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PERFORMANCE EVALUATION OF UNDERWRITING IN SHIP FINANCING*

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Abstract

The subject of this paper is the performance evaluation of the shipping finance underwriting. Insurance included in shipping finance is crucial for the financier to obtain as little credit as possible and we examine how the financing ship is sufficiently protected by the ship finance insurance. The complexity of ratios reports provides a perception of profitability in terms of percentages. This will be suitable for comparing companies and default ratios over time within the shipping business. The result of the model is formulated based on shipping companies in the world. We have analyzed the financial information based on the end result at companies' fiscal year of all shipping firms since 2011 till at the end of 2016, according to their financial statements. Our approach provides confidence intervals for the default probability of each rating. The probability of default interval can be adjusted by choosing an appropriate level of confidence.

Keywords: Finance insurance; Risk-adjusted value of underwriting; Reserve effects; Underwriting effects; Credit rating; Default.

JEL Classification: G22, M4, N2, N7

Öz

Bu çalışmanın konusu, gemi finansman sigortasında performans değerlemesidir. Bu model denizcilik firmalarının kredi ödemelerinde yaşayacakları zorlukların sigorta prim hesaplama ve karşılık ayırma teknikleri üzerindeki etkilerini incelemektedir. Gemi finansmanı sırasında istenen gemi finansman sigortası, kredi sağlayanlar açısından geri ödemelerde doğabilecek riski en az seviyede tutulmasında önem arz etmektedir. Bu tezde gemi finansman sigortasının kreditörlere sağladığı koruma incelenmiştir. Hesaplamalarımızda kullandığımız verilerin tümü dünyada halka açık olan 298 denizcilik şirketinin mali tablolarının incelenmesi ile oluşmaktadır. 2011 ve 2016 dönemi arasındaki halka açık denizcilik şirketlerinin tamamının mali tablolarına göre finansal verileri incelenerek rasyo analizleri yapılmıştır. Kullandığımız model denizcilik firmalarının kredi ödemelerinin zamanında yapamama ihtimalinin yüzdesel olarak ifade edilmesini sağlamaktadır. Bu çalışma denizcilik firmalarının finansmanından

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doğan borç ödeme risklerinin analizini yapmaktadır. Oluşturduğumuz model ile, her kredi notuna göre farklı güven aralıkları analizi yapılmakta ve kredilerin zamanında ödememe riski ise farklı güven aralıkları seçilerek hesaplanabilmektedir.

Anahtar Kelimeler: Finansman sigortası; Riske göre düzeltilmiş değer, Rezerv Etkileri; Değerleme etkileri, Ödeme riski.

JEL Sınıflaması: G22, M4, N2, N7

1. Introduction

The underwriting of ship finance is an assessment of the owner's guarantee of payment by the insurance company, usually the insurance company will give you the guarantor of the debtor's approved financier. Underwriting is a detailed and systematic analysis of the creditworthiness of the enhanced borrower, including company history, financial statements, performance and income, openly available information and independent credit reports. The maritime sector is considered as a commodity with signs of high capital and high risk and underperforming, financing prospects of the most difficult ships. Insurance refers to the structured process used by financial service providers such as banks, investors or insurance companies to identify and evaluate the risk of a potential customer. In the insurance industry, the practice of underwriting refers to the process of accepting or rejecting risks. Basically, underwriting consists of two components; risk assessment and pricing. It is the very heart of insurance and is the first step taken by an insurance company to generate premiums (Mhyr and Markham, 2003). Initially, insurance and subscription were identical. That is, the subscription refers to the operation of the insurance company. The underwriting process is intended to determine the credit needs, the quality of the collateral assets to be used to support the borrowing, and the borrower's ability to repay the debt. Upon completion of a formal underwriting process and a summary presented to a credit committee within the Financier, the Financier will either approve or reject the request for a loan (Becker, 2010). When the insurance industry developed, underwriting took a more specialized meaning. the method of determining what loss exposure will be insured, for what number of insurance, at what price, and under what situations is called underwriting. the process of underwriting involves four basic functions; a) Origination, Rating, Application, b) Ship Finance Due Diligence – Underwriting assessment (Financial Statement Analysis, Commercial Due Diligence, Surveying Analysis, Strategic Planning, Subjective Judgement), c) Contract Negotiation (Market Price, Fair Value, Present Value Estimate of FCF), d) Monitoring – Contract Execution. By performing these four functions, the underwriter increases the possibility of ensuring a safe and cost-effective distribution of risks. This is achieved first by looking for where insurance is part of the financing structure of ships. The insurance that involves the financing of the ships is vital for the lender to get the maximum possible credit risk and we look at how the loan for the ships is adequately protected through insurance of the naval financing.

The ship financier wants to minimize the credit risk by having the vessel as guarantee for the loan. Underwriting indicates to the practice used by financial institutions such as banks, investors or insurers to determine and assess the risk from a potential customer. The periodic change in the international transport market requires investors ship right capture investment opportunities. Ship investment lender could not only help financing, but also helped the shipping companies run efficiently. If the contracts are properly designed, the lenders have an incentive to see that a freight operation is carried out efficiently – it increases the likelihood that the investment is safe and profitable as expected. Conventional types of values taken for finance capital base is insufficient when the asset is a ship. Ship investment lenders could not only help to provide the financing, but also help to ensure that a shipping business run efficiently. Ship finance insurance is the one of the significant innovations of modern shipping finance. The ship finance insurance allows the parties to the deal to manage and spread risk, to take advantage of arbitrage opportunities, or to invest in new classes of risk that enhance market efficiency. the insurance cover, from a ship financier 's perspective, many times provide inadequate protection, something that is even more common during financial hardship. There are however measures available for the ship financier to take in order to gain a stronger position and thus achieve a smaller credit risk. What is important though is for the financiers to obtain knowledge about the potential coverage difficulties and also to learn how these can be limited as far as possible. Insurance liabilities are, by their very nature, uncertain. The insurance industry exists to buy the uncertainty of the insured by transferring at least part of this uncertainty for a price. Insurers offer this advantage in exchange for the payment of an early amount of money called premium. Shipping is a contribution to a wide range of business and an important factor for long-term growth. The underwriting of ship-financing refers to the ability to anticipate the future unpredictable negative elements and their ability to influence the value of the ships. Compared to the financing risks in other areas, the transport of finance sending their own characteristics to explain what kind of risk and risk elements.

2. Literature Review

Merchant ships are very expensive vessels; some ships can reach up to 500 million USD. These huge investments mean that the shipping industry is one of the world's most capital-intensive industries. This means that financing is an important factor for the maritime industry, especially in times of new investments. Shipment is an activity that is considered highly volatile, cyclical, intensive and often directed at capital. This can create a difficulty for shipping companies when they have to make interest payments and capital deductions in a depressed transportation market because they do not have adequate financial flows to comply with their contracts. The review of research literature in the underwriting estimates highlights the problems faced by those seeking to identify the correct estimation model and those who want to apply it. Bourgeon, Picard, and Pouyet (2008) develop an alternative theory of insurance market dynamics based on two assumptions. First, insured risks are dependent. Under this assumption, insurers' net worth determines the market capacity since it is necessary to back the contractual promises to pay defaults. Second, in raising net worth, external equity is costlier than internal equity. Equilibrium

price also might be affected if policyholders and/or re/insurers change their loss expectations after events such as catastrophes, leading to increased prices. Thus, the price increases follow the loss shocks because of constriction in supply and increased demand. The risky debt hypothesis predicts that policyholders are willing to pay higher premiums for greater financial quality, loss shocks that deplete the capital surplus of the firm are hypothesized to affect prices by driving insurers away from their optimal capital structures (Jean-Marc Bourgeon 2008). There are several aspects and performance evaluation techniques of the shipping companies in literature, and the crucial argument is to select a correct method according to the purpose of study. Shipping companies' leverage is completely a function of a company's demand for debt (Stiglitzand Weiss 1981). Faulkender and Petersen emphasize that empirical analyzes, when considering the use of a company, provide not only determinants of the company's preferred influence – the demand side, but also the factors that influence the limitations of influence. They argue that the ability of a company to issue public (assessed) debt can be interpreted as an indicator of high debt (Faulkender and Petersen 2006). Cummins and Danzon (1997) developed a model of price determination in insurance markets. Insurance is provided by firms that are subject to default risk. Demand for insurance is inversely related to insurer default risk and is imperfectly price elastic because of information asymmetries and private information in insurance markets. the model predicts that the price of insurance, measured by the ratio of premiums to discounted losses, is inversely related to insurer default risk and that insurers have optimal capital structures. Price may increase or decrease following a loss shock that depletes the insurer's capital, depending on factors such as the effect of the shock on the price elasticity of demand (Cummins and Danzon 1997). Girard (2000) focused on the main issue of the market assessment of responsibility. When using the actuarial calculation method or option method, the assumptions used should correspond to the market value. In this way, we are sure that our valuation is in line with the law of a price. Shipping companies offer a credit rating that has easier entree to debt markets, those without a rating, and therefore eligible companies will have more strength to use. This can materialize directly within a quantity channel (lenders are willing to lend more) or a price channel. Either way, Faulkender and Petersen document that opening up a new supply of debt capital increases a firm's leverage. In the literature of bankruptcy expectation, Altman (1968), Ohlson (1980) and Zmijewski (1984) are the highest quoted based on financial variables. Their bankruptcy models use different explanatory variables and statistical techniques. Therefore, the predictive power of these bankruptcy models differs. Dionne (2013) isolated major risk management issues such as lack of incentive agreements in the presence of information asymmetry, poor grades of structured products from credit rating agencies, poor pricing of complex financial products and poor regulation of structured finance. Risk management and underwriting go hand in hand. Chieng-Chung et al (2013) attempted to combine risk theory perception in insurance companies or property liability insurance with insurance, risk, and establish a link between risk management and the decision of the risk management strategy. Risk management was identified, a major part of the insurance process. Insurance performance and the outlook of the insured world do not reveal a visible pattern. This is because the insurance performance is a predetermined estimate and reflects the individual's performance. The risk can be avoided through preventive

