

An Empirical Study on the Determinants of the Debt Repayment Capability of Shipping Firms in Recession

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Abstract : In this study, an empirical analysis of 55 ship finance cases executed by a specific ship finance bank from 2009 to 2016 during the recession period was conducted. The purpose of this study was to find the factors affecting changes in the debt performance of Korean shipping companies. The main factors were the loan nature (investment purpose, loan-to-value (LTV), syndicated loans, loan terms, put-option, balloon, and spread), financial nature (total assets turnover, net profit-to-sales ratio, debt ratio, quick ratio, total borrowing, bonds payable to total assets, interest expenses-to-sales ratio, debt service coverage ratio (DSCR), and total assets), and the company nature (company age, chief executive officer's (CEO's) shares, and listing status). In this study, the factors affecting the debt repayment capability of domestic shipping companies (loan nature, financial nature, and company nature) were verified. The credit rating was used to measure the dependent variable, debt repayment ability. The variables of investment purpose, put-option, balloon, and spread in the loan nature, debt ratio in the financial nature, and the CEO's shares and company age in the company nature were found to be significant.

Key words : korean shipping companies, shipping finance, debt repayment capability, recession, logistic regression

1. Introduction

Usually ship finance requires a large amount of external capital. Accordingly, as a method for risk management from the side of the supplier bank, there is a syndicated loan between banks. In the case of shipping companies, which are borrowers, there is a method of lowering the investment cost of the ship by purchasing or ordering low-cost ships to cover the debt. In addition, it is possible to lower external payment obligations by minimizing external funding. There is also a method of preemptively securing an appropriate maritime freight rate for repayment of external debt through long-term contracts with superior shippers. However, despite the risk management efforts of suppliers and borrowers, shipping companies face difficulties in their ability to repay their debts during a long recession. It is meaningful to analyze the causes of relatively more defaults of Korean shipping companies compared to the overall international market during such a long recession. In addition, it is also meaningful to analyze the differences from shipping companies whose ability to repay their debts is maintained or rather improved during this period. This will provide meaningful information not

only for evaluating the stability of the shipping companies' debt repayment, but also for credit evaluation for investment decisions by banks and investors.

This paper traces the change in credit ratings experienced by Korean shipping companies that made ship investments through ship finance during the long recession since 2008. We will establish hypotheses about the factors that are judged to have an effect on the ability to repay their debts and verify through statistical analysis. For this study, 55 ship finance cases conducted during the period were selected as a sample. In this paper, we attempt to find variables that affect the change in debt repayment capability, that is, the change in credit rating using the logistic regression analysis. The results of this study will present the major factors affecting the change in the ability of shipping companies to repay their debt in ship finance. In addition, we would like to suggest considerations for ship investment through ship finance by the result.

Following the introduction, Chapter 2 summarizes prior research, Chapter 3 deals with research design for this study, and Chapter 4 conducts empirical analysis. In the final 5th chapter, we will discuss the results of this study.

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2. Literature Reviews

2.1 Shipping industry

The freight rate representing the shipping industry economy is determined on the basis of the fleet volume as a supply variable and world trade volume as a demand variable. In the shipping industry, it is difficult to adjust the fleet volume in the short term, so when a temporary supply-demand imbalance occurs, freight rates fluctuate greatly. It is also difficult to achieve a stable supply-demand balance in the long term. For about 20 years from 1996 to 2017, world trade volume increased by 3.7% per year on average, while fleet volume increased by 4.6% per year during the same period. In particular, the increase in cargo volume in the 10 years after the 2008 international financial crisis decreased to 3.0% per year, while the fleet volume increased 5.7% per year. And the long-term stagnation caused by excessive supply is intensifying.

