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"THE PROBABILITY OF DEFAULT AND RELATED PARTY TRANSACTIONS. EVIDENCE FROM INTERNATIONALLY LISTED COMPANIES."

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To my family and friends …

Abstract

The main purpose of this thesis is to examine the probability of default and related party transactions. The business transactions between maritime shipping companies listed on the stock exchanges and private companies, which are beneficially owned by the controlling shareholder of the public maritime shipping companies, can be broken down into two main types based on the nature of the business dealing, i.e., operating RPTs and financing RPTs. A logit model was used for estimating the probability of default of shipping company's and related party transactions. The dataset used for the analysis in this thesis contains fifty-five companies from the US SEC's archival data for the period 1993 to 2020, listed only maritime shipping companies on United States of America stock exchanges, Nasdaq and NYSE. While this study has identified some variables to be statistically significant, on the final model related party transactions can't show if affect the probability of default, isn't statistically significant and they cannot contribute substantial information to the probability of default.

Key words: probability of default, related party transactions, operating RPTs, financing RPTs.

Περίληψη

Ο κύριος σκοπός αυτής της διπλωματικής εργασίας είναι να εξετάσει την πιθανότητα αθέτησης πληρωμών και συναλλαγών με συνδεδεμένα μέρη. Οι επιχειρηματικές συναλλαγές μεταξύ ναυτιλιακών εταιρειών που είναι εισηγμένες στα χρηματιστήρια και ιδιωτικών εταιρειών, οι οποίες ανήκουν σε δικαιούχο μέτοχο των δημόσιων ναυτιλιακών εταιρειών, μπορούν να αναλυθούν σε δύο κύριους τύπους με βάση τη φύση της επιχειρηματικής συναλλαγής σε λειτουργικές συναλλαγές συνδεδεμένων μερών και χρηματοδοτικές συναλλαγές συνδεδεμένων μερών. Χρησιμοποιήθηκε ένα μοντέλο λογικό για την εκτίμηση της πιθανότητας αθέτησης των συναλλαγών της ναυτιλιακής εταιρείας και των συνδεδεμένων μερών. Το σύνολο δεδομένων που χρησιμοποιήθηκε για την ανάλυση σε αυτή τη διπλωματική περιέχει πενήντα πέντε εταιρείες από τα αρχειακά δεδομένα της SEC των ΗΠΑ για την περίοδο 1993 έως 2020, εισηγμένες μόνο εταιρείες θαλάσσιων μεταφορών στα χρηματιστήρια των Ηνωμένων Πολιτειών της Αμερικής, Nasdaq και NYSE. Αν και αυτή η μελέτη έχει εντοπίσει ορισμένες μεταβλητές που είναι στατιστικά σημαντικές, στο τελικό μοντέλο οι συναλλαγές με συνδεδεμένα μέρη δεν μπορούν να δείξουν εάν επηρεάζουν την πιθανότητα αθέτησης, δεν είναι στατιστικά σημαντικές και δεν μπορούν να συμβάλλουν ουσιαστικές πληροφορίες στην πιθανότητα αθέτησης.

Λέξεις κλειδιά: πιθανότητα αθέτησης, συναλλαγές με συνδεδεμένα μέρη, λειτουργικές συναλλαγές συνδεδεμένων μερών , χρηματοδότηση συναλλαγών συνδεδεμένων μερών.

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1.Introduction

The history of maritime transport is intertwined with the existence of human life. Maritime transport is the basis of the exchange of goods and is directly linked to meeting the needs of the people. The strategic development, the organization and the ever-evolving means of transport are interdependent with the development of the national economies but also of the world economy. ships, which dates back many centuries before Ancient Greece. 80-85% of world trade is conducted by ships. The construction of boats from ancient times and the continuous evolution from the paddle to the sail, the invention of the compass, where it allowed seafarers to discover new sea routes and places of trade and then the application of steam, propeller and the choice of iron and steel as a means of material, have made astonishing progress in maritime transport. Many shipping companies are listed on international stock exchanges, when markets increase shipping companies' listings on international stock exchanges, thus allowing international investors to access and invest in shipping.

Many of the listed shipping companies often show transactions with related parties transactions with various companies related to the major shareholder of the listed company. These transactions are often not made in market terms, with the result that the small shareholders of the listed companies become disadvantaged, to the detriment of the large shareholders who also have the Management of the ships.

According to the financial accounting standards board's (FASB) controlling shareholders can be defined as the ones who control, or can significantly influence the management, or the operating policies of a company. Therefore, even though concentrated ownership may lead to efficient monitoring that alleviates the principal-agent conflict of interests, it can often lead to default payment. Probability of default is a very important factor that will be examined in our study, so, probability of default it's an estimation of how likely it is that a borrower won't be able to make the repayment obligations on a debt or loan. Controlling shareholders can expropriate wealth by ensuring that their company will receive loans, buy supplies and materials at above-market prices, or sell goods and offer services at below-market prices to companies that are owned, or affiliated with the controlling shareholders. The likelihood of it occurring in relation to related party transactions and whether they

affect. In this study, was used a sample of 55 listed shipping companies and employ a logit model in order to see if related party transactions affect the probability of default, in other words to see if have any effect on the credit performance and creditworthiness of companies.