measures that include risk management. Since the premiums are the result of the future-losses, any changes in interest-rates would-induce changes in-premiums and the interest rates could be a cause of cycles. While there is no evidence that interest rates are themselves-cyclical, an unexpected-change in interest rate can lead to external-shocks that could generate an insurance cycle, Doherty and Garven (1992), Haley (1993), Lamb Tennant and Weiss (1997), Fung, Lai, Patterson and Witt (1998). Nicolas Berman, Jos´e de Sousa, Philippe Martin, Thierry Mayer, they show that the negative impact of financial crises on international trade is magnified for destinations with longer time-to-ship. They analyze a specific theoretical mechanism that could explain this time-to-ship effect. Exporters react to an increase in the probability of default of importers by increasing their export price and decreasing their export volumes to the destination in crisis (Berman et al. 2012). Victoria Ivashina and David Scharfstein, they have argued that cyclical variation in the demand for loan participations—whether through shocks to bank capital or variation in investor sentiment—can help to explain variation in the lead share and thus also increase the cyclicality of credit. One limitation of this analysis is that I have ignored the role of securitization in the syndication process (Ivashina & Scharfstein 2008). Doherty and Garven (1995) show that changes in interest-rates simultaneously affect the insurer's-capital structure and the equilibrium-underwriting profit. Depending upon-asset and shipping finance maturity-structure, capital market-access, and reinsurance availability, insurers will be differently affected by changing interest rates. the average market response to changing interest rates roughly tracks market clearing prices. These cyclical effects are enhanced for firms with mismatched assets and ships and costlier access to new capital and reinsurance. This evidence supports the capacity constraint hypothesis. Avenhuis uses a logistic regression analysis to estimate probability of default for non-financial companies. His study is concerned not only with the predictive ability of the model, but also the model's coefficient estimates. Four variables are included in his final model: total liabilities over total assets; total assets over GNP price-level index; some performance measure (Avenhuis 2013).

3. Role of Underwriting in Shipping Finance

Given the origins of the international freight market and the complexity and uncertainty of internal and external conditions, it is necessary to analyze, evaluate and evaluate transport companies to find the unresolved elements of this situation to control and maximize the creation of companies. This reduces the risk of ship financing. The unsafe elements of political, cultural, financial, fiscal and government policies, etc., which can affect the macroscopic economic conditions, will affect the operation of the ship. Risk in economical circumstance refers to the uncertain elements that exist in economy and influence the profit perspective of shipping enterprise which in normal cases will not be able to control the pattern of change of these risks (Aven, 2003). The value from a valuation model is influenced by ship-specific and market-related information. In some cases, new information may affect the assessment of all ships in a sector. It is unrealistic to expect or require absolute collateral in valuation, as cash flow and discount rate are incorrectly estimated. This also means that you have a reasonable margin for errors by providing recommendations

based on reviews. Every resource, both economic and real, has a value. Ships that are assets like any other, the traditional criteria for the valuation of investments in companies, can also apply to ships. The key to investing and managing these assets is to understand not only what the value is, but also the basis for the value. To find out what a ship is worth. The most important questions are: "What is worthwhile for me?" We focus on these questions by first focusing the valuation of pricing in a complete market structure and then also incorporating incomplete market-based procurement practices. Equal questions are known and are dealt with within the economic option theory of pricing. Therefore, the market model of the pricing option matches the practical applicability of the shipping finance insurance rates. For more practical rates, similarities and differences, let us outline insurance and option pricing in a parallel approach. In order to be an effective guaranty, a marine finance model could produce different types of production both economically and analytically. The evaluation, basically, remains the same no matter what type of company you are analyzing. There are three groups of companies where the evaluation of the valuation becomes more difficult and estimates of the value. the first group comprises companies with negative returns. Given the dependence of most models on pay growth to make projections for the future, the analysts have to evaluate approaches that make the outcome positive at least over time. You can do this by normalizing revenue in the current period or adjusting the margins from today's level to a sustainable level over time or reducing the impact. The approach used depends on why the company is primarily negative. The other group of carriers, in which estimates are hard to make, are young companies with little or no financial history. Here, information on comparable shipping companies can replace historical data and analysts can assess the inputs required for the assessment. The third group of shipping companies where the valuation can be difficult are unique companies with few or no comparable companies. The most effective way to avoid the risk of ship financing is to strengthen the work of collecting and analyzing political and economic information from other countries in order better to anticipate future political risk through information processing and reliability in the experience of the past.

4. Shipping Finance Underwriting Risk

Risks can be defined as deviations of the reasonable value of assets and liabilities between expectations and realizations related to the various factors that affect the value of cash flows. Once the insurance company has received an application, the guarantor has the responsibility to assess the risk and classify it according to the possibility of compensation. The insurance department will show whether the risk is to be accepted and, if so, how the policy is issued. Insurance companies cannot assume that a proposed insurance element represents an average risk of loss. Once the risk is accepted, the insurance company classifies and classifies the policy. Normally, a series of unsafe classifications are assigned before a definitive risk classification decision is reached. The purpose of using classifications is to separate risks into similar groups to which rates can be assigned. Insurers may have their own classification and rating system, or they may obtain a system from a rating agency. Besides the borrower's credit rating, most lending institutions use two primary underwriting requirements to determine whether a borrower will

be approved for the requested loan amount. After determining the acceptability of an applicant and assigning the proper classification and rating, the underwriter is ready to issue an insurance policy (Standard *et al*. 2011).

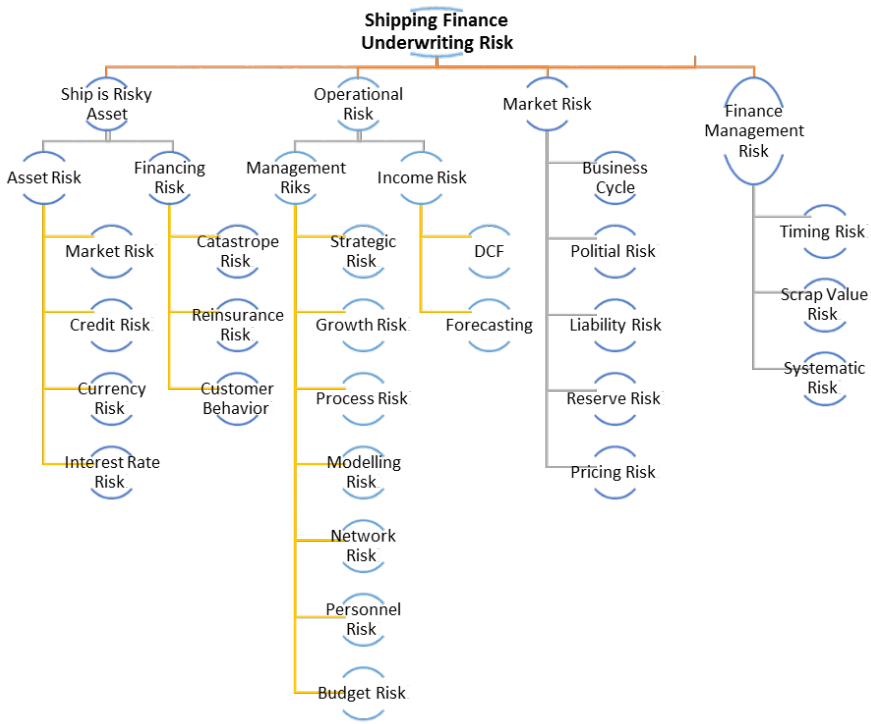
The underwriter needs to know the various types of policies available and can modify the form according to the requirements of the insurer. The three initial subscription tasks; classification and qualification, risk selection and policy selection, are interdependent. That is, the insurer determines that a certain risk is acceptable when using identified rates and methods. By taking a factor of election costs into account. There must be a balance between strictly assured in the selection standards and the need to maintain a large number of risk units. Assessment underwriting is so far too dependent on survey analysis. Most instruments attempt to reduce complexity by analyzing historical data such as annual reports or ratings by rating agencies and credit bureaus. In addition to these historical or topographical analyzes, the risk assessment should also include improved assessments based on open and confidential documents such as business cases and strategic owner plans, as well as individual experience and analyst knowledge of the company and its management, known in the industry, past market experience.

If it is possible to organize a-financing mechanism through exchange-for cash-in a-deep, wide and open market, the market fair-value. In-some situations, there-is a market, but the market cannot be an appropriate value. If there is no market for the exact same instrument, the market value-of similar ships, for the differences between the instrument adjusted and similar-instruments; When it comes to risks such as mortality, morbidity or ship-damage, the replication does not portfolios in today's-investment-markets. If no-market-value is available and no-suitable-similar-ships are available, use a present value-estimate-of-future cash-flows. This cash value should be an adjustment to the risk or due to the considerations above, do not represent the real price, the fair price is calculated as the current value of the cash flow. The present price-approach is a reasonable-approach to market value when executed properly. This applies in particular to financial instruments in which it is generally possible to estimate-future cash flows for-the instrument. Ships, the risky property guarantee can be divided into three main groups.

