCH model to calculate the VaR values of each dry bulk cargo ship, the following investment decision results can be obtained: the average VaR value of secondhand 10-year-old 180K DWT Capesize bulk carrier is relatively large, and the ratio to the actual value is also large, indicating that in the same investment environment, secondhand 10-year-old 180K DWT Capesize bulk carriers' investment risk value is relatively high. The average VaR value of new-building 180K DWT Capesize bulk carrier is larger than that of Panamax bulk carrier,

and its proportion to the actual value is small, indicating that the investment risk value of this type of ship is relatively small. The average VaR value of second-hand 10-year-old 82K DWT Panamax bulk carrier is relatively large and accounts for a large proportion of the actual value, indicating that the investment risk value of this type of ship is relatively high. The average VaR value of new-building 82K DWT Panamax bulk carrier is small and accounts for a small proportion of the actual value, indicating that the investment risk value of this type of ship is relatively low. Therefore, NJS should appropriately purchase new Panamax ships, then Panamax second-hand ships, and then Capesize new ships and Capesize second-hand ships.

Different risk control measures should be taken for different types of risks. In investor risk control measures, NJS should strengthen company information management and standardization construction, and guide investors to strengthen their learning of risk assessment knowledge. In the risk avoidance measures of the shipping market, NJS should use forward freight contracts and index floating methods. In financial market risk prevention measures, NJS should adopt a combination of self-owned and chartered ships, as well as reasonable financial tools to avoid risks. In policy risk control measures, NJS should establish a policy risk management mechanism and adopt a diversified business strategy. In ship technology risk prevention measures, NJS can reduce risks by participating in various ship type markets.

6.2 Recommendation

Shipping companies should attach importance to managing investment risks. In the qualitative analysis section, this study analyzed the investment risks of internal and external shipping companies in five aspects, thus determining the risk control measures for NJS. However, in real life, shipping companies may generate different

risks based on the size of the enterprise, different countries, and different historical backgrounds. The investment decisions in this article can be used as a reference for various shipping companies. In the quantitative analysis section, the risk of investment decisions is determined through the analysis of ship prices, without quantitative analysis of freight rates, fuel prices, and exchange rates. Further research can be conducted on these aspects.

There are also shortcomings in this research. When evaluating the Value at risk, the price index of other ship types in the dry bulk market was not considered. Secondly, this article only uses the GARCH model based on GED and does not use other distribution and GARCH family class models for calculation. Finally, due to the lack of practical experience, the consideration of Value at risk is not comprehensive enough and further improvement is needed.

Reference

Arfaoui, N., & Yousaf, I. (2022). Impact of COVID-19 on volatility spillovers across international markets: evidence from VAR asymmetric BEKK GARCH model. Annals of Financial Economics (AFE), 17(01), 1-25.

Bauwens, L., Laurent, S., & Rombouts, J. V. (2006). Multivariate GARCH models: a survey. Journal of applied econometrics, 21(1), 79-109.

Bendell, B. L. (2022). Environmental investment decisions of family firms—An analysis of competitor and government influence. Business Strategy and the Environment, 31(1), 1-14.

Hao, Ying, Liu, Xing, and Lin, Chaonan. (2005). An empirical study of overconfidence and investment decisions of executives of listed companies in China. China Management Science (05). doi:10.16381/j.cnki.issn1003-207x.2005.05.025.

Huang, Y., Dai, X., Wang, Q., & Zhou, D. (2021). A hybrid model for carbon price forecasting using GARCH and long short-term memory network. Applied Energy, 285, 116485.

IMI. (2023). Review of the International Dry Bulk Transport Market in Week 12, 2023. Retrieved from: http://www.simic.net.cn/news-show.php?id=265700.

Juselius, K. (2006). The cointegrated VAR model: methodology and applications. Oxford university press.

Lenza, M., & Primiceri, G. E. (2020). How to Estimate a VAR after March 2020 (No. w27771). National Bureau of Economic Research.

Li Cangshu & Shen Yan (2019). Identification, Measurement, and Prevention of Risks in New Financial Formats in the Digital Economy Era Managing the World (12), 53-69. doi: 10.19744/j.cnki.11-1235/f.2019.0163.

Liao Li, Li Mengran&Wang Zhengdi (2014). Smart investors: incomplete marketization interest rate and risk identification - evidence from P2P Peer-to-peer lending Economic Research (07), 125-137.

Ministry of Transport. (2022, March 17). gov.cn, from Website of the Ministry of Transport: http://www.gov.cn/xinwen/2022-03/17/content_5679521.htm

Mittal, S. K. (2022). Behavior biases and investment decision: theoretical and research framework. Qualitative Research in Financial Markets, 14(2), 213-228.

Pan, Yue, Dai, Yiyi, Wu, Chaopeng & Liu, Jianliang. (2009). Social capital, political relations and corporate investment decisions. Economic Studies (11), 82-94.Banerjee, P., & Dutta, S. (2022). The effect of political risk on investment decisions. Economics Letters, 212, 110301.