This thesis is organized as follows. A review of related literature is conducted in Section 2. In the third section, is lay out the hypotheses. Our dataset and methodology are presented in Section 4. In Section 5 are presented the results and our empirical findings. Concluding remarks and an empirical application of the model for investors is presented in the last section.

2.1 Probability of default.

There has been a lot of studies in the literature focusing on a company probability to default. Samples drawn from different industries and countries, include primarily non-financial or shipping companies. The methodologies employed multiple discriminant analysis, performances of neural networks and logit models.

Default is defined as the failure of the company to make timely payments of her debt, default occurs prior to bankruptcy and the first may not lead to the final bankruptcy. In the case of default, the shipping company and the bank must renegotiate the terms of the loan and the size of the installments. The existing literature investigates the default risk drivers of corporate loans in general but not specifically into the shipping sector where defaults are more often and of greater magnitude.

Altman E. in 1968 was the first one to use multivariate discriminant analysis to explain the interaction of financial ratios in predictive bankruptcy, this was the z-score methodology[1] that he uses, the final model was five financial ratios: working capital over total assets, retained earnings over total assets, earnings before interest and taxes over total market, market value of equity over book value of debt, sales over total assets. Altman's pioneer study is based on a sample of 66 publicly traded, manufacturing firms. Thirty-three of the firms had filed for bankruptcy and all had assets over $1 million. His model correctly predicts financial failure for 95% of the firms, one year prior to their demise. Accuracy decreases to 72% two years out and to 52% three years prior to insolvency.

Ohlson in 1980 study used a logit model and tested whether various financial ratios and other factors were associated with bankruptcy. His study was concerned not only with the predictive ability of the model, but also the model's coefficient estimates. Overall, four variables were included in his model: total assets over GNP price-level index; total liabilities over total assets; some performance measure or combination of performance measures (net income over total assets and/or funds provided by operations over total liabilities) and some measure of current liquidity (working capital over total assets or working capital over total assets, and current assets overcurrent liabilities jointly).

Barniv et al. in 2002 study examines classification and prediction of the bankruptcy resolution event. This post-bankruptcy classification and prediction of the final resolution is harder than discriminating between healthy and bankrupt firms because all filing firms are already in financial distress. A sample of 237 firms filing for bankruptcy is used. A ten-variable, three-group resolution logit model, which includes five accounting and five non-accounting variables is developed. Is concluded that non-accounting data add relevant information to financial accounting data for predicting post-bankruptcy resolution.

Charalambakis E. and Garret I. in 2014 have conducted a comparative analysis of the determinants of the probability of default for companies from India and the United Kingdom. Their results demonstrated that the binary logit model has a greater predictive power on the sample of companies from the UK, and the multiple discriminant analysis has higher predictive power on the sample of Indian companies.

2.2 Probability of default in shipping company.

Kavussanos and Tsouknidis in 2016 have conducted an analysis of key indicators of shipping companies' default risk on bank loans with the help of credit scoring models. The extreme volatility of the freight rates into shipping business casts doubts on the ability of a shipping company to generate sufficient cash flows to follow the repayment schedule of a loan. By utilizing a unique sample comprising of the loan portfolio of a ship lending bank, which contains both quantitative and qualitative data, several default risk drivers revealed. Findings suggest that the leverage ratio, the current ratio, and the internal bank rating can explain around 18% of the observed defaults in shipping bank loans. The results have several important implications for several players in the shipping market such as banks, ship-owners, financial institutions, and regulatory authorities.

Kavussanos and Tsouknidis in 2014 examined whether the bond issuer and macroeconomic and industry-specific variables account for the observed variation of credit spreads in global shipping bond issues, before and after the subprime financial crisis of the years 2007–2009. A generic panel of data regression model explain the bond spreads of global shipping companies where the bond spread is defined as the yield to maturity of the shipping bond minus the yield to maturity of a corresponding.

Mitroussi et al., in 2016 paper investigates the varying importance of a number of factors connected with the performance of corporate bank loans during times of financial turbulence in the shipping industry. Thirty shipping loans made during the period 2005–2009 are examined. Results suggest that financial factors, non-financial factors, ship owners′ experience, and employability and market risk indicators are the best criteria for evaluating the performance of shipping loans during turbulent market conditions and periods when financing options are restricted.

Charitou et al., in 2004 the main purpose of this study was to examine the incremental information content of operating cash flows in predicting financial distress and thus develop reliable failure prediction models for UK public industrial firms. Neural networks and logit methodology were employed to a dataset of fifty-one matched pairs of failed and non-failed UK public industrial firms over the period 1988– 97. The final models are validated using an out of sample period ex-ante test and the Lachenbruch jackknife procedure. The results indicate that a parsimonious model that includes three financial variables, a cash flow, a profitability, and a financial leverage variable, yielded an overall correct classification accuracy of 83% one year prior to the failure.