- The uncertainty about the time and size of the standard to be identified. The timetable for the standard to be provided by the insurance company depends on the conditions laid down in the terms of the contract and, moreover, on the nature of the cover financing arrangements for the ship finance insurance.
- The risk associated with the service of the insurance-company. This risk category relates-to the cost of the company as well as to the cost of the product. The actual amount of expenditure is not only the efficient operation of the company but is also influenced by external factors such as inflation.
- The ability of the borrowers to continue to pay the premiums. The continued premium is reflected in the risk of cancellation, cancellation or payment of the options available before expiry of the term of the agreement.

Interest rate risk derives from fluctuations in lending rates, which accentuate the financial problems of shipping companies when interest rates increase and firms must refinance their loans at a higher floating rate (Fabozzi *et al.* 2003). Common shipping insurance features include the existence of guarantees for the premium rate and / or the default period during the contract period. This is reflected in the performance levels for ship finance insurance contracts. In parallel, companies may also be exposed to currency risks if the currency of their income is not the nominal value of liabilities or operating costs. Insurance companies require capital to operate, and securities companies require compensation for the risk of their capital. The greater the risk, the greater the compensation. They can also include basic risks such as management errors, the implementation, deployment, and processing of client strategies, products, and business practices. These risks may include legal risks or registration risks for the insurance company. Many of the risks associated with ship financing insurance are very correlated. For example, the return on investment can influence future benefits through credit, which at the same time creates a competitive (disadvantageous) benefit that influences ship rates and freight rates for future maritime markets.

Figure 1: Shipping Finance Underwriting Risk



5. Methodology – Ship Finance Underwriting Pricing Model

In a recent article, Schuermann and Hanson present a methodology to estimate PDs by means of migration matrices duration method (Jafry and Schuermann, 2004). Ship finance insurance falls within the general category of risk-shifting insurance, whereby the chance or probability of loss is shifted to the insurance carrier. As such, credit insurance is under the umbrella of true ship finance insurance where the matter insured will definitely occur at some probability of occurrence, and the economic purpose is to spread the risk over a large pool of insureds. Every asset, both economic and real, has a value. Ships that are investment as something else can be the traditional criteria for the assessment of investment in any industry also apply to ships. The key to investing and managing these activities is to understand not only value but also value sources. The value of an assessment model is affected by specific information on boats and the market. In some cases, new information may affect the assessment of all ships in a sector. It is not realistic to expect or require an absolute assurance in the valuation, as the cash flow and the discount rate are incorrectly evaluated. This also means that you have a reasonable margin for errors in providing feedback-based suggestions. This paper-gives a new methodology-for obtaining-probability of defaults (PD) [4] of shipping firms for expected loss of the rating grades which can be further used in internal rating based approach of finance risk in ship finance. Common bank routines for the original probability of default values for such exposures are often focused on qualitative planning tools for bank-based primary or external notes. These practices, while customary in industry, do not fully satisfy the requirement of a statistical basis for expected PD values. A key contribution to modern credit risk modeling and management techniques is the borrower's default probability. As such, the accuracy of PD estimates determines the quality of the results of the ship financing risk models. We are studying and comparing two stages of difficulty by estimating a predefined distribution. If we stimulate the default distribution as accurately as possible. We receive significant long-term statistics. While the economic and social environment is changing. As a result, statistics must be adjusted with a trend type of value. One of the problems here is the estimate of this trend value. Another issue is the estimate of standard distribution as stochastic distribution.

We use an actuarial method of complexity, which will be the basis of our calculation. Mathematically, complexity is initially a process two function (i) and b (i) operation providing a third function, which is actually the user-defined version of one of the original features. Here we have two probability advantages that return a modified new distribution that forms the-cross of these-distributions. Under the assumption of relatively low-cost shipping and purchasing markets and informed customers, the business credit continues to be driven mainly by three measurements of credit guarantee, cost and risk costs combined with price gain. Examples of factors that should be considered for the subscription risk are,

- uncertainty about future defaults
- incorrect pricing due to poor data or inappropriate method

4 Default probability (PD) is a financial term that describes the probability of default in a given time horizon. Provides an estimate of the likelihood that a borrower will not be able to meet his debt obligations.

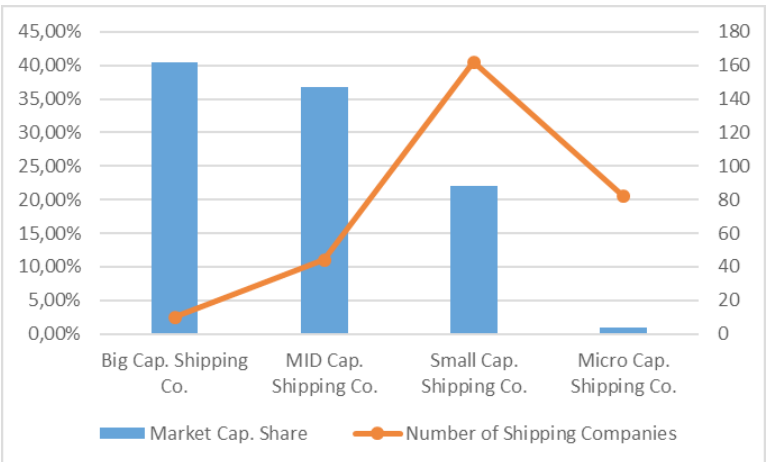
- the impact of a rapid growth of the business volume due to underpricing or, conversely, a decrease in the premium volume through over-pricing
- the lack of insurance guarantees, Such as inadequate approval strategy or disregard of insurance certificates and formulation guidelines
- a potentially catastrophic aggregation of default
- the geographic mix of business, including risk concentration and lack of diversification
- unreliable reinsurance programs, lack of availability of appropriate reinsurance,

Our model uses only the total quantity of ship owners and the total quantity of default values in each class. One of our main-concerns is to use the weight of the default of each class within the regular portfolio, which is achieved with the Bayesian theorem.

6. Data Description

The data sample consists of 298 shipping companies in the period 2011– 2016. The financial and detailed data for the companies were gathered from the end of year outlook, whereas the industry specific variable for the shipping market was created using data collected from Rasyonet, Transportation & Port Industry report. In our analysis, a number of variables were used and tested to predict the likelihood that the company's default would take place in a year. The study studied several aspects of the organization's operational and financial performance, such as efficiency, liquidity and profitability. For most reports, an acceptable level is determined in comparison with relationships between companies in the same industry. These relationships are usually of two type; a comparison of elements between years or a comparison of elements in the same year. The number of conditions that can be calculated is large and many conditions make it important to choose the right conditions.

Figure 2: Shipping Companies Comparison by Market Capital



The figure 2 above shows for the scaling the number of companies in each credit ratings according to their market capital. Credit rating is scaled from 'AAA', 'AA', 'A', 'BBB', 'BB', 'B' to 'CCC" level. Credit grades are an indication of the probability that a company will repay its debts on time. As such, ratifications improve the information flow between institutional-finances – (investors) and borrowers – (issuers) and reduce the investor's costs for the collection, analysis and monitoring of financial positions of borrowers. The financiers are distributed to rating grades 'AAA', 'AA', 'A', 'BBB', 'BB', 'B', and 'CCC', with frequencies 'nAAA', 'nAA', 'nA', 'nBBB', 'nBB', 'nB' and 'nCCC'. The grade with the highest credit worthiness is indicated by AAA, the grade with the lowest creditworthiness is denoted by 'CCC'. There are some important ratios to analyze for financiers before investing money in shipping companies. All parts are equally important when conducting a financial statement analysis. However, the balance sheet and income statement are of special interest as they are used for financial statement modeling, forecasting future financial statements and valuating of the firm. So, the purpose of the analysis is to forecast future cash flows. The industrial rating is used to find the credit premium which is used to analyze the cost of capital. The industrial rating represents the default risk of the firm. Rating of AAA to BBB is considered investment grade, rating of BB to B is considered speculative and CCC and below is considered high risk and in default.

7. Global Shipping Industry's Rating

The influence of the company is completely a function of the company's demand for debt (Stiglitz and Weiss, 1981). Faulkender and Petersen (2006) emphasize that empirical analyzes, when considering the use of a company, contain not only determinants of the company's preferred influence – the demand side but also the factors that influence the limits of influence – the offer side. However, – firms-are sometimes-rationed-by financiers based on-surveys, report that an important goal of chief financial officers – (CFOs) – is to maintain financial flexibility (Graham and Harvey, 2001).

They argue that the ability of an enterprise to issue public debt can be interpreted as an indicator of high financing capacity. Companies with creditworthiness have easier access to the debt markets than those who do not have a rating, and thus the rated companies will have more influence. This result can be either directly across a volume channel (finances are ready to borrow more) or a price channel, companies with access to a cheaper source of capital borrow more). Either way, Faulkender and Petersen document that opening up a new supply of debt capital increases a firm's leverage (Faulkender and Petersen 2006). The fact of having a credit rating involves collecting and processing information through the rating agency and therefore the public rating companies suffer from less pronounced data irregularity so that public sector firms experience from asymmetry of less pronounced information.