The contraction of the real economy caused by the international financial crisis in 2008 and the resulting downturn in the shipping economy showed a much longer period of recession than the historical average of the 7-year period, about 2 to 3 years. The Baltic Dry Index (BDI), a representative shipping index, recorded 11,677 in May 2008, the highest point in the long-term boom, and then plunged into the global financial crisis in September 2008 and fell to 678 in December. Since then, between 2009 and 2011, there has been a period when the BDI index exceeded 2,000, but there is a long-term recession that rarely exceeds the BDI index of 2,000 for nearly eight years from 2011 to 2018. Theoretically, in the case of longer than average recession, the continuous increase in supply due to counter-cyclical investment is pointed out as the main reason (Stopford, 2009). However, this long-term recession has been the cause of continued excess fleet after the increase in ship orders due to the China effect that led the long-term boom just before. In addition, as China and Korea continued to invest in ships to boost the shipbuilding industry, the market failed to adjust the natural supply and demand according to the freight rate economy, and suffered a long-term downturn in the shipping industry due to the continued excess fleet. In the Korean shipping market, for example, between 2008 and 2018 during the downturn in shipping, the number of ships increased by 26.3% and

tonnage by 85.2%, from 786 ships 32.8 million DWT to 993 ships 6,079 million DWT (Korean Shipowners' Association, 2009 & 2019). The global shipping market is also showing an increase in fleet volume, exceeding the increase in cargo volume from the 2008 financial crisis to 2016. Nevertheless, there was no adjustment of supply and demand due to adjustment of supply due to lower freight rates (UNCTAD, 2019).

For shipping companies that use sea freight as cash flows for their operations, the decline in freight rates caused by the long-term downturn in the shipping industry is a decisive factor for shipping companies to cover their debts. Shipping companies usually have freight income from shipping services, gains from asset sales from ship sales, and scrap income. However, freight rates are the primary operating cash flow for the shipping industry. Operating profit through this is a major factor in determining external payment capability. The long-term shipping downturn after the international financial crisis has become a period of testing domestic shipping companies' ability to repay their debts.

Hanjin Shipping, STX Pan Ocean and Korea Line, among the top 10 companies based on the ship tonnage (GT) in 2008, suffered credit accidents such as court receivership due to the risk of default. In addition, many shipping companies suffered from difficulties in restructuring for financial soundness such as workouts. In the case of SK Shipping, despite its own restructuring such as the sale of the bunkering business, it was not able to overcome financial difficulties such as high debt and was sold to Han & Company, a specialized investment company. HMM also escaped the crisis of court receivership after trying to normalize through the sale of the dedicated ship business and the sale of companies within the group. However, HMM was separated from the Hyundai Group and transferred to the domination of creditors represented by Korea Development Bank. In the end, all of the top 5 companies in the Korean shipping industry had problems with their ability to repay their debt. On the other hand, Polaris Shipping, which is based on a long-term iron ore transportation contract with Vale in Brazil, expanded its fleet to No. 1 in terms of tonnage. Moreover, companies such as Hyundai Glovis, H-Line Shipping, and Sinoco Petrochemical, which are also based on long-term freight forwarding contracts, have emerged as top companies. Sinokor Merchant Maritime which is based on container cargo in East Asia, continues to rank in the top group

through fleet expansion. In the end, domestic shipping companies are showing polarization among companies that have failed due to failure to pay off their debts amid a long-term economic downturn, and those that have succeeded through expanding their fleet and market share as well as expanding their business.

Table 1 Status of Korean shipping companies

R a n k i n g	2008 year-end			2018 year-end		
	Company	No. of ships	tonnage (GT)	Company	No. of ships	tonnage (GT)
1	Hanjin Shipping Co., Ltd.	63	3,954	Polaris Shipping Co., Ltd.	36	4,584
2	Hyundai Merchant Marine Co., Ltd.	42	3,409	Sk Shipping Co., Ltd.	40	4,528
3	Pan Ocean Co., Ltd.	61	2,106	Pan Ocean Co., Ltd.	71	3,457
4	Korea Line Corp.	24	1,693	Hyundai Glovis Co., Ltd.	48	3,248
5	Sk Shipping Co., Ltd.	24	1,534	H-Line Shipping Co., Ltd.	37	3,215
6	Changmyung Shipping Co., Ltd.	19	1,353	Korea Line Corp.	30	2,156
7	Sinokor Merchant Maritime Co., Ltd.	6	679	Sinokor Merchant Maritime Co., Ltd.	35	1,760
8	Eukor Car Carriers Inc.	10	637	Sinokor Petrochemical Co., Ltd.	33	1,747
9	Polaris Shipping Co., Ltd.	4	595	Hyundai Merchant Marine Co., Ltd.	20	1,719
10	Korea Lng Trading Co., Ltd.	4	397	Eukor Car Carriers Inc.	25	1,502
	total	257	16,357	total	375	27,916

Source : Shipping Statistics 2008 & 2018,
Korean Shipowners' Association, 2009 & 2019.