Lozinskaia et al. in 2017 proposed a model aiming to assist banks in assessing more accurately the credit worthiness of companies in the shipping sector. Used a sample of 192 listed shipping companies and employ a logit model in order to investigate the determinants of the probability of default. There findings were a changing trend in the marginal effects of relevant variables, on the probability of default. Further showed, through an empirical application, how obtained results can be used in a managerial decision-making process and in a bank credit underwriting process in order to assess the creditworthiness of a shipping company. So, when a bank decides to give a loan to a shipping company, it can add the rate for credit risk to the loan rate, having preliminary carried out calculations of the probability of a shipping company's default.

2.3 Related party transactions (RPTs)

Related party transactions (RPTs) include business transactions between a company and its own controlling shareholders, or their affiliated companies. In general, RPTs

have been found to affect major corporate decisions such as payout policies. Studies examining the expropriation of minority shareholders' rights and RPTs give contradictory findings because two conflicting views are associated with the impact of RPTs, transaction efficiency and conflict of interest internal audit choices, initial public offerings as well as mergers and acquisitions.

The first type of business transactions between a public company and its own controlling shareholders occurs when the nature of the business dealings is the provision of services to the public company. In particular, the controlling shareholder is providing services to the public company about certain operating activities, through its privately-owned companies. The second type of business transactions between a public company and its own controlling shareholders occurs when the nature of the business dealing is the extension of credit to the public company for working capital purposes, or provision of debt capital to the public company for general corporate purposes, including the acquisition of vessels.

Empirical studies provide mixed results on the effect of corporate size on the quality of corporate governance. For example, Doukas et al., in 2000 appraised the monitoring activity of security analysis from the perspective of the manager–shareholder conflict. Using a data set of more than 7,000 company-year observations for manufacturing companies tracked by security analysts over the 1988–94 period, they found that security analysis acts as a monitor to reduce the agency costs associated with the separation of ownership and control. Also found, however, that security analysts are more effective in reducing managerial non-value-maximizing behavior for single segment than for multisegmented companies. In addition, the shareholder gains from the monitoring activity of security analysis are larger for single segment than for multisegmented companies.

A strict definition of board independence is hard to sustain. Shipilov in 2010 and his study explain that in principle, however, board independence is defined as the presence of independent board members who do not have a kinship relationship with the CEO, or the chairman of the board and are not affiliated with the shareholders, or with the company's partners, suppliers, or customers. Organizational adoption of subsequent practices sharing the same logic more likely, irrespective of these practices' adoptions by the organization's network contacts. Is shown that evidence of

such effects though analyzing the diffusion of governance practices related to the logic of board reform in Canada.

Fixed debt payments restrain managerial flexibility with respect to the free cash flows, which further implies a negative association between financial leverage and wealth transfers from minority shareholders to controlling ones. Zhu et al., (2012) reinvestigates the relationship between financial leverage and firm characteristics in a cross-sectional setting and a panel setting, that a cross-sectional multiple regression model sharing common divisors suffers from a latent spurious ratio problem. Model results suggest past realization of debt explains most of the current debt level after controlling for indigeneity. They find no significant association between debt and firm characteristics.

Su et al., in 2012 used a data analysis to examine the dividend policy at Chinese firms, which appears to be strongly motivated by agency costs and political connections. They find that firms that pay less in cash dividends are associated with more related-party transactions, which represents wealth expropriation from general stockholders. Also, politically connected firms pay higher cash dividends than non-politically connected firms. Further analysis shows that the ownership structures of these Chinese firms play a critical role in the dividend policies with respect to related-party transactions and political connections.

Andrikopoulos et al., in 2013 explores the relationship between internet disclosure, profitability, and financial structure in the shipping sector. Studying the websites of 171 international listed shipping corporations in 2010 construct a disclosure index to measure the quantity of disseminated informations for each firm in the sample and explored the cross-sectional determinants of disclosure performance. Measuring corporate performance with profitability, they develop a simultaneous equation model and our GMM results produce evidence of a statistically significant positive relationship between the extent of internet disclosure and corporate performance.

Andreou et al., in 2014 study examined the relation between corporate governance with (i) financial management decisions such as earnings management and sub-optimal investment, and (ii) firm performance in maritime firms. The study reveals that important corporate governance measures, such as insider ownership, board size,

presence of corporate governance committees, the percentage of directors serving on the boards of other firms and CEO duality, are associated with financial management decisions and firm performance. The associations revealed can potentially assist in mitigating agency problems and improving financial management decisions and performance in maritime firms.

Larger boards of directors have been found to be positively associated with RPTs Bennouri et al., in 2015. Using a sample of 394 French firms for the period of 2001 to 2010, they study the relationship between female directorship and firms' accounting (ROA and ROE) and market-based (Tobin's Q) performance. They find that female directorship significantly increases ROA and ROE, and significantly decreases Tobin's Q. They find that the positive relationship between accounting performance and female directorship remains when included these attributes, while the negative relationship between Tobin's Q and female directorship disappears. Interestingly, the different attributes of female directors do not uniformly affect accounting and market-based performance.