As a result, companies that have a rating can use a pecking contract perspective to reduce debt and increase equity. As emphasized by Frank and Goyal (2009), however, this effect is ambiguous

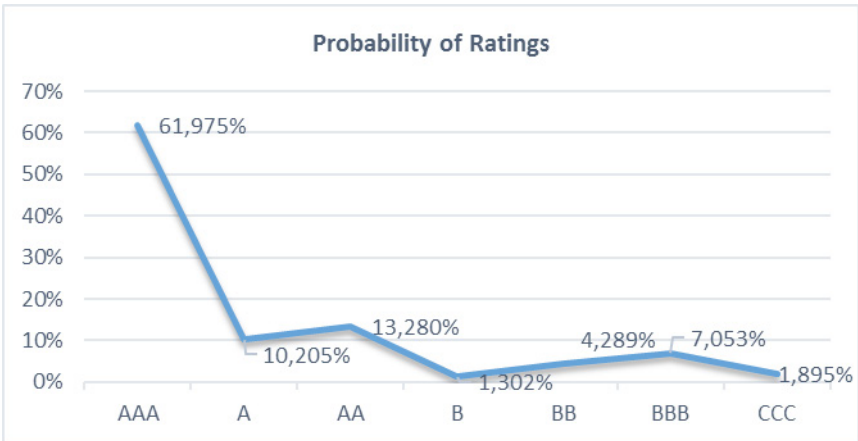
as lower adverse selection costs increase the frequency with which firms tap the external capital market, potentially resulting in more debt. Shipping earning expectations is negative at the moment in 2016 because EBITDA ratios will worsen, with freight rates likely to remain depressed during sufficient amount of supply. One of the leading example is that South Korean shipping giant. The Hanjin-Shipping was declared bankrupt by a South Korean court after months of uncertainty at Feb.2017. Hanjin-Shipping has been one of the 10 best companies in the world. The company had problems with $ 5.4 billion in debt in August 2016, the company did not get more money from its creditors. Hanjin-Shipping went into liquidation and filed for judicial protection. Stopping the line of credit immediately results in an inability to buy fuel, is immediately translated into ships that cannot go in the port and immediate results to all customers go to their competitors. "According to Ian Lewis who is managing director of corporate finance division of Moody's. The aggregate EBITDA of Moody's-rated shipping companies will fall by 7%-10% in 2016. (Lewis 2017)." Such a result is much worse than the low-single-digit percentage decline we forecast in March 2016, when we changed our outlook for the industry to negative from stable. Moody's report says that conditions will remain weak for the dry bulk segment. In particular, freight rates are very low, despite the fact that the high levels of cancellations and scrapings will keep the gap between supply growth and demand growth narrow. The report points out that Moody's will consider changing the outlook for the global shipping industry back to stable if shipping supply growth exceeds demand growth by less than 2%, or demand growth exceeds supply growth by up to 2%, and if aggregate EBITDA growth is within a range of '-5% to +10%' year over year. Moody's will consider a positive outlook for the global shipping industry if the oversupply of ships declines materially and the aggregate year-over-year EBITDA growth for companies that Moody's rates appears likely to exceed 10%.

8. Analysis of Credit Rating

We calculate financial ratios based on the results that end in the fiscal year of the companies. We have analyzed the financial information of all shipping companies from 2011 to the end of 2016, according to their budget. The most important strengths of naval funding insurers will be their ratings. According to estimates of ABN Amro (2014), more than 80% of all external funding needs in the shipping industry were traditionally covered by debt finance. All variables are scrutinized at the upper and lower confidence level. Built on a sample of 298 shipping companies, we exam whether they follow a target capital structure and examine the dynamics of capital structure adjustments subsequent to distresses in leverage. The Figure 3 provides on overview of percentage distribution of shipping firms according to their market capital, the sample period is from 2011 to 2016. In order to investigate the prediction of the-economic conditions, the significance of the individual variables examined a thorough logistic regression to show which of these conditions are empirically important to explain the failure of the company before it is assessed for the multi-action analysis. The profitability ratio gives an overview of the profitability in percent. This can be useful when comparing business and development over time within an industry. In addition, these relationships can be adapted to the user of the relationship, both from the viewpoint of

the creditor and from the perspective of the investor. Rating agencies require that all possible financial contacts be of asset grade before being considered as insurance coverage.

Figure 3: Shipping Finance Rating According to Market Cap



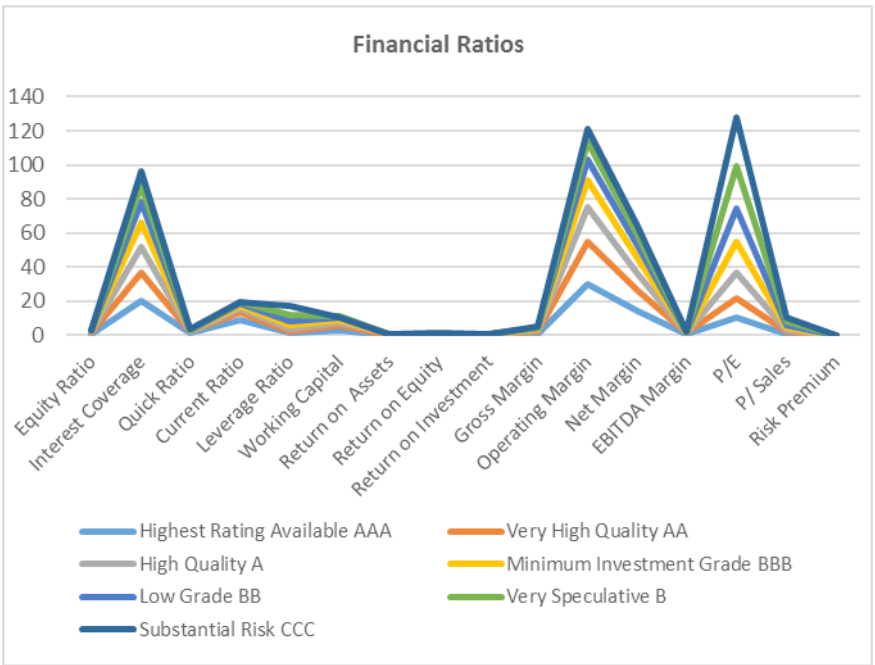
The main strengths of ship financing companies will be their rating. As a result, they work closely with rating agencies to inform them. The profitability report provides an overview of profitability as a percentage. This can be useful when matching shipping asset and development over time in a shipping industry. In addition, these terms can be tailored to you according to terms, both a vision oriented creditors and an investor-driven vision. Obviously, capital suitability and creditworthiness play a key role in credit ratings for credit ratings. In addition, underwriting agencies require that all possible transactions are of investment grade quality before insurance packages are considered. According to estimates of ABN Amro (2014), more than 80% of all external funding needs in the shipping industry were traditionally covered by debt finance. De Angelo et al. (2011) suggest that the optimal capital structure from the traditional static point of view – where financial managers trade off the tax benefits of debt against the distress costs of excessive debt – may not be optimal. The costs of leverage include the opportunity cost of its consequent future inability to borrow and therefore vary with firms' financial conditions and investment needs in the future. Shipping companies operate in a risky environment, most previous studies put their effort on risk management strategies using freight rate derivatives. According to our calculations, the marine insurance financial targets roughly 65% of the available extension as the insurance premium required for the AAA rating. Investors benefit from increased security and liquidity of the shipowner's credit. They also benefit from the ability of the insurance company's credit scrutiny and the convenience that the insurer is sharing the risk lending its credit quality the question. National variables do not affect decisions on the capital structure of shipping companies, arguing that shipping is a truly global business with limited local influences. Listed shipping companies have relatively high leverage ratios and therefore an increase in financial risk.

This AAA rated issuer will provide loan cost reductions (due to the price advantages above the cost of the collateral) and increases the liquidity of the creditor's debt market.

9. Financial Risk Ratios Analysis

The company's risk reports are mainly used to evaluate the company's capital structure and the current risk assessed in relation to the company's debt level. The ability of the company to effectively manage outstanding debt is crucial to ensuring financial stability and profitability of operations. The level of debt and debt management also have a significant impact on the profitability of the company, since the funds needed to pay debts reduce profit margins and cannot be invested in growth. Figure 4 provides ratio analysis information and some of the financial ratios are listed below which has also been included in our benchmarking analysis.

Figure 4: Financial Ratios Analysis



The Debt to Capital Ratio; "The debt ratio can be used as an alternative measure for assessing a company's debt situation. What is perhaps more important than the company's total debt is its ability to repay its pending debt. If a shipping company has a debt / equity ratio, you can use a variety of equity measurement metrics to evaluate a company together with its debt and equity ratios to get a more complete picture of the company's ability to deliver debts. It is possible to do so with financial models that allow us to see to what extent a company falls. Debt itself is not a

problem, as long as the company can make the necessary payments. Neither the debt ratio nor the debt ratio is based on the ability of a company to cover its debt or on which companies lend at different interest rates. The interest coverage ratio represents these factors. Instead of just the total debt, the calculation of this metric includes the cost that a company pays in relation to the operating income of the company. The debt to equity ratio is a leverage measure that provides a basic framework of the financial structure of a company in terms of how it is capitalizing on its operations and indicating its financial strength."

The Debt to Equity Ratio; "A lower ratio-is usually preferred, as it-means that the company finances its business more through its financial resources than through debt financing. The debt ratio is an important financial indicator that offers a more direct comparison of debt financing with equity financing. It is also an indicator of a company's ability to meet its debt obligations in place."