2.2 Debt Repayment Capability

There have been various studies for a relatively long period of prior studies related to the ability of companies to repay their debts. Altman(1968) and Beaver(1966)

introduced the analysis for prediction of corporate defaults using the financial ratio. It proves that financial ratio analysis is useful in predicting defaults. However, this study has limitations in its application to service industries such as shipping in terms of its manufacturing-oriented default prediction model. Ohlson(1980) developed a prediction model of the corporate bankruptcy using the logit model. Firm size, financial structure, firm performance, and liquidity were analyzed as factors influencing corporate failure. Bonfim(2009) conducts empirical research that simultaneously considers micro and macro factors that determine the success or failure of a company. The main micro-factors that influence a company's default are financial structure, profitability and liquidity, and recent operating results and investment policies. In addition, the statistical reliability of the results was further increased when the time-effects and macro factors were simultaneously considered.

In previous studies, the default risk was predicted without considering the characteristics of each industry. For this study, it is necessary to look at previous studies on factors that determine the default or debt payment ability of shipping companies. Kang et. al.(2017) analyzed the determinants of the risk premium for 66 ship finance loans conducted from 2010 to 2016. In this paper, characteristics of collateral and level of market risk exposure were used as variables for the shipping industry. As a result, it was found that the bank's financing cost and the degree of exposure to market risk had a significant effect on the spread. The important factors influencing the spread are CDS premium, LTV, loan term, loan amount, consecutive profit period, ROA, leverage ratio, business power of the borrower and the Clarksonsea index and MSCI index.

Kavussanos and Tsouknidis(2014) investigated whether bonds, issuers, affiliated industries, and macro variables before and after the 2008 financial crisis affect the difference in bond spreads in global bond issuance. As a result, secondary liquidity of bonds, volatility of the stock market, bond market cyclicalities, freight rate income, and credit rating of bond issuers are the main determinants. Kavussanos and Tsouknidis(2016) went one step further and proposed a credit scoring model for empirical evaluation of the determinants of bankruptcy risk of ship financing. This model is intended to predict the probabilities of default of ship finance and to differentiate between default and non-default loans. As a theoretical framework, 6C's was extended by adding Company from the traditional credit

analysis tool, 5C's (Character, Capacity, Capital, Collateral, Conditions). In the paper, an empirical analysis of a data set of 128 loan portfolios of 63 shipping companies executed by a specific shipping bank for a total of 14 years from 1997 to 2011 was analyzed. In this analysis, the importance of financial factors, which played a major role in the existing default prediction model such as Altman Z-score, was not found. This explains that in the fast-changing shipping industry, historical financial data are less contributing to default forecasts. Instead, 1) major advance fee/loan amount of bank loans, 2) 1-year TC fare minus the Spot fare (1yr TC minus the Spot rate), 3) Inactive Tonage/All fleet, 4) Time-charter policy, etc. Variables were found to be the main variables explaining the possibility of default.

In a similar approach, Mitroussi et. al. (2016) analyzed the factors affecting the payment of debt through hypotheses verification on 18 determinants of debt performance for 30 bulker ship finances handled by the Bank of Greece. As a result, it was found that there is a positive relationship with the probability of default between the loan and the amount of the balloon, and the higher the leverage ratio, the higher the probability of default. In addition, the higher the shipowner's business power, the lower the exposure to market risk of freight rates, the lower the possibility of default. In conclusion, this study provides more effective information to both banks and shipowners by analyzing credit risk factors reflecting the unique characteristics of the shipping industry. In particular, it was concluded that market sentiment such as stable shipping contracts for ships and the shipping economy act as an important factor in the possibility of bankruptcy. At the same time, qualitative factors such as the shipowner's business power and strong leadership that can normalize in case of bankruptcy are also explained as important.