Cao et al., (2016) used hand-collected data on entrepreneurs' political connections and firm ownership, they construct several original measures of social capital and examine their effect on the performance of entrepreneurial firms in China after their initial public offerings. Political connections or a high percentage of external investors tend to enhance firm performance, but intragroup related-party transactions commonly lead to performance decline. These forms of social capital have a strong influence on the performance of Chinese firms, whereas formal governance variables such as board size or board independence have little effect. Although social capital may serve as an informal governance mechanism and effectively substitute for formal governance mechanisms in an emerging market, this role of social capital raises several ethical concerns, notably the development of rent-seeking and crony capitalism.

Boateng et al., (2017) monitored mechanisms and within-firm governance variables to investigate the operating performance of 340 mergers and acquisitions in China over the 2004–2011 period. Results document a significant deterioration in post-acquisition operating performance of acquiring firms over 12–36 months. They find independent directors, managerial shareholding, ownership concentration have a positive and significant impact on operating performance of acquiring firms.

However, the related party transactions exert a negative and significant effect on matched control adjusted ROA. Further analysis of their sub-sample indicates that privately owned enterprises are better monitors compared to the state-owned enterprises.

Marchini et al., in 2018 examined whether firms use related party transactions for earnings management, and then, whether they try to minimize detection through the format of related party transactions disclosure. Firstly, they analyze the association between related party transactions and the probability of reporting small earnings increase. Related party transactions may have significant impact on, and implications for, earnings management. According to the agency theory, related party transactions are used opportunistically, while the efficient transaction hypothesis argues that related party transactions meet the economic needs of the business. Next they investigate the association between the probability of reporting small earnings increases through related party transactions and disclosure quality. Disclosure quality should be studied in relation to impression management and investor attention; this approach takes account of the idea that earnings management behavior may influence the quality of disclosure as a possible way of lowering conflict of interest. In line with the agency theory, findings show that revenue related party transactions are more likely to be used to manage earnings than other types of transaction; related party transactions with ultimate parents are associated with lower probability of reporting small earnings increases compared to operations with other related parties. Lastly, their results confirm that the decision to engage in earnings management is related to lower disclosure quality.

2.4 Related party transactions (RPTs) in shipping.

Tsouknidis in 2019 examines the relationship between institutional ownership and firm performance for U.S. listed shipping companies using quarterly 13F reports of institutional holdings over the period 2002 to 2016, institutional investors hold a substantial percentage of ownership of U.S.-listed shipping firms, whose effects on firm performance have not been examined previously in the literature. Results reveal a negative relationship between the percentage of institutional ownership and firm performance, which is primarily attributed to non-strategic rather than strategic

institutional investors. This result gives a set of panel data estimators which consider the appearance of dynamic endogeneity in the relationship examined.

In 2021 Andrikopoulos et al., explored the RPTs in public maritime shipping companies, by compiling a unique panel data of US public maritime shipping companies for 2011 to 2018 (a period of great liquidity due to extensive significant leasing programs) in order to investigate the determinants of RTPs as well as the forbears of principal-principal conflicts. The business transactions between maritime shipping companies listed on the stock exchanges and private companies, which are beneficially owned by the controlling shareholder of the public maritime shipping companies, can be broken down into two main types based on the nature of the business dealing, operating RPTs and financing RPTs. In addition, provided empirical evidence that profitability, financial leverage, firm size, board size and board independence are important determinants of related party transactions. Also, above-average operating RPTs and above-average financing RPTs are associated with above-average operating expenses and below-average interest expenses, respectively.

3. Hypotheses

From the literature survey it appears that financial and non-financial variables such as industry specific and company characteristics, as well as macroeconomic variables influence the probability of shipping companies' default. Grammenos, C. T., Nomikos, N. K. and Papapostolou,N. C.,, in 2008 have shown that freight rates have a significant impact on the probability of shipping companies default. Mitroussi et al. in 2016 have demonstrated that market risk indicators are important factors in measuring credit risk, especially during turbulent markets and the periods when funding is limited. Kavussanos and Tsouknidis (2016) have shown that it is important to consider both the current state of the ship transport market and the forecast for the future when assessing the probability of default of a shipping company's loan.

As a probability of default, defines a shipping company that has lost a payment in the year is studied the financial statement.

Was used either of three variables to reflect profitability of a shipping company—the return on assets (ROA), earnings before interest, income taxes, depreciation and amortization (EBITDA) and return on equity (ROE) which reflects the efficiency of using equity as a means of financing a company, and it is widely used for comparing the profitability of companies operating in the same or related industries. ROA is considered as an indicator of default; Altman (1968) as the ultimate existence of a company is built upon the return on its assets. (Beaver 1966, Altman 1968, Dewaelheyns and Van Hulle 2006) have shown that the probability of default reduces when return on assets increases. EBITDA is often used to determine the financial standing of a company, Pompe and Bilderbeek (2005). Grammenos, Nomikos, and Papapostolou (2008) find evidence that the probability of default decreases when the return on equity rises. Based on the above, is formulated the following hypothesis:

Hypothesis 1: Ceteris paribus, is expected that profitability of a shipping company is negatively associated with the probability of default.

In several studies (Altman 1968, Johnsen and Melicher 1994, Dewaelheyns and Van Hulle 2006), it was shown that the likelihood of default reduces, when the size of a company increases. Moreover, in Grammenos, Nomikos, and Papapostolou (2008) authors mentioned that shipping companies are very asset intensive. Is postulated that:

Hypothesis 2: Ceteris paribus, the size of the shipping company is negatively associated with the probability of default.