The Interest Coverage Ratio; "A lower ratio means fewer results available to finance-payments-and also means-that the company cannot-handle any interest rate increase. Interest coverage is a fundamental measure of a company's ability to handle short-term financing costs. The value of the quotas indicates the number of times a company can annually make interest payments on its outstanding debt with current profit before taxes and interest. A relatively low coverage ratio shows a higher debt burden for the company and an increased risk of neglect or financial insolvency.

Leverage Ratio; Calculation of this ratio can help management to identify the best possible levels and the combination of financial and operating influences for the company. The degree of leverage combined provides a more complete and complete assessment of the overall risk of a company, taking into account both leverage and leverage. This leverage report evaluates the combined effect of corporate risk and financial risk on company earnings (EPS), given a rise or fall in sales."

Current-Ratio; "The current ratio is Current-Asset/Current-Liabilities. Current-assets (inventory, cash, accounts receivable) to Current-liabilities. The current ratio explains if a firm has enough resources to meet its debt maturing over the next year. A ratio of, 7 and more is often promoted as being sound, but this is also contingent on the type of shipping company."

Interest-Coverage-Ratio; "The Interest Coverage Ratio is EBIT-/-Interest Expenses. The interest coverage ratio reviews the firm's ability to meet its interest from pre-debt, pretax earnings (EBIT). A higher ratio is thus preferable but may fluctuate according to industry and economy."

Price to Book-Ratio; "A higher P / B ratio in the same industry reflects a better market outlook with the same amount of invested capital as better results, resulting in discounted cash flows and better current valuation. The P / B ratio is often used as a multiple value and a P / B value below the industry average can mean that the company is underestimated. We believe that the P / B report demonstrates how companies efficiently use invested capital to create value. In our

grading method, higher P / B ratios result in better performance, it depends, of course, on the value of the ship that is added to the book."

Return on-Equity Ratio; "The average ROE of the last 5 years can give us a better idea of historical growth. Capital returns tell us the percentage returned by each dollar (or other monetary unit) invested by the shareholders. ROE is a favorite for all time – to provide a short-term performance metric for capital investors. They not only directly measure returns to shareholders but also factors in multiple performance metrics such as leverage, profit margin, and revenue. Return on net assets / net profit."

Return on Capital, the Return-on Capital (ROC) ratio is EBIT/Book-Value of Debt + Book-Value of Equity. Return on Capital gives an overview over the profitability of the firm, by comparing return to invested capital.

Return on Net-Operating Assets; "The Return on Net Operating Assets (RNOA) ratio is Net Operating Profit After Taxes/ Average Net Operating Assets. Return on Net Operating Assets provides an overview over the relationship between operating profit after tax and operating assets invested in the shipping firm."

The Solvency-Ratio; "It is of special interest for companies that invest money in (or lend money to) a shipping company such as banks. For the same reason, we have measured the Net debt ratio of the companies' analyzed. Maximum requirements for net debt ratios are often included in bank covenants."

EBITDA; "Earnings-Before Interest, Taxes, Depreciation-&-Amortization (EBITDA) is a very popular, but also controversial measure of operating performance in the bulk shipping industry. This ratio is important for credit-institutions as it indicates the-ability of the company to pay the-interest expenses on the debts. In fact, most shipping companies report EBITDA in their earnings report."

Working Capital; "The working capital over total assets ratio (WC/TA) is a measure-of the net liquid assets of the firm relative to the-total assets. Meeting long term liabilities is only relevant when a company is able to pay its short-term liabilities in the short run. Normally, a firm with negative working-capital is likely to experience problems meeting its short-term obligations because there are simply not enough current assets to cover them. As a result, we-would expect a higher probability of default to be related to lower values of this ratio."

Current-Ratio; "As a rule of thumb, a current ratio-of approximately 1.5 is-generally deemed to be healthy-while current ratios less than 1 are generally deemed to be unhealthy. The current ratio indicates the ability of the company to pay its short-term liabilities in the short run and is calculated by dividing the total of current assets by the amount of current liabilities. A low current ratio would reflect possible insolvency problems, as companies need-enough liquid assets-to meet short-term-liabilities."

10. Estimated Default Exposure Analysis

Credit risk indicators are constructed directly from observed book-value ship volatility. This information is used to construct four credit risk indicators, the distance-to distress, the default probability, credit spread [5], and expected losses given default. Financial risk ratios are mainly used to assess the company's capital structure and the current level of risk assessed in relation to the company's debt level. The company's ability to manage its outstanding debt effectively is crucial for the company's financial and operating results. Debt levels and debt management also have a significant impact on the company's profitability, since debt relief reduces profit margins and cannot be used for growth.

Some of the financial reports are listed below which has also been included in our benchmarking analysis. The default value is expressed as non-payment of principal or interest programmed. A default forwarding company when the market value of its assets (the value of the underlying asset) falls below its liabilities to be paid (the point of default) or interrupts the advance payment of the loan on time. There are three key values that determine a shipping firm's estimated default frequency (EDF) [6] credit-measure,

- The level of the shipping company's obligations – point of non-compliance
- The current market value of the shipping company, the market value of the assets
- Vulnerability – market value to volatility of large volume assets.

These are objective and non-judicial variables; credit measures have systematically outperformed rating agencies to distinguish between shipping companies for non-compliance and those that do not. Creditor need to realize the loss that can be sustained due to a loan to a shipping credit that may be default, this is known as expected loss (EL). EL can be expressed as a simple formula where EDF is the default exposure, PD is the default probability, LGD is the default loss.

EL = PD x LGD x EDF

The probability of default (PD) is the probability that the loan will not be repaid and this will be a default. It should be calculated for each borrower. Exposure to credit risk is the amount owed by the borrower to the debtor during the default; default value (EAD). In general, EAD will be nothing more than funding. Default probability (PD) and default loss are the risk metrics used to assess and manage credit risk. The metric is used to calculate EL. We use our PD calculation specifically designed for the shipping companies here. PD may range from 0% to 100%. If a borrower has 50% PD is considered a less risky company than a company with 80% PD. Figure 10-1 shows how to estimate the default frequency and is a measure of the likelihood that a

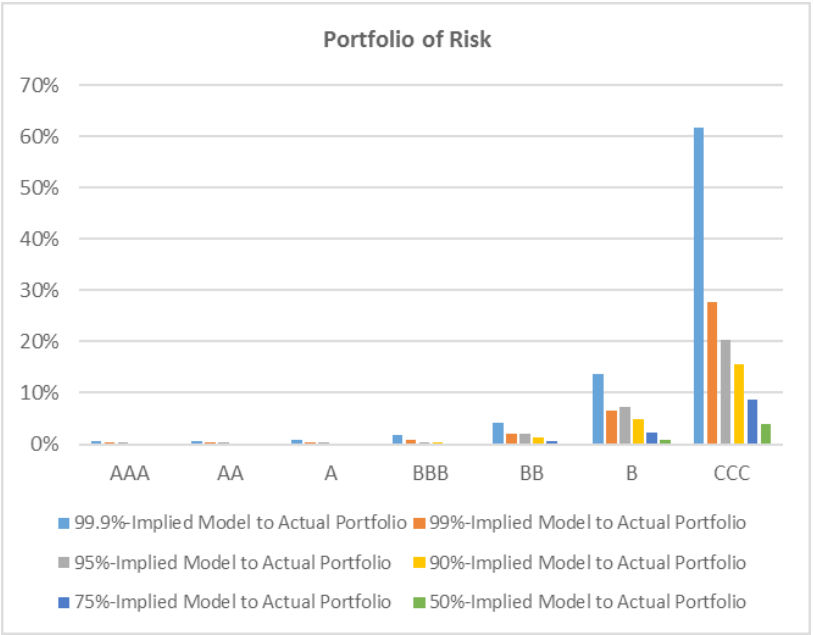
5 A credit spread is the difference in yield between a US Treasury bond and debt with the same maturity but lower quality. A credit spread may also refer to an option strategy where a premium is sold and a reduced premium option is purchased at the same underlying value.

6 RiskCalc's expected default measurement measure combines information from balance sheet and equity markets into a highly predictable self-credit rating.

shipping company will miss a fixed period of time (usually one year). We use our PD calculation specifically designed for the shipping companies here. PD may range from 0% to 100%. If a debtor has a 50% PD, it is considered a less risky company than a company with 80% PD. In shipping finance and credit default issues, estimated default frequency credit measures exhibit a number of characteristic that distinguish them from conventional and other statistical approaches to measuring default risk.

- Predefined default credit methods are a dynamic and advanced measure, unlike alternatives that generally contain accounting data that are essentially historical and retrospective.
- The default credit methods are the real, critical probabilities in debt prices and portfolio management operations, as opposed to alternative products that only offer relative classes.
- The estimated default frequency credit methods are based on the cause and effect model that is not statistically adequate to predict non-compliance. The result in a reliable performance over time. On the contrary, the same agency's obligation corresponds to different default rates at different times.

Figure 5: Implied Model to Actual Portfolio of Shipping Companies



11. Forecasting Distress with Discriminant Analysis

The default shipping value is the release of a creditworthiness test that determines the probability of bankruptcy of a public shipping company.