The point that can be confirmed in previous studies is that the factors that affect shipping companies' ability to repay their debts are different from those of general corporate finance. Starting with Ohlson(1980), logistic regression analysis has been used dominantly in research on predicting corporate insolvency. In fact, even in banks, logistic regression models are the predominantly used to predict corporate bankruptcy. Logistic regression analysis was also used in a study of Mitroussi et. al. (2016) to measure the ability to repay ship finance debt.

3. Research design

3.1 Variables and hypotheses

In this study, with reference to the studies of Kavussanos & Tsouknidis(2014) and Mitroussi et al.(2016), we intend to analyze the factors that change the ability of shipping companies to repay their debts. Loan nature, financial nature, and company nature were selected as factors that change the debt repayment capability of shipping companies.

1) Loan nature

Stopford(2009) pointed out that ship financing conditions, that is, the loan nature of Mitroussi et al(2016), can have a direct impact on the performance of the obligation to pay external borrowings following the ups and downs in the shipping freight market. In particular, the proportion of loans, maturity, and balloon amount among the contents of loan contracts can be major factors. The usual loan period for ship finance is 5 to 10 years. This means that there is a high possibility of a downturn during the short cycle of the freight market during the loan period. It is recommended to carefully select the proportion of loans and repayment conditions, assuming that the cash inflow due to freight rates is less than the cash payment obligation for external payment. From this point of view, the content of the loan agreement is used as a classification criterion for the decision variable. Based on empirical observations, the debt performance hypotheses related to the terms of the loan nature can be deduced as follows.

H1: The lower loan to value (LTV), the higher the possibility of debt repayment. In other words, there is a high possibility that the credit rating of the company will be equal to or higher after the loan.

H2: The longer the loan tenor at the time of approval, the higher the possibility of debt repayment. In other words, there is a high possibility that the credit rating level will be the same or higher.

H3: If the spread is high, the possibility of debt repayment decreases. In other words, there is a high possibility that the credit rating will be lowered.

H4: Syndicated loans increase the likelihood of debt repayment compared to single loans. In other words, there is a high possibility that the credit rating level will be the same or higher.

H5: If there is a put option, the possibility of debt repayment is lower than if it is not. In other words, there is a high likelihood that the credit rating will decline.

2) Financial nature

In previous studies, in the case of a shipping company's default prediction model or a determinant of debt repayment, unlike general corporate finance, the unique characteristics of the shipping industry and shipping companies are presented as the determining variable. In particular, the nature of shipping companies, such as risk exposure to the shipping market and charter policy, are more important variables than financial nature. However, in this paper, it is very meaningful to verify whether the financial nature of a shipping company are significant as a variable that determines a shipping company's ability to repay its debts. In particular, the government is conducting financial soundness assessments for companies that have a certain amount of loans in banks (more than 5 billion won in case of general commercial banks). Based on these results, corporate restructuring is initiated, that is, workouts or court receivership. The financial soundness evaluation follows the financial evaluation model of the Financial Services Commission. And it consists of five items: profitability, financial repayment ability, financial safety, cash flow, and liquidity. There is a difference by bank, and in common, the possibility of repayment of borrowings is evaluated through analysis of profitability, financial soundness, and cash flow. The hypotheses of the ability to repay debts related to the financial nature can be established as follows.

H6 : The lower a company's debt ratio is, the more likely it is to repay its debt. In other words, there is a high possibility that the credit rating of the company will be equal or higher.

H7: The higher the quick ratio, the higher the possibility of debt repayment. In other words, it is highly likely that the credit rating of the company will be the same or higher.

H8: The higher the net profit-to-sales ratio, the higher the possibility of debt performance. In other words, there is a high possibility that the credit rating will be the same or higher.

H9: The higher the debt service coverage ratio (DSCR), the higher the possibility of debt repayment. In other words, there is a high possibility that the credit rating will be the same or higher.

H10: The higher the total asset turnover ratio, the higher the possibility of debt repayment. In other words, there is a high possibility that the credit rating will be the same or higher.

3) Company nature

Among the characteristics of a shipping company, the matters mentioned in the preceding research as the non-financial nature of the company are the reliability of the shipping company as a customer, the degree of exposure to market risk (Mitroussi et al., 2016), firm age and time-charter (Kavussanos et al., 2014).