Next, is considered that the solvency of a shipping company and the working capital shows if a company is capable to meet current liabilities only with the use of current assets. If the current liabilities growth ratio significantly exceeds the current assets growth ratio, this could be a warning for the liquidity of a company. Thereafter, insufficient liquidity can lead to full insolvency of a company and, as a result, to its default. Is formulated the following hypothesis:

Hypothesis 3: Ceteris paribus, the working capital of the shipping company is negatively associated with the probability of default.

Several studies (Altman 1968, Ohlson 1980, Dewaelheyns and Van Hulle 2006) have demonstrated that a high level of financial leverage occurs when there is a shortage of equity, and this is a signal of high financial risk for a company, which increases the probability of default. A positive relationship between financial leverage and the probability of default in the shipping industry was found in the study, Kavussanos and Tsouknidis (2016). Is therefore expect:

Hypothesis 4: Ceteris paribus, the higher financial leverage and the ratio of financial dependence is associated with a higher probability of default.

Related party operating transactions between a public company and its own controlling shareholders occurs when the nature of the business dealings is the provision of services to the parent company with regard to certain operating activities, through its privately-owned companies. The most commonly used justification is that the company listed on a stock exchange has outsourced these operating activities to

the entities affiliated with the controlling shareholder because it does not have the capacity to carry out those operating activities in-house. If the pricing of the services charged by the private company affiliated with the controlling shareholder of the public company is at the same level as the prevailing market price, then the related party operating transaction is done at arm's-length basis. On the contrary, if the compensation paid to the private company affiliated with the controlling shareholder of the public company is either above (or below) the market, then the related party operating transaction is done at non-arm's-length basis. Clearly, the controlling shareholder, who has the power to direct the public company's decision making, has an incentive to engage in operating RPTs, in which the pricing of the service provided is above market, rather than below prevailing market price, or at the same level as the prevailing market price.

Operating RTPs can positively or negatively affect the probability of default. Increasing positively means that the more transactions they have regarding operating RTPs, the more the probability of default increases, i.e. the ship owner transfers wealth from the listed company to the privately owned company. The opposite can also happen and transfer wealth from the privately owned company to the public to help it, negatively affecting the probability of default.

Hypothesis 5: Ceteris paribus, is expected that operating RTPs is related to the probability of default.

Related party financing transactions between a public company and its own controlling shareholders occurs when the nature of the business dealing is the extension of credit to the public company for working capital purposes, or provision of debt capital to the public company for general corporate purposes, including the acquisition of vessels. So, the controlling shareholder of the public company, through its privately owned special purpose entities, is lending capital to the public company. The most used justification is that the company listed on a stock exchange has engaged into financing activities with the entities affiliated with the controlling shareholder because it has limited financing options. The business transactions pertaining to the financing activities can be made either at arm's-length basis, or at

non-arm's-length basis. In the event that public company's access to debt capital is limited, then if the interest rate of the loan charged by the related party is at the same level as the prevailing market lending rates, then the related party financing transaction is done at arm's-length basis. On the contrary, if the interest rate paid to the related party is either above, or below the market, then the related party financing transaction is done at non-arm's-length basis. The controlling shareholder, who has the power to direct the public company's decision making, may have an incentive to engage into financing RPTs at non-arm's-length basis, either by charging higher interest rate compared to market, or by improving its priority in the free cash flow. In the context of the maritime shipping industry, financing RPTs can take many forms and can be implemented structures. The most prevalent financing structure of business transactions between a public company and its own controlling shareholders, or financing RPTs, is the asset-based senior loan facility. Under this structure, interest payments and the debt capital provided by the controlling shareholder are secured by the collateral value of a vessel, or pool of vessels, and other customary shipping specific securities such as assignment of earnings, pledge of the ship-owning company's shares and downstream, or upstream corporate guarantees.

Will be considered the possibility that financing RTPs affect the probability of default. The ship owner may transfer funds and borrowing from the privately owned company to the parent to assist it so there is a negative relationship between financing RTPs and the probability of default. But may the private owned company transfer funds and borrowing from the parent company, so there can be a negative relationship between financing RTPs and the probability of default.

Hypothesis 6: Ceteris paribus, is expected that financing RTPs is related to the probability of default.

4. Sample description and methodology

4.1 Dataset

The dataset used for the analysis in this thesis contain maritime shipping companies listed on United States of America stock exchanges, Nasdaq and NYSE. Like the study of Andrikopoulos et al., (2021) our study includes only maritime shipping companies listed on United stock exchanges, because US listed companies apart from the financial data, customary and statutory accounting, are obliged by FASB ASC 850–10-50 to disclose in their financial statements all their related party transactions in separate lines in their financial statements. Such a level of transparency from the US public companies due to US Securities and Exchange Commission (SEC) regulations, ensures the validity and reliability of our data set.