Weighting Factor: a, b, c...p

Variables: $x_1, x_2, x_3, \ldots, x_{15}$

Shipping Default Rating= $a_1 x_1 + a_2 x_2 + a_3 x_3 + \ldots + a_n x_n / n$ (11.1)

Table 1: Shipping Default Ranking Score Component Definitions

Variable	Definition Ratio of Shipping companies	Weighting-Factor
x1	Total Debt to Equity	A
x2	Interest Coverage	B
x3	Quick Ratio	C
x4	Current Ratio	D
x5	Leverage Ratio	E
x6	Working Capital	F
x7	Return on Asset	G
x8	Return on Equity	H
x9	Return on Investment	I
x10	Gross Margin	J
x11	Operating Margin	K
x12	Net Margin	L
x13	EBITDA Margin	M
x14	P/El	N
x15	P/ Sales	P

SDR = AX1 + BX2 + CX3 + …. +NX14 + PX15/15

- Grade 3.0 and over – Secure Zones. The company is considered safe based on the financial statements and ratio analysis.
- Grade between 2.2 and 3.0 – Standard Zones. There is an average probability that the shipping company will be bankrupt within the next 2 to 3 years of operations.
- Grade less than 1.8 – Risky Zones. The grade indicates a high probability of default within-this time period.

11.1. Utilize the Risk Financing Portfolio

The model calculates only the detailed number of shipping companies and the number of defaults in each grade. One of our main concerns is to use the weight of non-compliance of each grade within the default group that will be achieved simply by applying the Bayesian Theorem. Our shipping financing insurance coverage model focuses on a topic other than default probability and will use simple information from group of the shipping companies. This method uses progressive analysis techniques to involve the result of previous experiments in the design of the

next experiment. It will produce the default probability at any degree of the next customer that will be part of the portfolio. Now, as Bayesian Theorem says,

$$P(A/B) = \frac{P\,B/A * P(A)}{P(B)} \qquad (11.2)$$

A: is ratio of debtors in a ranking

B: is a result of default

For estimating probability of defaults, we use all available company's financial statements and quantitative information of ratios and rating grades. Our model delivers confidence intervals for the probability of defaults of each rating grade. For example, we have the following portfolio: Therefore, our table will-provide results for-each grade in this way;

Table 2: Bayesian Estimate which provides the weights of default in each grade

GRADE	*NUMBER of SHIPPING CO.*	*NUMBER of DEFAULTS*	***λ***
'AAA'	6	1	2.01%
'AA'	22	1	7.38%
'A'	92	1	30.87%
'BBB'	71	1	23.83%
'BB'	57	1	19.13%
'B'	28	1	9.40%
'CCC'	22	1	7.38%
Total	298	7	

The above is based on the Bayesian estimate, which provides a default grade for each grade, based on the total default portfolio or simply the probabilities of each grade, taking into account the overall default grade for this grade. This estimate can only answer the question that, given the default, there is a probability that a debtor has a certain category.

11.2. Assumption of No Default

The rating grades sorted by 'AAA', 'AA', 'A', 'BBB', 'BB', 'B', 'CCC' with frequencies nAAA, nAA, nA, nBBB, nBB, nB, nCCC. The AAA is the highest credit worthiness. We assume that the probability of defaults of pAAA of grade 'AAA', pAA of grade 'AA', pA of grade 'A', pBBB of grade 'BBB', pBB of grade 'BB', pB of grade 'B', pCCC of grade 'CCC' suggest the reducing credit worth of the grades, in the logic of the following difference:

$$nAAA <= nAA <= nA <= nBBB <= nBB <= nB <= nCCC \qquad (11.3)$$

The variance indicates that we assume the ordinal-borrower ranking to be correct. According to (11.3), the probability of default pAAA of grade AAA cannot be greater than the probability of default pCCC of grade CCC. As a consequence, the most prudent estimate of the value of pAAA is obtained under the assumption that the probabilities pAAA and pCCC are equal.

Then, from (11.3) even follows (pAAA= pAA=-pA= pBBB= pBB= pB= pCCC).

Suppose that this report, we are now proceeding to determine a confidence region for pAAA at confidence leve This confidence region can be explained as the set of all acceptable values of pAAA with the property that the probability of not observing any default during the observation period is not less than 1– $\boldsymbol{\gamma}$.

If we have pAAA = pAA = pA = pBBB = pBB = pB = pCCC, then the seven rating grades 'AAA', 'AA', 'A', 'BBB', 'BB', 'B' and 'CCC' don't differ in their relevant riskiness.

So, we should allocate with a similar example of size nAAA+ nAA+ nA+ nBBB+ nBB+nB+nCCC without any default during the inspection pfd. Assuming unconditional independence of the default events, the possibility of witnessing no defaults turns out to be $(1-pAAA)^{nAAA + nAA + nA + nBBB+ nBB+ nB+ nCCC}$. As a consequence, we have to explain the difference

$$(1-\gamma) \leq (1-pAAA)^{nAAA+nAA+nA+nBBB+nBB+nB+nCCC} \tag{11.4}$$

for pA, to acquire the confidence region at pA level as a set of all pA values such that

$$pA \leq 1-(1-\gamma)^{1/(nAAA+nAA+nA+nBBB+nBB+nB+nCCC)} \tag{11.5}$$

According to data collected till 2016 with rating of last 5-year rating average the result is

$$nAAA = 6, nAA = 22, nA = 92, nBBB = 71, nBB = 57, nB = 28, nCCC = 22 \tag{11.6}$$

Table 3: Confidence bound PAA of pAA, PA of pA, PBBB of pBBB, PBB of pBB, PB-of pB, PCCC of pCCC as a function of the confidence level

Confidence Level	50%	75%	90%	95%	99%	99.9%
PAAA	0.23%	0.46%	0.77%	1.00%	1.53%	2.29%
PAA	0.24%	0.47%	0.79%	1.02%	1.56%	2.34%
PA	0.26%	0.51%	0.85%	1.10%	1.69%	2.53%
PBBB	0.39%	0.78%	1.29%	1.67%	2.55%	3.81%
PBB	0.65%	1.29%	2.13%	2.76%	4.21%	6.25%
PB	1.38%	2.73%	4.50%	5.82%	8.80%	12.90%
PCCC	3.10%	6.11%	9.94%	12.73%	18.89%	26.95%

In order to above table, there is a convincing dependence of the higher confidence level P – confidence limit on the level of confidence. The sample size is an important driver at the top of the confidence level. Smaller is the size of the sample that can be used for greater confidence. This is not an unwelcome effect because the intuitive classification should be better, the greater the number of debtors in a portfolio without any default observation. We then generate default probabilities for the total number of default values in the portfolio. We do not take into account the shipping companies' default rates for each grade. We will also consider the above and generate a distribution of frequencies with Poisson distribution, being the most appropriate.

Refer to the Table 3, we first calculate the parameter-of the distribution which-is lambda (λ) which-will take the impact of number of grade and defaults against them in each grade. As we know the probability mass function (pmf) of the Poisson distribution is, where,

λ = rate of default in each grade

x = amount of incremental default in the particular grade

$$p(x,\lambda) = \frac{e^{-\lambda}-\lambda^{x}}{x!} p(x,\lambda) = \frac{e^{-\lambda}-\lambda^{x}}{x!} \text{ for } x, = 0,1, 2\ldots \quad (11.7)$$

The Poisson distribution will generate the probabilities of incremental nonconformity in each degree and for each level of confidence and these results will be injected into our basic model, the complexity.

11.3. The Probability of Default of Rating Grades

There are two stages of difficulty in accessing a default distribution. If we approach the default distribution as much as possible. We need to collect long-term statistics. The default distribution is the distribution of the default amount that an insurer paid for a given period, for example for a year. Therefore, the default distribution should be analyzed by two factors.

Frequency distribution

The default size distribution.

Frequency distribution; the default frequency is a number that is calculated from the reference point if the default setting occurs in the risk group that an insurer maintains at a given time, the logical distribution of the predetermined frequency is considered a binomial distribution. Assuming that the number of risks and the presence rate of the predetermined mean values are a risk group p and p, respectively, the distribution is expressed by the following binomial expansion formula.

$$P(X = k) = (\binom{n}{kl}.)p^{k}q^{n-k} \quad (11.8)$$

1-p = q, k is probable default number.

The probability of bankruptcy is any risk in a collective risk that an insurer is retaining is not always the same. According to a risk group it is separated into many types of risk groups with different number of risks and frequency of non-compliance. Suppose that the number of risks and the default frequency rate of seven numbers of risk classification group are, AAA,AA,A,BBB,BB,B,CCC and PAAA, PAA, PA, PBBB, PBB, PB, PCCC respectively the following formula holds.

P= AAAxPAAA+AAxPAA+AxPA+BBBxPBBB+BBxPBB+BxPB+CCCxPCCC/7

The distribution-of default occurrence of a risk of-financing is accordingly-expressed by the following formula

$$\binom{AAA}{k} p^k q^{AAA-k} * \binom{AA}{k} p^k q^{AA-k} * \binom{A}{k} p^k q^{A-k} * \ldots * \binom{CCC}{k} p^k q^{CCC-k} \quad (1.9)$$

where * shows complexity.