In the case of shipping companies, the longer their business history, the more reliable they will be in transactions with ship banks that engage in related financing, and all conditions for loans such as concluding loans, interest rates, and maturity can be advantageous. In addition, it can be inferred that shipping companies that have gained experience in risk management while experiencing the inevitable ups and downs in the shipping economy are more likely to overcome the crisis caused by the upcoming economic ups and downs compared to those that do not.

H11: The longer the business is, the higher the possibility of debt performance. In other words, there is a high possibility that the credit rating of the company will be the same or higher.

H12: The higher CEO's shares at the time of loan approval, the lower the possibility of debt repayment. In other words, there is a high possibility that the credit rating of the company will be the same or higher.

H13: It is more likely that unlisted shipping companies will perform their debts rather than listed. In other words, it is

highly likely that the credit rating of unlisted shipping companies will be the same or higher.

4) Credit grade

A company's ability to perform its debt, which indicates the possibility of repaying its external debts, is usually expressed in terms of the company's credit rating. These credit ratings inform the stakeholders surrounding the company, such as shareholders, investors, banks, and raw material suppliers, about the level of the company's ability to repay its external debts. The stability of the business such as market position and business prospects, the ability to generate cash flows, and the stability of capital, such as the capital structure and the ability to raise capital, are subject to evaluation. International credit rating agencies include Moody's and S&P. The credit rating structure is generally divided into 10 levels, from the highest grade AAA to AA, A, BBB, BB, B, CCC, CC, and default grades C and D. Among these grades, AA, A, BBB, BB, B, and CCC grades are divided into three stages, respectively, and classified into a total of 21 grades. In the case of Korea, three companies, including Korea Corporate Ratings, NICE Ratings, and Korea Ratings, are performing most of the credit rating work. In general, companies with a credit rating of BBB- or higher and AAA are classified as investment grade. Ratings below BB+ are speculative and the rating grades give a warning to investors. In addition to issuing corporate bonds in the capital market, the rating ratings of these rating companies are used in various business activities such as bank loans, bidding and contracts, and credit transactions.

In the case of Korea Development Bank, which actively handles ship finance, its credit rating is shown in Table 2 below.

The rating system is divided into two levels, AA, A, BBB, and BB, and 14 levels are the basic rating system, but the level for practical application is divided into 20 levels. This is a measure of the possibility of a loan transaction from the perspective of a supplier bank. At the same time, it is used in all aspects of credit business, such as becoming a basic cost when calculating interest rates. It can be a key consideration in determining the timing of ship investment, the proportion of external borrowing, and conditions for a company as a borrower.

Table 2 Risk level and default rate proposed by credit rating

Credit rating		Risk level	Default Rate (%)
Normal	AAA	Practically none	0.015
	AA	Rare	0.07
	A1	A little bit	0.2
	A2	Modest	0.42
	BBB1	Less than Average	0.77
	BBB2	Average	1.72
	BB1	More than Average	3.34
	BB1	Acceptable	5.81
	B1	Tolerable	8.98
	B2	Early warning	14.16
Default	CCC	Worrisome	30.07
	CC	Tangible	71.2
	C	Default	100.0
	D		

Source : Corporate credit rating business commentary, Korea Development Bank, 2017.

3.2 Methodology

In this paper we seek to partially accommodate the data collection and analysis methodology presented by Mitroussi et al.(2016). The correlation between each variable and the probability of default and capital cost of shipping companies was analyzed. For the empirical analysis of the thesis, 30 cases of ship financing for bulk carriers conducted by Greek banks for five years from 2005 to 2009 were targeted. Assumptions were made for each variable and the association was analyzed through the binary logit model.

Logistics regression analysis is a representative quantitative analysis method used in the corporate insolvency prediction model. Compared to discriminant analysis, which is often used for forecasting insolvency, it has the advantage of being easy to interpret and intuitive to understand. In addition, the sign of the regression coefficient estimated in logit analysis and the level of statistical significance can determine which variables are important for insolvency prediction. In logit analysis, the probability of bankruptcy is expressed as a logistic function as follows.

$$P(Z_i) = \frac{1}{1 + e^{-Z_i}}$$

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

We need to estimate Z_i to find $P(Z_i)$, the probability that the firm will go bankrupt. In this paper, dependent variables

are divided into two groups according to repayment ability. The group was divided into a group which its rating was demoted by three or more levels for 5 years and a group that did not. If there is no credit rating change, 0 is assigned, and if there is a credit rating change (downgrade), the value of 1 is assigned. We estimate variables with high explanatory power for signs of corporate insolvency (credit rating decline). The probability of bankruptcy of a specific company is obtained by substituting the coefficient of the company's variable into the estimated logit function.