So, is compiled a data set of 55 US public maritime shipping companies from the US SEC's archival data for the period 1993 to 2020. In our sample is included all companies registered under the Standard Industrial Classification (SIC) of 4412 - Deep Sea Foreign Transportation of Freight with available data. From the SEC archive, is collected data from 55 maritime shipping companies over the twenty-seven-year period that ended in 2020. The maritime shipping companies contained in our data set appear in Table A 5 of the Appendix.

4.2.1 Payment Default

As dependent variable is used the payment default, that defines if a shipping company is in default, means that if a shipping company has lost a payment of loan in the year is studied the financial statement anytime between 1993 and 2020. Several factors can affect the borrowers' probability of default in bank loan agreements. A scoring model can be utilized to combine the different bits of information a credit institution may have at its disposal and reveal the relevant

ones to assess the payment default of a borrower. In this study, the development of a credit scoring model is empirically examined. The model in its general form is shown below:

$$Score_{it}=b_0+b_1x_{1t}+b_2x_{2it}+\ldots+b_kx_{kit}+u_{it}=b'x_{it}+u_{it} \quad (1)$$

with u_{it}~i.i.d.$(0,\sigma_U^2)$, $E(u_{it})=0$, $E(u_{it}^2)=\sigma_u^2$, for $E(u_{it}u_{jt})=0$

where i = 1, 2,.. ., n identifies the shipping company ; t = 1, 2, .. ., T denotes the time period; $Score_{it}$

represents the credit scoring for a shipping company ₀at time t, taking continuous values in the range [0,1] – see Eq. (2) below for the exact definition of this dependent variable; x_{kit} (k = 1, .. ., K) denotes the matrix of the K independent variables used to explain default risk b (b_i; i = 1, .. ., K) stands for the vector of the corresponding parameters; and u_{it} is the random error term, which follows a white noise error process with a distribution that has mean zero and variance r^2 and stands for the within-loans errors.

A consequence of the above is that u_{it} is orthogonal with the repressor's in the model; that is, $E(u_{it}x_{kit}) = 0$.

A logit model is used to estimate Eq. (1) by utilizing historical records of a cross section of shipping companies. The aim is to forecast the probabilities of default (PD's) and to discriminate between defaulted and non-defaulted companies. In practice, this is achieved by representing default probabilities as a logistic function, which when applied to (1) leads to:

$$Prob(y_{it})=\Lambda(Score_i)=\exp(b'x_i)/[(1+\exp(b'x_i)]=1/[1+\exp(-b'x_i)] \quad (2)$$

where, the discrete indicator variable y_{it} takes the value one (1) if the shipping company defaulted in year t and zero (0) otherwise. The estimated coefficients, represented by the b vector, are obtained by maximizing the following log likelihood function:

$$lnL=\Sigma y_i ln[\Lambda(b'x_i]+(1-y_i)ln[1-\Lambda(b'x_i)] \quad (3)$$

4.2.2 Financial specific variables

For the companies of our sample, is collected the applicable accounting data in order to calculate the financial variables to capture the effect on the probability of default of the financial structure, the liquidity and the profitability of the company. All financial-specific variables are drawn from the audited financial statements. Includes: (1) Profitability, Net Result Margin measured as Net Result over Gross Operating Revenues, Net Result return on Equity (ROA) defined as Net Result over Total Assets and Net Result return on Equity (ROA) as Net Result over Total Equity. It shows the combined effect of leverage, liquidity, assets and debt on the operating profit of the company. A negative sign of its coefficient is expected since the higher the profit margin, the lower is the expected probability of default.
(2) Liquidity, Liquidity ratios provide an indication of the ability of the company to pay all of his Current Liabilities. Is used the working capital measured as Current Assets minus the Current Liabilities, Cash ratio as Cash and Cash Equivalents plus Restricted current Cash plus Restricted non-current Cash over Total Current Liabilities, Current Ratio as Total Current Assets over Total Current Liabilities, Quick Ratio as Current Assets deduct Inventories over Total Current Liabilities, Receivable Ratio as Cash and Cash Equivalents plus Restricted current Cash plus Restricted non-current Cash plus Trade and Account receivables plus Other Receivables over Total Current Liabilities. Higher liquidity increases the chances that the repayment scheduled is followed and no payment default occurs.
(3) Total Assets, also is used variables of Total Assets and the Natural Logarithm of Total Assets. (4) Financial leverage, is a mix of debt and equity used to finance the company. The expected sign is positive since the higher the financial leverage, the higher is the expected probability

of payment default. Ratio Leverage is measured as Total Liabilities over Total Assets, Ratio Leverage 2 as Total Liabilities over Total Equity, Ratio leverage 3 as Logarithm of Total Liabilities over Logarithm of Total Assets.

4.2.3 Variables representing the relating party transactions

4.2.3.1 Operating RPTs

To calculate the magnitude of operating relating party transactions is needed to calculate the ratios of (1) RTPs operating expenses[1] over (i) total operating expenses[2] (ii) total assets (iii) gross operating revenues. Then must calculate the ratio of (2) RTPs total expenses[3] over (i) total operating expenses (ii) total assets (iii) gross operating revenues. In addition (3) the net ratio of RTPs operating expenses over (i) total operating expenses (ii) total assets (iii) gross operating revenues. And last (4) the net ratio of RTPs total expenses over (i) total operating expenses (ii) total assets (iii) gross operating revenues.