12. The Distribution of Default in Shipping

The initial sample is the deal with a range without default. For another example, we change the primary example assuming that the default has been observed. In another example, we show how you can change the method to take into account the default zero correlation. For this purpose, the most suitable binomial distribution that will provide the required probability for different number of default values for a given class. Such as one default for each grade. We have a total of 7 defaults in our portfolio and we want to know the probability of any non-conforming presence in grade A. The binomial distribution has the probability mass function (pmf):

$$P(X = k) = (\,{}^{n}_{k}.)p^k(1 - -p)^{n-k} \quad (12.1)$$

$$P(X = k) = (\,{}^{nAAA + \mathrm{nAA} + \mathrm{nA} + \mathrm{nBBB} + \mathrm{nBB} + \mathrm{nB} + \mathrm{nCCC}A + nB + nC}_{k})p^k(1 - p)^{nAAA+\mathrm{nAA}+\mathrm{nA}+\mathrm{nBBB}+\mathrm{nBB}+\mathrm{nB}+\mathrm{nCCC}A+nB+nC-k} \quad (12.2)$$

where the parameters are defined as,

'n' = total number of portfolio defaults

'k' = default number in a given grade

'p' = probability as estimated – by the Bayesian theorem

In considering default size, the distribution becomes more and more complex. Assuming that a risk collective is created by risk being P_{AAA}, P_{AA}, ……., P_{CCC} of default occurrence rate and confidence level is constructed by C0.5, C0.75, C0.9, C0.95, C0.99, C0.999 and D_{AAA}, D_{AA}, …., $D_{CCC,}$ of default size and AAA, AA…, CCC risk number which are the case of P_{AAA} * D_{AAA}, …P_{CCC} * D_{CCC} correspondingly the risk collective is expressed by the range of following risk group.

R_{AAA} [AAA, C0.5, P_{AAA}, D_{AAA}], R_{AAA}[AA,C0.75,P_{AA},D_{AA}],.....R_{AAA}[AAA,C0.999,P_{AAA},D_{AAA}]

R_{AA} [AA, C0.5, P_{AA}, D_{AA}], R_{AA}[AA, C0.75,P_{AA},D_{AA}] , …… ……R_{AA}[AA,C0.999,P_{AA},D_{AA}]

R_{A} [A, C0.5, PA, D_{A}], R_{A}[A,C0.75,PA,D_{A}] , ……..R_{A}[A,C0.999,PA,D_{A}]

R_{CCC} [CCC, C0.5, P_{CCC}, D_{CCC}], R_{CCC}[AAA, C0.75,P_{CCC},D_{CCC}] , …. R_{CCC} [CCC, C0.999, P_{CCC}, D_{CCC}],

In the event that each risk is independent of the stochastic point of view, the default allocations of each rating are indicated by the following formula,

$B_{AAA}(D_{AAA}k, AAA, C0.5, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{AAA}(D_{AAA}k, AAA, C0.75, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{AAA}(D_{AAA}k, AAA, C0.90, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{AAA}(D_{AAA}k, AAA, C0.95, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{AAA}(D_{AAA}k, AAA, C0.99, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{AAA}(D_{AAA}k, AAA, C0.999, P_{AAA}) = \binom{AAA}{kl} p^k q^{AAA-k}$

$\binom{AAA}{kl} p^k q^{AAA-k}$

$B_{CCC}(D_{CCC}k, CCC, C0.999, P_{CCC}) = \binom{CCC}{k} p^k q^{CCC-k} \binom{CCC}{k} p^k q^{CCC-k}$

Because a default distribution of a risk group is a composite function of the default distribution of such classifications, while the binomial distribution function is not always a binomial distribution, a default distribution of a risk group is not always being a binomial distribution. As a result, the distribution function of a risk group is described as Q (D.k, Rating, C, P).

$Q(D_{AAA}k; AAA, P) = B_{AAA}(D_{AAA}k; AAA, PAAA) * B_{AA}(D_{AA}k; A, P_{AAA}) * B_A(D_Ak; A, P_A) * B_{BBB}(D_{BBB}k; BBB, P_{BBB}) * B_{BB}(D_{BB}k; A, P_{BB}) * B_B(D_Bk; A, P_B) * B_{CCC}(D_{CCC}k; A, P_{CCC})$

This is the-logical approach for default distribution-which might occur-in a risk collective. By doing so-we are-able to get the results for each grade (AAA, AA, A, BBB, BB, B, CCC in the following tables) in the form which is presented in Table 4. As a result, probabilities of different probability defects are generated through the Binomial Distribution as,

Table 4: Probability of Estimate through Binomial Distribution

Probability of Estimate	'AAA' GRADE	'AA' GRADE	'A' GRADE	'BBB' GRADE	'BB' GRADE	'B' GRADE	'CCC' GRADE
X	P(X=x)	P(X=x)	P(X=x)	P(X=x)	P(X=x)	P(X=x)	P(X=x)
0	0.8672935	0.5845878	0.0754322	0.1488220	0.2262588	0.5012247	0.5845878
1	0.1247477	0.3261830	0.2358171	0.3258350	0.3745944	0.3638520	0.3261830
2	0.0076899	0.0780003	0.3159492	0.3057394	0.2657911	0.1131984	0.0780003
3	0.0002634	0.0103624	0.2351725	0.1593796	0.1047724	0.0195652	0.0103624
4	0.0000054	0.0008260	0.1050285	0.0498500	0.0247802	0.0020290	0.0008260
5	0.0000001	0.0000395	0.0281436	0.0093551	0.0035165	0.0001262	0.0000395
6	0.0000000	0.0000010	0.0041897	0.0009753	0.0002772	0.0000044	0.0000010
7	0.0000000	0.0000000	0.0002673	0.0000436	0.0000094	0.0000001	0.0000000

We think again the portfolio of 'First method' with frequencies nAAA, nAA nA nBBB, nBB, nB, and the nCCC. Unlike previous assumption, this time we guess during the last period, a default observed in grade AAA, was one of the default observed in grade AA, was a default observed in grade A, a default observed in grade BBB, a default observed as BB, a default observed in-grade-B and a default observed in grade-CCC (Total default is 7).

As in the first approach, we determined a more conservative region of confidence for pA of PD than A. We also do so by assuming that the PDs of the four grades are equal. This allows me to consider the entire portfolio as a homogeneous sample of nA + nB + nC + nD. Therefore, the probability of observing no more than seven predefined settings is given by the expression.

13. The Distribution Approximation

We have calculated the probability of default by simply using the total actual number of defaults in the portfolio. Next take account of the above as well and generating a frequency distribution with a Poisson distribution as the most suitable. Consider-the sum of two independent discrete random variables X and Y whose values are limited to non-negative integer. Let fX (i) represents the probability distribution of X and FY (i) represents-the probability distribution of Y. The distribution-of their sum 'Z'= X + Y is given-by the formula-discrete complexity.

We calculated the default probability by simply using the real total of default values in the portfolio. Then, consider the above and generate a frequency distribution with a Poisson distribution as the most appropriate. Consider the sum of two independent variables 'X' and 'Y', whose values are limited to a non-negative integer. Both fX(i) the probability distribution of 'X' and fY(i) represents the probability distribution of 'Y'. The distribution of its sum 'Z' = 'X' + 'Y' is given by the discrete formula complexity.

The random variable Z = X + Y has probability distribution fZ(i) given by

$$Fz(z) = f_{x+y}(z) - P(Z = z) = \sum_{x=0}^{z} 1 f_x(x) - f_y(z - x)$$

for z= 0,1,2, …

By the discrete complexity formula, Z-=-x1 + x2 has probability distribution

Use the binomial formula

$$(a+b)^m = \sum_{x=0}^{m} \binom{m}{x} a^x\, b(1-a)^{m-x}(a+b)^m = \sum_{x=0}^{m} \binom{m}{x} a^x\, b(1-a)^{m-x}$$

Although a certain compound Poisson distributions poison compound is a compound Poisson-distribution-function defaults actual distribution are not Poisson distribution, because of the second element (D_{AAA}, D_{AA}, ..., D_{CCC}) included. Suppose actual default probability distribution of a collective risk to be so,

AAA= Average default rate, K_{AAA}= Complexity of rating,

C_X= Confidence level

AAA = AAA. C0.5. K_{AAA}+ AAA. K_{AAA} C0.75+ AAA. K_{AAA}. C0.90 + AAA. K_{AAA}. C0.95+ AAA. K_{AAA} C.099+ AAA. K_{AAA}. C0.999

AA = AA. K_{AA}.C0.5+ AA. K_{AA} C0.75+ AA. K_{AA}.C0.90+ AA. K_{AA} C0.95+ AA. K_{AA} C.099+ AA. K_{AA}.C0.999

A = A. K_A .C0.5+ A. K_A C0.75+ A. K_A.C0.90+ A. $K_{A.}$ C0.95+ A. K_A C.099+ A. K_A.C0.999

BBB = BBB. K_{BBB} C0.5+ BBB. K_{BBB}.C0.75+ BBB. K_{BBB}.C0.90+ BBB. K_{BBB}.C0.95+ BBB. K_{BBB} C.099+ BBB. K_{BBB}.C0.999

BB = BB. K_{BB} C0.5+ BB. K_{BB} C0.75+ BB. K_{BB}.C0.90+ BB. K_{BB}.C0.95+ BB. K_{BB}. C.099+ BB. K_{BB}.C0.999

B = B. K_B.C0.5+ B. K_B.C0.75+ B. KB.C0.90+ B. K_B.C0.95+ B. K_B.C.099+ B. K_B.C0.999

CCC = CCC. K_{CCC}.C0.5+ CCC. K_{CCC}.C0.75+ CCC. K_{CCC}.C0.90+ CCC. K_{CCC}.C0.95+ CCC. K_{CCC}.C.099+ CCC.K_{CCC}.C0.999