Power, M. (2004). The risk management of everything. The Journal of Risk Finance, 5(3), 58-65.

Rokhayati, H., Sholihin, M., Supriyadi, S., & Nahartyo, E. (2022). The effect of regulatory focus and performance measurement on corporate social responsibility investment decisions. Social Responsibility Journal, 18(5), 1004-1018.

Sachdeva, M., Lehal, R., Gupta, S., & Gupta, S. (2022). Influence of contextual factors on investment decision-making: a fuzzy-AHP approach. Journal of Asia Business Studies.

Shao, R. Q.. (2003). A review of international shipping investment decision making research. Journal of Transportation Engineering (04), 116-120.

SISI. (2023). 2022 International Dry Bulk Market Annual Report. Retrieved from SISI: http://sisi-smu.org/2023/0308/c8845a197228/page.htm

State Statistical Bureau. (2023). Statistical Bulletin on National Economic and Social Development of the People's Republic of China in 2022. Retrieved from http://www.stats.gov.cn/sj/zxfb/202302/t20230228_1919011.html

Stoneburner, G., Goguen, A., & Feringa, A. (2002). Risk management guide for information technology systems. Nist special publication, 800(30), 800-30.

Vee, D. C., Gonpot, P. N., & Sookia, N. (2011). Forecasting Volatility of USD/MUR Exchange Rate using a GARCH (1, 1) model with GED and Student’st errors. University of Mauritius research journal, 17, 1-14.

Wang Libo. (2022). Analysis of risk factors of electric ship investment decision. China Maritime (11), 64-67. doi:10.16831/j.cnki.issn1673-2278.2022.11.021.

Xia, Q., & Chen, F. (2022). Shipping Economics Development: A Review from the Perspective of the Shipping Industry Chain for the Past Four Decades. Journal of Shanghai Jiaotong University (Science), 27(3), 424-436.

Zhang Jijun. (2000). Fuzzy hierarchical analysis (FAHP). Fuzzy Systems and Mathematics (02), 80-88.

Zheng Xian'an (2022). Discussion on Enterprise Risk Management Issues and Improvement Measures Administrative Assets and Finance (24), 37-39

Zhou Zhiyi. (2022). Research on optimization of group decision making in platform-based enterprises in the digital economy. Investment and Entrepreneurship(19),152-154.

Appendix

Raw data：The following are the prices for new and second-hand dry bulk vessels of various ship types:

Date	second har new		secondhan new	
01-Jan-2010	3.78419	4.025352	3.314186	3.569533
08-Jan-2010	3.78419	4.025352	3.314186	3.569533
15-Jan-2010	3.78419	4.025352	3.341093	3.569533
22-Jan-2010	3.78419	4.025352	3.341093	3.569533
29-Jan-2010	3.795489	4.025352	3.341093	3.569533
05-Feb-2010	3.795489	4.025352	3.38439	3.569533
12-Feb-2010	3.795489	4.025352	3.38439	3.569533
19-Feb-2010	3.795489	4.025352	3.401197	3.583519
26-Feb-2010	3.795489	4.025352	3.401197	3.583519
05-Mar-2010	3.806662	4.025352	3.449988	3.583519
12-Mar-2010	3.806662	4.025352	3.449988	3.597312
19-Mar-2010	3.806662	4.025352	3.449988	3.597312
26-Mar-2010	3.806662	4.025352	3.449988	3.604138
02-Apr-2010	3.806662	4.025352	3.449988	3.610918
09-Apr-2010	3.806662	4.025352	3.526361	3.610918
16-Apr-2010	3.806662	4.034241	3.526361	3.610918
23-Apr-2010	3.806662	4.043051	3.526361	3.610918
30-Apr-2010	3.806662	4.051785	3.526361	3.610918
07-May-2010	3.806662	4.051785	3.526361	3.610918
14-May-2010	3.806662	4.069027	3.526361	3.624341
21-May-2010	3.806662	4.077537	3.526361	3.624341
28-May-2010	3.806662	4.077537	3.526361	3.624341
04-Jun-2010	3.806662	4.077537	3.540959	3.624341
11-Jun-2010	3.806662	4.077537	3.540959	3.630985
18-Jun-2010	3.806662	4.085976	3.511545	3.637586
25-Jun-2010	3.806662	4.085976	3.511545	3.637586
02-Jul-2010	3.806662	4.085976	3.511545	3.637586
09-Jul-2010	3.7612	4.085976	3.433987	3.637586
16-Jul-2010	3.7612	4.085976	3.433987	3.637586
23-Jul-2010	3.7612	4.085976	3.433987	3.637586
30-Jul-2010	3.73767	4.085976	3.433987	3.637586
06-Aug-2010	3.73767	4.085976	3.449988	3.637586
13-Aug-2010	3.73767	4.077537	3.449988	3.624341
20-Aug-2010	3.73767	4.077537	3.449988	3.624341
27-Aug-2010	3.73767	4.077537	3.449988	3.624341
03-Sep-2010	3.73767	4.094345	3.449988	3.624341
10-Sep-2010	3.73767	4.094345	3.449988	3.624341
17-Sep-2010	3.73767	4.077537	3.449988	3.624341
24-Sep-2010	3.73767	4.060443	3.449988	3.624341
01-Oct-2010	3.73767	4.060443	3.449988	3.624341
08-Oct-2010	3.73767	4.060443	3.449988	3.624341
15-Oct-2010	3.73767	4.060443	3.449988	3.624341
22-Oct-2010	3.73767	4.060443	3.449988	3.624341
29-Oct-2010	3.73767	4.060443	3.401197	3.624341
05-Nov-2010	3.73767	4.051785	3.401197	3.624341
12-Nov-2010	3.73767	4.051785	3.401197	3.610918
19-Nov-2010	3.713572	4.047428	3.401197	3.604138
26-Nov-2010	3.713572	4.047428	3.401197	3.604138
03-Dec-2010	3.713572	4.047428	3.401197	3.604138
10-Dec-2010	3.663562	4.047428	3.401197	3.604138
17-Dec-2010	3.663562	4.047428	3.401197	3.604138
24-Dec-2010	3.637586	4.043051	3.332205	3.597312
31-Dec-2010	3.637586	4.043051	3.332205	3.597312
07-Jan-2011	3.637586	4.034241	3.332205	3.597312
14-Jan-2011	3.583519	4.025352	3.332205	3.583519
21-Jan-2011	3.637586	4.016383	3.367296	3.569533
28-Jan-2011	3.637586	4.016383	3.367296	3.569533
04-Feb-2011	3.637586	4.016383	3.367296	3.569533
11-Feb-2011	3.637586	4.016383	3.367296	3.569533
18-Feb-2011	3.637586	4.011868	3.367296	3.569533
25-Feb-2011	3.637586	4.007333	3.367296	3.569533
04-Mar-2011	3.637586	4.007333	3.367296	3.569533
11-Mar-2011	3.637586	3.998201	3.367296	3.555348
18-Mar-2011	3.610918	3.998201	3.332205	3.540959
25-Mar-2011	3.610918	3.988984	3.332205	3.540959
01-Apr-2011	3.610918	3.988984	3.332205	3.526361
08-Apr-2011	3.610918	3.988984	3.332205	3.526361
15-Apr-2011	3.610918	3.988984	3.332205	3.526361
22-Apr-2011	3.610918	3.988984	3.332205	3.526361
29-Apr-2011	3.610918	3.988984	3.332205	3.526361
06-May-2011	3.610918	3.988984	3.332205	3.526361
13-May-2011	3.610918	3.988984	3.332205	3.526361
20-May-2011	3.610918	3.988984	3.258097	3.526361
27-May-2011	3.555348	3.988984	3.258097	3.526361