4. Empirical analysis

This study is an empirical study targeting Korean shipping companies. It closely analyzes the loan situation of 55 ship finance cases that actually occurred during the shipping economic downturn that continued after the 2008 financial crisis. The purpose of this study is to analyze the factors that determine the change in the shipping company's ability to repay its debt, which is revealed by the credit rating by tracking the dynamic credit rating change of the shipping company after the loan is approved.

In this paper, credit rating decline is used as an indicator of shipping company failure. Five years after approval, we track changes in credit ratings according to the bank's regular ratings. It is also intended to determine if any negative changes have occurred in your ability to repay your debt. However, in determining whether a negative change has occurred, a case where the credit rating at the time of approval is A- or higher is defined as a case where it has decreased by three or more stages. In the case of BBB+ or lower, we will define it as a case of falling more than two levels.

There are 3 models for each of three factors (loan nature, financial nature, and company nature). There is a model that is analyzed by step selection method by inputting all additionally utilized variables. Therefore, the empirical analysis model of this study is analyzed into a total of 4 models. The results are shown in Table 3 below.

For Model 1 (loan nature), the model goodness-of-fit tests (Hosmer and Lemeshow tests) resulted in a higher chi-square value of 6.482 and a significance probability value of 0.485. It is a statistically valid model. At the 5% significance level, investment purpose, put option, and balloon were analyzed to be significant. The spread variable was analyzed to be significant at the 10% significance level.

Table 3 Result of analysis

Factors	Variables	M1	M2	M3	M4
Loan Nature	Investment purpose	2.274**			2.123**
	LTV	-.652			
	Syndicated loan	-.422			
	Loan term	.337			
	Put option	-.543**			
	Balloon	4.375**			
	Spread	-60.102*			
Financial Nature	Total assets turnover		-.564		
	Net profit to sales		1.330		
	Debt ratio		.750*		
	Quick ratio		.832		
	Total borrowings and bonds payable to total assets		-.024		
	Interest expenses to sales		-3.275		
	DSCR		-.267		-.201
	Total assets		.000		
Company Nature	Company age			-.034	-.056**
	CEO's shares			1.295*	
	Listing status			-1.931	
Constants		-3.046*	.341	2.377	-1.275
Hosmer & Lemeshow test : χ^2 (p-value)		6.482 (0.485)	9.597 (0.213)	11.084 (0.135)	12.356 (0.089)
Classification accuracy		76.4%	78.7%	69.1%	72.3%

Signif. codes: 0.05 '**', 0.1 '*'.

LTV, loan maturity, and Syndicated Loan, which are mentioned to have an impact on future credit rating changes in hypothetical inferences related to loan conditions, are not statistically significant. Unfortunately, this is presumed to be because the bank is preemptively adjusting LTV and loan maturity so that each loan can be repaid through the review process. However, even so, loans with short maturities and high LTV are highly likely to have a negative impact on debt performance. Therefore, additional research is required by new statistical methods such as converting quantitative variables into qualitative variables. It is meaningful to find statistical significance that credit ratings generally decline in the case of loans that refinance existing borrowings rather than fleet expansion and replacement during the investment motive. In particular, when the bank manager deals with ship finance, the motive for investment has a great influence on the ability to repay its debts, and it has implications that considerable attention is required in the case of the refinance. In loan condition, it was verified that Put Option

had a negative effect on debt performance and Balloon Payment had a positive effect. It should also be actively reflected in the direction that ship finance demanders and suppliers do not weaken their ability to repay their debts when negotiating loan terms. In particular, in the case of put options, which have become common in recent years, when the event of the put option event arrives during the long-term shipping downturn, it poses a great challenge to the management of shipping companies with payment obligations. Therefore, a careful approach to this is necessary. Syndicated Loan is a measure for the bank as a supplier to share the risk of loans between banks, and it was found that it did not have a special effect on the shipping company, the borrower.