Therefore, we suggest using the principle most conservative estimate to derive the "relative" probability of default of the classes of risk and scale down to an appropriate level of confidence in the overall portfolio of shipping finance portfolio. Results by running complex model provides a matrix for each class. This-is the-very model of a default distribution that can occur in a risk group. We observe the behavior of the model event of default only in the lower level grades of CCC as a single default. Let's see the results first. Corresponding matrices for each class generated which-provided-us with the final result of the model. The values-in the last column-gives the

implicit model portfolio actual probabilities for each grade. To get the final probability of default, we have to find out the specifics of probability to the original number of confidence in a particular class, and then the resulting cumulative-probabilities is the desired probability of default for that grade. The results are given in the table below,

Table 5: Ship Finance Insurance Contract Model

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	1.33%	0.00891%	99.9%	0.67109%
AA	22	1	0.34%	7.38%	1.38%	0.00961%	99.9%	0.69731%
A	92	1	0.37%	30.87%	1.59%	0.01287%	99.9%	0.80786%
BBB	71	1	0.56%	23.83%	3.37%	0.05873%	99.9%	1.74172%
BB	57	1	0.93%	19.13%	7.83%	0.33290%	99.9%	4.24940%
B	28	1	2.00%	9.40%	20.99%	2.85426%	99.9%	13.58608%
CCC	22	1	4.55%	7.38%	34.45%	21.31525%	99.9%	61.80710%
TOTAL	298	7						

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	0.63%	0.00198%	99.0%	0.31056%
AA	22	1	0.34%	7.38%	0.66%	0.00214%	99.0%	0.32286%
A	92	1	0.37%	30.87%	0.76%	0.00289%	99.0%	0.37480%
BBB	71	1	0.56%	23.83%	1.68%	0.01388%	99.0%	0.81781%
BB	57	1	0.93%	19.13%	4.27%	0.08742%	99.0%	2.02559%
B	28	1	2.00%	9.40%	15.45%	1.01658%	99.0%	6.51500%
CCC	22	1	4.55%	7.38%	46.93%	13.13303%	99.0%	27.70425%
TOTAL	298	7						

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	0.30%	0.00088%	95.0%	0.28186%
AA	22	1	0.34%	7.38%	0.31%	0.00096%	95.0%	0.29322%
A	92	1	0.37%	30.87%	0.36%	0.00130%	95.0%	0.34129%
BBB	71	1	0.56%	23.83%	0.81%	0.00289%	95.0%	0.34118%
BB	57	1	0.93%	19.13%	2.10%	0.04336%	95.0%	1.95746%
B	28	1	2.00%	9.40%	8.20%	0.61842%	95.0%	7.16479%
CCC	22	1	4.55%	7.38%	29.21%	6.24844%	95.0%	20.32142%
TOTAL	298	7	9.09%					

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	0.20%	0.00039%	90.0%	0.17776%
AA	22	1	0.34%	7.38%	0.21%	0.00042%	90.0%	0.18496%
A	92	1	0.37%	30.87%	0.24%	0.00057%	90.0%	0.21551%
BBB	71	1	0.56%	23.83%	0.54%	0.00289%	90.0%	0.48272%
BB	57	1	0.93%	19.13%	1.42%	0.02002%	90.0%	1.26424%
B	28	1	2.00%	9.40%	5.73%	0.30939%	90.0%	4.86282%
CCC	22	1	4.55%	7.38%	21.84%	3.79075%	90.0%	15.62326%
TOTAL	298	7	9.09%					

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	0.10%	0.00011%	75.0%	0.07837%
AA	22	1	0.34%	7.38%	0.11%	0.00012%	75.0%	0.08157%
A	92	1	0.37%	30.87%	0.13%	0.00016%	75.0%	0.09515%
BBB	71	1	0.56%	23.83%	0.29%	0.00082%	75.0%	0.21495%
BB	57	1	0.93%	19.13%	0.77%	0.00588%	75.0%	0.57305%
B	28	1	2.00%	9.40%	3.22%	0.10007%	75.0%	2.33437%
CCC	22	1	4.55%	7.38%	13.36%	1.55605%	75.0%	8.73220%
TOTAL	298	7						

Grades	No of Shipping Co.	No of Defaults	Avg. Default Rate	Bayesian Estimates	Realized PDs Estimates	Complexity	Confidence Level	Implied Model to Actual Portfolio
AAA	6	1	0.34%	2.01%	0.06%	0.00004%	50.0%	0.02965%
AA	22	1	0.34%	7.38%	0.06%	0.00004%	50.0%	0.03087%
A	92	1	0.37%	30.87%	0.07%	0.00005%	50.0%	0.03604%
BBB	71	1	0.56%	23.83%	0.16%	0.00027%	50.0%	0.08186%
BB	57	1	0.93%	19.13%	0.44%	0.00196%	50.0%	0.22073%
B	28	1	2.00%	9.40%	1.90%	0.03545%	50.0%	0.93240%
CCC	22	1	4.55%	7.38%	8.39%	0.64643%	50.0%	3.85157%
TOTAL	298	7						

According to the below table and each class has only one default over the past year, for example, in grade CCC a five years old ship with value of 10 million in the secondary market will create exposure calculations.

Table 6: Expected Loss

Grade	Expected Loss: PD*LGD*EDF %99.9	Expected Loss: PD*LGD*EDF %99	Expected Loss: PD*LGD*EDF %95	Expected Loss: PD*LGD*EDF %90	Expected Loss: PD*LGD*EDF %75	Expected Loss: PD*LGD*EDF %50
AAA	79,816.35	51,690.31	49,394.68	41,066.25	33,115.14	29,217.84
AA	81,857.13	52,674.32	50,302.94	41,642.74	33,371.21	29,315.21
A	90,437.30	56,829.86	54,148.98	44,086.35	34,457.96	29,728.74
BBB	161,406.70	92,270.05	54,140.19	65,463.52	44,041.99	33,394.56
BB	339,025.74	188,892.91	183,442.12	127,984.77	72,689.47	44,504.06
B	850,921.19	548,045.50	600,028.66	415,871.35	213,594.99	101,437.36
CCC	2,531,496.18	2,243,185.56	1,652,559.51	1,276,706.7	725,421.71	334,971.13

Default for the portfolio contains reliable quantitative statements, both at full level of the default probability of the default and the class level, and the relative increase in risk from the rating. In an intense non-default case, across the portfolio, this information consists only of the total number of shares per qualifying level. Predicted predictions may seem minor at first sight. But given the amount of information available, the results are not out of reach. We believe that choosing a moderate trust level is appropriate in most applications. The results have implications for investors, insurers and ship owners. Easily available and calculable variables maintained in the coverage period, the-insurers can classify problems which have a high default probability and thus support investment decisions. It is important to-mention at this point-that there are several external and internal factors that-maritime sectors are difficult to-evaluate and use in the quantifying analysis.

14. Conclusion

Shipping finance risk is dynamic, and there are no set rules for how these risks are managed. The insurance industry itself is exposed to sudden changes in their approach to certain risks and therefore it cannot be taken for granted that the insurance coverage will always be available. In addition, not all running risks are insurable and the proceeds of insurance may not be sufficient to cover lost revenues or increased expenses. It is therefore important to differentiate between risks for which an insurance solution exists and risks for which there is limited or no insurance solution. In ship-based lending the financier's main concern weather the ship is available and if so when needed, whereas in ship lending it is the physical asset that is important that the ship produces a revenue stream sufficient to service its debt. In this article, we have introduced a new model for calculating the possible financing of ship default in the insurance portfolio. The main financial variables related to the probability of default are capital ratio, interest rate, rapid indicator, current ratio, leverage ratio, current assets, return on assets, return on equity, return on investments, gain gross operating profit, net profit, EBITDA, P/E ratio, risk premium and specific sectoral variable, which includes the conditions of the shipping market during the coverage. Our results show that the typical variables of the financial structure influence to a great extent the cross-sectional alternative of leverage ratios in the maritime industry. The value of the ship is

positively related to the leverage and its economic impact is more pronounced in comparison with other sectors. Profitability, asset risk and the leverage effects are inversely related to the leverage, but there is only weak evidence for market timing behavior in our sample of shipping companies. The methodology is based on confidence intervals, using more traditional calculations, and is based on mechanism analysis, called complexity. We calculate Bayesian probability, Binomial distribution, Poisson distribution, Probability Mass distribution, Complexity and realized the probability of each scenario on expectation. In addition, we have developed various scenarios to see the behavior of the model. The model justified his performance well. The model-justified his performance well. This model is very convenient, and related organizations can use this model accordingly. The current complexity of the estimation of the portfolio model suggests that higher leverage values are associated with higher probabilities of failure. In addition, if companies leverage in excess of equity capital of 60% or more, the probability of default and will be very high. In addition, capital, EBITDA margin, current ratio and labor interest coverage for the total capital ratio is also a negative relation to the likelihood of default. Listed shipping companies have a relatively high leverage ratio and hence greater financial risk. Such AAA ratings give the issuer reduced borrowing costs and better repayment of the creditor's debt. According to our estimates, ship finance insurance target-around over 40% of the available spread as the required insurance premium for AAA ratings. Investors benefit from greater security and liquidity from the ship owner's credit. They also benefit from the expertise of the guarantor's credit monitoring experience and the comfort that the insurer divides with the risk of credit granting on the quality of credit the issue.

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