03-Jun-2011	3.555348	3.988984	3.258097	3.526361
10-Jun-2011	3.555348	3.988984	3.258097	3.526361
17-Jun-2011	3.555348	3.988984	3.258097	3.526361
24-Jun-2011	3.555348	3.988984	3.258097	3.526361
01-Jul-2011	3.555348	3.979682	3.258097	3.51898
08-Jul-2011	3.496508	3.979682	3.178054	3.511545
15-Jul-2011	3.496508	3.970292	3.135494	3.496508
22-Jul-2011	3.496508	3.960813	3.135494	3.496508
29-Jul-2011	3.496508	3.951244	3.135494	3.48124
05-Aug-2011	3.496508	3.951244	3.135494	3.48124
12-Aug-2011	3.465736	3.951244	3.135494	3.48124
19-Aug-2011	3.401197	3.941582	3.044522	3.465736
26-Aug-2011	3.314186	3.941582	3.044522	3.465736
02-Sep-2011	3.367296	3.931826	3.044522	3.433987
09-Sep-2011	3.367296	3.931826	3.044522	3.433987
16-Sep-2011	3.367296	3.931826	3.044522	3.433987
23-Sep-2011	3.367296	3.931826	3.044522	3.433987
30-Sep-2011	3.367296	3.931826	3.044522	3.433987
07-Oct-2011	3.367296	3.921973	3.044522	3.417727
14-Oct-2011	3.367296	3.912023	3.044522	3.401197
21-Oct-2011	3.367296	3.901973	3.044522	3.401197
28-Oct-2011	3.367296	3.901973	3.044522	3.401197
04-Nov-2011	3.401197	3.89182	3.044522	3.401197
11-Nov-2011	3.401197	3.89182	3.044522	3.401197
18-Nov-2011	3.401197	3.881564	2.995732	3.401197
25-Nov-2011	3.401197	3.881564	2.995732	3.401197
02-Dec-2011	3.332205	3.901973	2.995732	3.401197
09-Dec-2011	3.295837	3.881564	2.995732	3.401197
16-Dec-2011	3.277145	3.881564	2.995732	3.401197
23-Dec-2011	3.277145	3.881564	2.995732	3.401197
30-Dec-2011	3.277145	3.881564	2.995732	3.401197
06-Jan-2012	3.332205	3.881564	3.068053	3.401197
13-Jan-2012	3.332205	3.871201	3.068053	3.38439
20-Jan-2012	3.332205	3.871201	3.068053	3.38439
27-Jan-2012	3.332205	3.871201	3.068053	3.367296
03-Feb-2012	3.332205	3.871201	2.995732	3.349904
10-Feb-2012	3.332205	3.86073	2.995732	3.349904
17-Feb-2012	3.332205	3.86073	2.944439	3.341093
24-Feb-2012	3.332205	3.850148	2.890372	3.332205
02-Mar-2012	3.332205	3.850148	2.890372	3.332205
09-Mar-2012	3.332205	3.850148	2.890372	3.332205
16-Mar-2012	3.295837	3.850148	2.890372	3.332205
23-Mar-2012	3.258097	3.850148	2.890372	3.332205
30-Mar-2012	3.178054	3.850148	2.890372	3.332205
06-Apr-2012	3.178054	3.850148	2.890372	3.332205
13-Apr-2012	3.178054	3.839452	2.890372	3.332205
20-Apr-2012	3.178054	3.839452	2.890372	3.332205
27-Apr-2012	3.178054	3.839452	2.890372	3.332205
04-May-2012	3.178054	3.839452	2.890372	3.332205
11-May-2012	3.178054	3.839452	2.890372	3.332205
18-May-2012	3.178054	3.839452	2.890372	3.332205
25-May-2012	3.178054	3.839452	2.890372	3.332205
01-Jun-2012	3.178054	3.839452	2.890372	3.332205
08-Jun-2012	3.178054	3.839452	2.890372	3.332205
15-Jun-2012	3.178054	3.839452	2.890372	3.323236
22-Jun-2012	3.178054	3.839452	2.833213	3.323236
29-Jun-2012	3.091042	3.839452	2.833213	3.323236
06-Jul-2012	3.091042	3.839452	2.833213	3.323236
13-Jul-2012	3.091042	3.839452	2.833213	3.323236
20-Jul-2012	3.091042	3.839452	2.772589	3.323236
27-Jul-2012	3.091042	3.839452	2.772589	3.323236
03-Aug-2012	3.091042	3.839452	2.772589	3.323236
10-Aug-2012	3.091042	3.839452	2.772589	3.323236
17-Aug-2012	3.091042	3.839452	2.772589	3.323236
24-Aug-2012	3.044522	3.839452	2.772589	3.314186
31-Aug-2012	3.044522	3.839452	2.772589	3.314186
07-Sep-2012	3.044522	3.839452	2.772589	3.295837
14-Sep-2012	3.044522	3.834061	2.772589	3.295837
21-Sep-2012	3.044522	3.828641	2.70805	3.295837
28-Sep-2012	3.044522	3.828641	2.674149	3.295837
05-Oct-2012	3.044522	3.828641	2.674149	3.295837
12-Oct-2012	3.044522	3.828641	2.60269	3.286534
19-Oct-2012	3.044522	3.828641	2.60269	3.286534
26-Oct-2012	3.044522	3.828641	2.60269	3.286534
02-Nov-2012	3.044522	3.828641	2.60269	3.286534