Increased operating RPTs indicate that a public company is paying high remuneration to service vendors affiliated with its controlling shareholders. In other words, a large magnitude of operating RPTs implies that entities affiliated with the controlling shareholder are receiving high amount of revenue, in exchange for services offered to the public company, such as services concerning technical management and ship operations, chartering and commercial services as well as general and administrative services.

1.RTPs operating expenses is: RTPs brokerage and commission + RTPs total direct voyage cost + RTPs total operating costs + RTPs management fees + RTPs administrative expenses + RTPs other expenses.
2.Total operating expenses is: brokerage and commission+ RTPs brokerage and commission + total direct voyage cost + RTPs total direct voyage cost + total operating costs + RTPs total operating costs + management fees + RTPs management fees + administrative expenses + RTPs administrative expenses + other expenses+ RTPs other expenses.
3. RTPs total expenses is: RTPs brokerage and commission + RTPs total direct voyage cost + RTPs total operating costs + RTPs management fees + RTPs administrative expenses + RTPs other expenses+ RTPs other losses.

4.2.3.2 Financing RPTs

To calculate the magnitude of financing relating party transactions, must calculate the ratios of (1) RPT FIN 1: short term debt due to related parties + long term debt due to related parties + amounts due to related parties' current portion + amounts due to related parties' noncurrent portion – amounts due from related parties' current portion – amounts due from related noncurrent portion, then is calculated the ratio of RPT FIN 1 over total assets and over total liabilities. (2) RPT FIN2: short term debt due to related parties + long term debt due to related parties + amounts due to related parties' current portion + amounts due to related parties' noncurrent portion, then will be calculated the ratio of RPT FIN 2 over total assets and over total liabilities. (3) RPT FIN 3: amounts due to related parties' current portion + amounts due to related parties' noncurrent portion, then will be calculated the ratio of RPT FIN 3 over total assets and over total liabilities.

Increased financing RPTs indicates that a public company has received high amount of debt capital from affiliated companies with the controlling shareholder. In other words, a large magnitude of financing RPTs implies that entities affiliated with the controlling shareholder are lending high amounts of capital and/or are extending credit, in exchange of interest payable by the public company.

4.2.4 Shipping freight variables

(1) The Clarksea index is a freight rate index published by Clarkson's Research Limited. It is constructed to be representative of freight rates in all cargo carrying sectors of the global shipping industry. ClarkSea indices are published by Clarkson's Research on a weekly basis as indicators of earnings for all the main commercial vessel types involved in ocean cargo transportation of various commodities. The sectors covered in the ClarkSea Index are Oil tankers (VLCC: 200,000–399,999 dwt; Suezmax: 120,000–199,999 dwt; Aframax: 75,000–119,999 dwt and clean product carriers), Dry bulk carriers (Capesize: 150,000+ dwt; Panamax: 60,000–70,000; Handymax: 50,000–60,000 dwt and Handysize: 15,000–35,000 dwt), Gas carriers (Very Large Gas Carriers: 180,000–320,000 dwt) and fully cellular containerships. Separate Clarksea indices are constructed for each of these subsectors of shipping.

The overall ClarkSea index is constructed as a weighted average of freight rates in all shipping subsectors, with the weights used reflecting the number of vessels in each fleet sector. The indices are constructed from rates directly collected from Clarksons' brokers on a daily and weekly basis. (2) Baltic Dry Index (BDI) is considered a barometer for the shipping market, is a shipping and trade index created by the London-based Baltic Exchange.

Table 1
Description of Variables

Variables	Definition
Net Result	Net profit of company's activities
Net Result Margin	Net result over gross operating revenues
Net Result ROA	Return on assets calculated as Net profit over Assets
Net Result ROE	Return on equity calculated as Net profit over Equity
Cash Ratio	Cash and Cash Equivalents + Restricted Cash Current + Restricted Cash non-current over Total Liabilities
Current Ratio	Total Current Assets over Total Liabilities
Working Capital	Current Assets – Current Liabilities
Total Assets	Total assets refer to the total amount of assets owned by company
Total Assets Logarithm	The Logarithm of Total Assets
Ratio Leverage 1	Total Liabilities over Total Assets
Ratio Leverage 2	Total Liabilities over Total Equity
Ratio Leverage 3	Total Liabilities Logarithm over Total Assets
RPTs Operating Expense Net	Operating RTPS Expenses – Revenue from RPTs
RPTs Expenses Total Net	Total RPTs Expenses – Revenue from RPTs – other Income Gains from RPTs
RPTs Operating Expenses	RTPs brokerage and commission + RTPs total direct voyage cost + RTPs total operating costs + RTPs management fees + RTPs administrative expenses + RTPs other expenses
RPTs Total expenses	RTPs brokerage and commission + RTPs total direct voyage cost + RTPs total operating costs + RTPs management fees + RTPs administrative expenses + RTPs other expenses+ RTPs other losses
RPTs Operating Net Ratio	Net Operating RPTs Expenses over Gross Operating Revenue
RPTs Total Net Ratio	Total Net RPTs Expenses over Gross Operating Revenue
RPTs Operating Ratio	Operating RPTs Expenses over Gross Operating Revenue
RPTs Total Ratio	RPTs Total Expenses over Gross Operating Revenue
RPT Fin 1	Short term debt due to related parties + long term debt due to related parties + amounts due to related parties' current portion + amounts due to related parties' noncurrent portion – amounts due from related parties' current portion – amounts due from related noncurrent portion
RPT Fin 2	Short term debt due to related parties + long term debt due to related parties + amounts due to related parties' current portion + amounts due to related parties' noncurrent portion
RPT Fin 3	Amounts due to related parties' current portion + amounts due to related parties' noncurrent portion
RPT Fin Ratio 1	RPT Fin 1 over Total Assets
RPT Fin Ratio 2	RPT Fin 2 over Total Assets
RPT Fin Ratio 3	RPT Fin 3 over Total Assets
BDI Log	Baltic Dry Index Logarithm
Clarksea Average Log	Clark sea Average Logarithm