For Model 2 (financial nature), the model goodness-of-fit tests (Hosmer and Lemeshow tests) resulted in a higher chi-square value of 9.597 and a significance probability value of 0.213. It is a statistically valid model. Only debt ratio variable was analyzed to be significant at the 10% significance level.

Most in financial nature, such as the quick ratio, net profit on sales, debt repayment coefficient, and total asset turnover, were not statistically significant. However, only the debt ratio is statistically significant at the 10% significance level. As pointed out in other previous studies (Kavussanos & Tsouknidis, 2016), this can be said to be meaningful in terms of reaffirming that the influence of past financial natures on debt performance is limited for shipping companies. It appears that shipping companies' ability to repay their debts is more affected by non-financial factors such as shipping market conditions and timing of operations and investments rather than financial factors. Nevertheless, it is very meaningful that the debt-to-equity ratio was confirmed to have some statistical significance despite the limited number of data. This is because it can serve as a theoretical basis for presenting guidelines for specific debt ratios as a prerequisite for supporting policy financing for shipping companies at the government level, such as shipbuilding programs, and demanding compliance with them.

For Model 3 (company nature), the model goodness-of-fit tests (Hosmer and Lemeshow tests) resulted in a higher chi-square value of 11.084 and a significance probability value of 0.135. It is a statistically valid model. Only CEO's shares variable was analyzed to be significant at the 10% significance level.

The significance of the company age and listing status

was not statistically verified in company nature. However, it was found that only the shares of the CEO had a negative effect on the ability to payment debt. In a previous study (Mitroussi et al. 2016), the company age has been identified as an important confidence variable in financial transactions such as bank loan. Nevertheless, it is a somewhat unexpected conclusion that the significance of this study has not been verified. It was found that the stake of the CEO affects the credit rating change. It was analyzed that privately-owned companies with a high stake in the CEO had low debt repayment abilities. This result shows that controlling shareholder management does not play a proper role, in the shipping companies.

For Model 4 (all variables), the model goodness-of-fit tests (Hosmer and Lemeshow tests) resulted in a higher chi-square value of 12.356 and a significance probability value of 0.089. It is a statistically valid model at the 5% significance level. At the 95% confidence level, investment purpose, company age were analyzed to be significant. In the case of variable of investment purpose, it was analyzed that there is a possibility that the credit rating of refinancing loans will decline rather than loans for ship purchase. It was also analyzed that the longer the business period, the lower the risk of credit rating decline.

5. Conclusion

This empirical study targeted 55 companies that performed ship financing conducted by a specific ship finance bank from 2009 to 2016 in the Korean financial market. 1) Credit conditions at the time of application and approval of loans (weight of loan, maturity of approval, interest rate spread, cooperative loan, whether or not put option) 2) financial situation (debt ratio, quick ratio, net profit ratio, debt repayment coefficient, total asset turnover) 3) Data such as company status (business history, credit rating, listing status) were collected.

In addition, the change in the debt performance capability of the relevant companies was to derive a correlation between ship finance and shipping companies insolvency by tracking the change in credit rating five years after approval.

This paper empirically analyzed the factors affecting the change in debt repayment capacity of shipping companies during the recession. Through the results of this paper, we presented how ship finance borrowers and suppliers can strategically respond to the economic recession.

This study proves that the 5-7 year ‘put option’ condition, which is generally reflected in ship financing conditions and structure design, has a negative effect on shipping companies. It shows that the put option condition based on the convenience of the fund provider is a practice that needs to be improved in terms of improving the stability of shipping management. Previous studies show that the significance of past financial factors is low in the ups and downs in the management of shipping companies. Nevertheless, this study proved that the debt-to-equity ratio had a negative effect on the ability to repay debt. This is an important achievement of this paper. This is because it presents the theoretical basis emphasized in terms of shipping policy improvement, ship finance, and management stability of shipping companies. However, the significance of quantitative data such as LTV in loan nature and the company age in company nature is low. This result requires additional research. In addition, there are few studies on the management stability of shipping companies related to ship investment in Korea, and more research is needed in the future.

Finally, there are limitations to this study. We need to find out the various variables that affect the decline in the credit rating of shipping companies. And you need to get and analyze more samples.

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