09-Nov-2012	3.044522	3.828641	2.60269	3.286534
16-Nov-2012	3.044522	3.828641	2.60269	3.277145
23-Nov-2012	3.044522	3.828641	2.564949	3.277145
30-Nov-2012	3.044522	3.828641	2.564949	3.277145
07-Dec-2012	3.044522	3.828641	2.564949	3.277145
14-Dec-2012	3.044522	3.828641	2.564949	3.277145
21-Dec-2012	3.044522	3.828641	2.564949	3.277145
28-Dec-2012	3.044522	3.828641	2.564949	3.277145
04-Jan-2013	3.044522	3.828641	2.564949	3.277145
11-Jan-2013	3.044522	3.828641	2.564949	3.277145
18-Jan-2013	3.044522	3.828641	2.564949	3.277145
25-Jan-2013	3.044522	3.828641	2.564949	3.277145
01-Feb-2013	3.091042	3.828641	2.564949	3.277145
08-Feb-2013	3.091042	3.828641	2.564949	3.277145
15-Feb-2013	3.091042	3.828641	2.564949	3.277145
22-Feb-2013	3.091042	3.828641	2.564949	3.277145
01-Mar-2013	3.091042	3.828641	2.564949	3.277145
08-Mar-2013	3.091042	3.839452	2.60269	3.277145
15-Mar-2013	3.091042	3.839452	2.60269	3.277145
22-Mar-2013	3.091042	3.839452	2.60269	3.277145
29-Mar-2013	3.091042	3.839452	2.60269	3.277145
05-Apr-2013	3.091042	3.839452	2.60269	3.277145
12-Apr-2013	3.091042	3.850148	2.639057	3.277145
19-Apr-2013	3.091042	3.850148	2.70805	3.277145
26-Apr-2013	3.091042	3.850148	2.70805	3.277145
03-May-2013	3.091042	3.850148	2.70805	3.277145
10-May-2013	3.091042	3.850148	2.75684	3.277145
17-May-2013	3.091042	3.86073	2.75684	3.277145
24-May-2013	3.113515	3.86073	2.75684	3.277145
31-May-2013	3.113515	3.86073	2.772589	3.286534
07-Jun-2013	3.113515	3.86073	2.772589	3.295837
14-Jun-2013	3.113515	3.86073	2.74084	3.305054
21-Jun-2013	3.068053	3.86073	2.74084	3.305054
28-Jun-2013	3.068053	3.86073	2.74084	3.305054
05-Jul-2013	3.068053	3.86073	2.74084	3.314186
12-Jul-2013	3.068053	3.86073	2.74084	3.314186
19-Jul-2013	3.068053	3.865979	2.74084	3.314186
26-Jul-2013	3.068053	3.871201	2.74084	3.314186
02-Aug-2013	3.068053	3.871201	2.70805	3.314186
09-Aug-2013	3.068053	3.881564	2.70805	3.314186
16-Aug-2013	3.068053	3.881564	2.74084	3.314186
23-Aug-2013	3.068053	3.89182	2.74084	3.323236
30-Aug-2013	3.068053	3.89182	2.74084	3.332205
06-Sep-2013	3.068053	3.896909	2.74084	3.332205
13-Sep-2013	3.157	3.901973	2.74084	3.332205
20-Sep-2013	3.295837	3.912023	2.74084	3.332205
27-Sep-2013	3.295837	3.912023	2.74084	3.332205
04-Oct-2013	3.295837	3.931826	2.74084	3.332205
11-Oct-2013	3.367296	3.941582	2.833213	3.341093
18-Oct-2013	3.367296	3.951244	2.833213	3.349904
25-Oct-2013	3.367296	3.960813	2.833213	3.349904
01-Nov-2013	3.367296	3.960813	2.833213	3.349904
08-Nov-2013	3.367296	3.970292	2.833213	3.367296
15-Nov-2013	3.401197	3.979682	2.833213	3.367296
22-Nov-2013	3.401197	3.979682	2.833213	3.367296
29-Nov-2013	3.401197	3.979682	2.890372	3.367296
06-Dec-2013	3.433987	3.979682	2.890372	3.37588
13-Dec-2013	3.433987	3.979682	2.890372	3.38439
20-Dec-2013	3.433987	3.979682	2.890372	3.38439
27-Dec-2013	3.433987	3.979682	2.890372	3.38439
03-Jan-2014	3.449988	3.988984	2.917771	3.38439
10-Jan-2014	3.449988	3.998201	2.944439	3.401197
17-Jan-2014	3.449988	4.007333	2.970414	3.401197
24-Jan-2014	3.496508	4.007333	3.020425	3.401197
31-Jan-2014	3.496508	4.016383	3.020425	3.409496
07-Feb-2014	3.496508	4.016383	3.068053	3.409496
14-Feb-2014	3.496508	4.025352	3.068053	3.409496
21-Feb-2014	3.496508	4.025352	3.091042	3.417727
28-Feb-2014	3.526361	4.025352	3.091042	3.417727
07-Mar-2014	3.555348	4.025352	3.091042	3.417727
14-Mar-2014	3.583519	4.034241	3.091042	3.42589
21-Mar-2014	3.583519	4.034241	3.091042	3.42589
28-Mar-2014	3.583519	4.034241	3.113515	3.42589
04-Apr-2014	3.637586	4.034241	3.157	3.42589
11-Apr-2014	3.637586	4.043051	3.157	3.42589
18-Apr-2014	3.637586	4.043051	3.157	3.42589
25-Apr-2014	3.637586	4.051785	3.113515	3.42589
02-May-2014	3.637586	4.051785	3.113515	3.42589
09-May-2014	3.610918	4.060443	3.068053	3.42589
16-May-2014	3.610918	4.060443	3.044522	3.42589
23-May-2014	3.610918	4.060443	3.044522	3.42589
30-May-2014	3.610918	4.060443	3.044522	3.42589
06-Jun-2014	3.610918	4.060443	3.044522	3.42589
13-Jun-2014	3.583519	4.060443	2.995732	3.42589
20-Jun-2014	3.526361	4.060443	2.917771	3.42589
27-Jun-2014	3.526361	4.051785	2.917771	3.42589
04-Jul-2014	3.526361	4.043051	2.917771	3.42589
11-Jul-2014	3.526361	4.034241	2.917771	3.42589
18-Jul-2014	3.526361	4.034241	2.917771	3.42589
25-Jul-2014	3.526361	4.025352	2.917771	3.42589
01-Aug-2014	3.526361	4.016383	2.917771	3.417727
08-Aug-2014	3.526361	4.016383	2.862201	3.417727
15-Aug-2014	3.526361	4.016383	2.862201	3.417727
22-Aug-2014	3.526361	4.016383	2.833213	3.417727
29-Aug-2014	3.526361	4.016383	2.833213	3.417727
05-Sep-2014	3.526361	4.011868	2.833213	3.417727
12-Sep-2014	3.526361	4.011868	2.833213	3.417727
19-Sep-2014	3.526361	4.011868	2.80336	3.417727
26-Sep-2014	3.555348	4.011868	2.80336	3.417727
03-Oct-2014	3.555348	4.011868	2.74084	3.42589
10-Oct-2014	3.555348	4.007333	2.74084	3.417727
17-Oct-2014	3.555348	4.007333	2.70805	3.417727
24-Oct-2014	3.465736	4.007333	2.70805	3.417727
31-Oct-2014	3.465736	3.998201	2.691243	3.417727
07-Nov-2014	3.465736	3.993603	2.691243	3.409496
14-Nov-2014	3.433987	3.988984	2.691243	3.409496
21-Nov-2014	3.433987	3.988984	2.691243	3.401197
28-Nov-2014	3.401197	3.988984	2.691243	3.401197
05-Dec-2014	3.349904	3.988984	2.691243	3.401197
12-Dec-2014	3.349904	3.988984	2.674149	3.401197
19-Dec-2014	3.314186	3.988984	2.674149	3.401197
26-Dec-2014	3.314186	3.988984	2.674149	3.401197
02-Jan-2015	3.314186	3.988984	2.674149	3.401197
09-Jan-2015	3.258097	3.988984	2.639057	3.401197
16-Jan-2015	3.258097	3.979682	2.639057	3.392829
23-Jan-2015	3.258097	3.979682	2.639057	3.392829
30-Jan-2015	3.258097	3.979682	2.639057	3.392829
06-Feb-2015	3.218876	3.974998	2.60269	3.38439
13-Feb-2015	3.091042	3.974998	2.564949	3.38439
20-Feb-2015	3.044522	3.974998	2.564949	3.367296
27-Feb-2015	3.044522	3.951244	2.564949	3.367296
06-Mar-2015	3.091042	3.951244	2.564949	3.367296
13-Mar-2015	3.091042	3.951244	2.564949	3.367296
20-Mar-2015	3.091042	3.951244	2.564949	3.349904
27-Mar-2015	3.091042	3.951244	2.564949	3.349904
03-Apr-2015	3.091042	3.951244	2.564949	3.349904
10-Apr-2015	3.091042	3.951244	2.564949	3.349904
17-Apr-2015	3.091042	3.951244	2.564949	3.349904
24-Apr-2015	3.091042	3.951244	2.564949	3.332205
01-May-2015	3.091042	3.931826	2.564949	3.323236
08-May-2015	3.044522	3.931826	2.564949	3.323236
15-May-2015	2.944439	3.921973	2.484907	3.314186
22-May-2015	2.890372	3.912023	2.442347	3.314186
29-May-2015	2.890372	3.912023	2.442347	3.314186
05-Jun-2015	2.890372	3.912023	2.397895	3.314186
12-Jun-2015	2.890372	3.901973	2.397895	3.305054
19-Jun-2015	2.890372	3.901973	2.397895	3.305054
26-Jun-2015	2.890372	3.89182	2.397895	3.305054
03-Jul-2015	2.890372	3.89182	2.397895	3.305054
10-Jul-2015	2.890372	3.89182	2.397895	3.305054
17-Jul-2015	2.890372	3.89182	2.397895	3.305054
24-Jul-2015	2.944439	3.89182	2.397895	3.305054
31-Jul-2015	2.970414	3.89182	2.442347	3.305054
07-Aug-2015	2.995732	3.89182	2.484907	3.305054
14-Aug-2015	2.995732	3.89182	2.484907	3.305054
21-Aug-2015	2.995732	3.881564	2.484907	3.295837
28-Aug-2015	2.995732	3.881564	2.484907	3.295837
04-Sep-2015	2.995732	3.881564	2.484907	3.295837
11-Sep-2015	2.995732	3.871201	2.484907	3.286534
18-Sep-2015	2.995732	3.871201	2.484907	3.286534
25-Sep-2015	2.995732	3.871201	2.484907	3.286534
02-Oct-2015	2.995732	3.86073	2.397895	3.286534
09-Oct-2015	2.995732	3.850148	2.351375	3.286534
16-Oct-2015	2.995732	3.850148	2.351375	3.286534
23-Oct-2015	2.995732	3.850148	2.351375	3.286534
30-Oct-2015	2.995732	3.850148	2.351375	3.286534
06-Nov-2015	2.772589	3.850148	2.251292	3.286534
13-Nov-2015	2.74084	3.850148	2.197225	3.286534
20-Nov-2015	2.70805	3.839452	2.197225	3.277145
27-Nov-2015	2.70805	3.839452	2.197225	3.277145
04-Dec-2015	2.70805	3.839452	2.197225	3.277145
11-Dec-2015	2.639057	3.839452	2.140066	3.277145
18-Dec-2015	2.639057	3.828641	2.140066	3.277145
25-Dec-2015	2.60269	3.828641	2.140066	3.277145
01-Jan-2016	2.60269	3.828641	2.140066	3.277145
08-Jan-2016	2.60269	3.828641	2.140066	3.277145
15-Jan-2016	2.564949	3.828641	2.140066	3.277145
22-Jan-2016	2.564949	3.828641	2.079442	3.277145
29-Jan-2016	2.564949	3.828641	2.079442	3.277145
05-Feb-2016	2.564949	3.828641	2.079442	3.277145
12-Feb-2016	2.564949	3.828641	2.079442	3.277145
19-Feb-2016	2.484907	3.828641	2.079442	3.277145
26-Feb-2016	2.484907	3.817712	2.079442	3.258097
04-Mar-2016	2.484907	3.817712	2.079442	3.258097
11-Mar-2016	2.484907	3.817712	2.079442	3.258097
18-Mar-2016	2.484907	3.806662	2.079442	3.248435
25-Mar-2016	2.484907	3.806662	2.079442	3.248435
01-Apr-2016	2.525729	3.806662	2.079442	3.238678
08-Apr-2016	2.525729	3.806662	2.079442	3.238678
15-Apr-2016	2.525729	3.806662	2.079442	3.238678
22-Apr-2016	2.639057	3.806662	2.079442	3.238678
29-Apr-2016	2.639057	3.806662	2.079442	3.238678
06-May-2016	2.639057	3.795489	2.079442	3.228826
13-May-2016	2.639057	3.795489	2.079442	3.228826
20-May-2016	2.639057	3.795489	2.079442	3.228826
27-May-2016	2.639057	3.78419	2.079442	3.218876
03-Jun-2016	2.639057	3.772761	2.079442	3.218876
10-Jun-2016	2.639057	3.7612	2.079442	3.208825
17-Jun-2016	2.639057	3.749504	2.079442	3.198673
24-Jun-2016	2.639057	3.73767	2.079442	3.188417
01-Jul-2016	2.639057	3.73767	2.079442	3.188417
08-Jul-2016	2.639057	3.73767	2.079442	3.188417
15-Jul-2016	2.639057	3.73767	2.079442	3.188417
22-Jul-2016	2.639057	3.73767	2.079442	3.188417
29-Jul-2016	2.639057	3.73767	2.079442	3.188417
05-Aug-2016	2.639057	3.731699	2.079442	3.188417
12-Aug-2016	2.639057	3.731699	2.079442	3.188417
19-Aug-2016	2.639057	3.731699	2.079442	3.188417
26-Aug-2016	2.639057	3.731699	2.079442	3.188417
02-Sep-2016	2.639057	3.731699	2.079442	3.188417
09-Sep-2016	2.639057	3.731699	2.079442	3.188417
16-Sep-2016	2.639057	3.73767	2.079442	3.198673
23-Sep-2016	2.639057	3.73767	2.079442	3.198673
30-Sep-2016	2.639057	3.73767	2.079442	3.198673
07-Oct-2016	2.639057	3.73767	2.079442	3.198673
14-Oct-2016	2.639057	3.73767	2.079442	3.198673
21-Oct-2016	2.639057	3.73767	2.079442	3.198673
28-Oct-2016	2.639057	3.73767	2.079442	3.198673
04-Nov-2016	2.639057	3.73767	2.079442	3.198673
11-Nov-2016	2.639057	3.73767	2.079442	3.198673
18-Nov-2016	2.639057	3.73767	2.079442	3.198673
25-Nov-2016	2.70805	3.73767	2.079442	3.198673
02-Dec-2016	2.70805	3.73767	2.079442	3.198673
09-Dec-2016	2.70805	3.73767	2.079442	3.198673
16-Dec-2016	2.70805	3.73767	2.140066	3.198673
23-Dec-2016	2.70805	3.73767	2.140066	3.198673
30-Dec-2016	2.70805	3.73767	2.140066	3.198673
06-Jan-2017	2.772589	3.73767	2.251292	3.198673
13-Jan-2017	2.772589	3.73767	2.251292	3.198673
20-Jan-2017	2.772589	3.73767	2.251292	3.198673
27-Jan-2017	2.772589	3.73767	2.251292	3.198673
03-Feb-2017	2.772589	3.73767	2.302585	3.198673
10-Feb-2017	2.772589	3.73767	2.302585	3.198673
17-Feb-2017	2.772589	3.73767	2.302585	3.198673
24-Feb-2017	2.772589	3.73767	2.302585	3.198673
03-Mar-2017	2.772589	3.73767	2.442347	3.198673
10-Mar-2017	2.890372	3.73767	2.484907	3.198673
17-Mar-2017	2.995732	3.73767	2.564949	3.198673
24-Mar-2017	2.995732	3.73767	2.564949	3.198673
31-Mar-2017	2.995732	3.73767	2.639057	3.208825
07-Apr-2017	2.995732	3.749504	2.639057	3.218876
14-Apr-2017	3.157	3.749504	2.639057	3.218876
21-Apr-2017	3.178054	3.749504	2.639057	3.218876
28-Apr-2017	3.178054	3.749504	2.639057	3.218876
05-May-2017	3.178054	3.749504	2.639057	3.218876
12-May-2017	3.178054	3.749504	2.639057	3.218876
19-May-2017	3.178054	3.749504	2.639057	3.218876
26-May-2017	3.178054	3.749504	2.639057	3.218876
02-Jun-2017	3.178054	3.749504	2.639057	3.218876
09-Jun-2017	3.178054	3.749504	2.60269	3.218876
16-Jun-2017	3.178054	3.749504	2.60269	3.218876
23-Jun-2017	3.178054	3.749504	2.60269	3.218876
30-Jun-2017	3.178054	3.749504	2.60269	3.218876
07-Jul-2017	3.091042	3.749504	2.60269	3.218876
14-Jul-2017	2.995732	3.749504	2.60269	3.218876
21-Jul-2017	2.995732	3.749504	2.60269	3.218876
28-Jul-2017	2.995732	3.749504	2.60269	3.198673
04-Aug-2017	2.995732	3.749504	2.60269	3.198673
11-Aug-2017	2.995732	3.749504	2.60269	3.198673
18-Aug-2017	3.044522	3.749504	2.60269	3.198673
25-Aug-2017	3.044522	3.749504	2.60269	3.198673
01-Sep-2017	3.044522	3.749504	2.60269	3.198673
08-Sep-2017	3.044522	3.749504	2.639057	3.198673
15-Sep-2017	3.044522	3.749504	2.639057	3.198673
22-Sep-2017	3.068053	3.749504	2.639057	3.198673
29-Sep-2017	3.068053	3.749504	2.639057	3.198673
06-Oct-2017	3.068053	3.749504	2.639057	3.198673
13-Oct-2017	3.068053	3.749504	2.639057	3.198673
20-Oct-2017	3.068053	3.7612	2.639057	3.218876
27-Oct-2017	3.044522	3.7612	2.639057	3.218876
03-Nov-2017	3.044522	3.7612	2.639057	3.218876
10-Nov-2017	3.044522	3.7612	2.639057	3.218876
17-Nov-2017	2.995732	3.772761	2.60269	3.218876
24-Nov-2017	2.995732	3.78419	2.60269	3.238678
01-Dec-2017	2.995732	3.78419	2.60269	3.238678
08-Dec-2017	2.995732	3.78419	2.60269	3.238678
15-Dec-2017	3.020425	3.78419	2.60269	3.238678
22-Dec-2017	3.020425	3.78419	2.674149	3.238678
29-Dec-2017	3.020425	3.78419	2.674149	3.238678
05-Jan-2018	3.020425	3.78419	2.674149	3.238678
12-Jan-2018	3.135494	3.78419	2.674149	3.238678
19-Jan-2018	3.157	3.78419	2.674149	3.238678
26-Jan-2018	3.157	3.78419	2.674149	3.238678
02-Feb-2018	3.157	3.78419	2.674149	3.238678
09-Feb-2018	3.157	3.795489	2.70805	3.248435
16-Feb-2018	3.157	3.795489	2.70805	3.248435
23-Feb-2018	3.157	3.795489	2.70805	3.248435
02-Mar-2018	3.157	3.806662	2.70805	3.248435
09-Mar-2018	3.157	3.817712	2.70805	3.248435
16-Mar-2018	3.157	3.828641	2.772589	3.277145
23-Mar-2018	3.157	3.828641	2.80336	3.277145
30-Mar-2018	3.157	3.828641	2.80336	3.277145
06-Apr-2018	3.157	3.828641	2.80336	3.277145
13-Apr-2018	3.157	3.839452	2.80336	3.277145
20-Apr-2018	3.178054	3.850148	2.80336	3.277145
27-Apr-2018	3.178054	3.850148	2.80336	3.277145
04-May-2018	3.218876	3.850148	2.80336	3.277145
11-May-2018	3.218876	3.86073	2.80336	3.277145
18-May-2018	3.218876	3.86073	2.80336	3.295837
25-May-2018	3.218876	3.86073	2.80336	3.295837
01-Jun-2018	3.218876	3.86073	2.80336	3.314186
08-Jun-2018	3.218876	3.871201	2.80336	3.314186
15-Jun-2018	3.258097	3.871201	2.80336	3.314186
22-Jun-2018	3.258097	3.871201	2.80336	3.314186
29-Jun-2018	3.258097	3.871201	2.80336	3.314186
06-Jul-2018	3.258097	3.871201	2.80336	3.314186
13-Jul-2018	3.258097	3.871201	2.80336	3.314186
20-Jul-2018	3.258097	3.871201	2.80336	3.314186
27-Jul-2018	3.258097	3.871201	2.80336	3.314186
03-Aug-2018	3.258097	3.871201	2.74084	3.314186

10-Aug-2018	3.258097	3.871201	2.74084	3.323236
17-Aug-2018	3.258097	3.871201	2.74084	3.332205
24-Aug-2018	3.258097	3.871201	2.74084	3.332205
31-Aug-2018	3.258097	3.871201	2.74084	3.332205
07-Sep-2018	3.258097	3.881564	2.74084	3.332205
14-Sep-2018	3.218876	3.881564	2.74084	3.332205
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23-Nov-2018	3.178054	3.912023	2.70805	3.332205
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