Table 2 presents descriptive statistics of the variables used in the estimation of the econometric model. All variables are winsorized to reduce the effect of possible outliers, winsorizing sets all the data points less than the 1st percentile of each

variable equal to the 1st percentile and all the data points exceeding the 99thpercentile equal to the 99th percentile, thereby excluding extreme observations from the sample.

Table 2
Descriptive Statistics of Variables - Sample period 1994–2020, Annual data.

Variables	Mean	Median	Maximum	Minimum	Standrad Deviation	Skewness	Kurtosis	Jarq.-Bera [p-value]
Panel A: Descriptive statistics of financial variables.								
Payment Default	0.0650	0.000	0.000	1.000	0.246	3.527	13.444	4070.972 [0.000]
Net Result	7505127.	10939000	1.23E+09	-2.81E+09	1.84E+08	-5.2473	95.98724	224392.2 [0.000]
Net Result Margin	-0.237016	0.052617	38.72193	-45.24250	3.389275	-5.0410	118.31	343364.2 [0.000]
Net Result ROA	-0.014143	0.012377	33.22353	-78.80811	3.726854	-13.618	340.13	2931614. [0.000]
Cash Ratio	1.5358	0.770444	54.29547	0.000	3.14251	9.4679	138.3111	478359.2 [0.000]
Working Capital	-12352311	6853000.	6.88E+08	-2.43E+09	2.71E+08	-4.1491	32.41	23933.38 [0.000]
Total Assets	1.93E+09	1.31E+09	1.31E+10	543000.0	2.02E+09	2.3615	10.46	1999.905 [0.000]
Total Assets Logarithm	20.77331	20.99644	23.29292	13.20486	1.371332	-1.5247	7.27	707.5568 [0.000]
Ratio Leverage 1	2.497442	0.563590	675.1547	0.000369	28.27109	22.1696	523.47	6992082. [0.000]
Ratio Leverage 2	1.839873	1.247754	106.1164	-61.49254	7.447292	5.75035	129.47	413277.4 [0.000]
Ratio Leverage 3	0.973193	0.973071	1.493374	0.618818	0.048161	3.76373	43.93	44396.90 [0.000]
RPTs Operating Net Ratio	-0.091946	0.000	1.387352	-12.58339	0.798977	-9.8911	126.16	398761.0 [0.000]
RPTs Total Net Ratio	-0.095056	0.000	1.387352	-12.68139	0.806155	-9.8053	125.04	391523.0 [0.000]
RPTs Operating Ratio	0.5046	0.000	2.0222	0.000	0.1659	7.5317	72.6072	129972.1 [0.000]
RPTs Total Ratio	0.5331	0.000	2.0222	0.000	0.1735	7.4965	71.6968	126691.4 [0.000]
RPTs Fin Ratio 1	-12648872	0.000	6.21E+08	-8.65E+08	97132668	-2.4033	29.46	18541.72 [0.000]
RPTs Fin Ratio 2	0.022073	0.000158	3.309392	0.000	0.1491277	18.1954	387.43	3821005. [0.000]
RPTs Fin Ratio 3	0.140962	0.000	74.58723	0.000	3.007582	24.7207	612.40	9579172. [0.000]
Panel B: Shipping freight variables								
Clark Sea Average Logarithm	9.5139	9.4035	10.4071	9.1483	0.3410	1.3931	4.2563	242.5127 [0.000]
Baltic Dry Index Logarithm	7.2675	7.0950	8.8637	6.5117	0.6013	1.1440	3.6705	140.5286 [0.000]

Notes: See Table 1 for definitions of variables. Min and max are the minimum and maximum values of the sample data, respectively. Skewness and kurtosis are the estimated centraliz third and fourth moments. J-B is the Jarque and Bera (1980) test for normality; the JB statistic is distributed. Numbers in square brackets [.] indicate p-values.

Table 3
Correlation Matrix

	Payment default	Net result	Net result margin	Net result ROA	Cash ratio	Working capital	Total assets	Total assets logarithm	Ratio lev 1	Ratio lev 2	Ratio lev 3	RPTs Oper Exp net ratio	RPTs Oper total Exp net ratio	RPTs Oper Exp Ratio	RPTs Oper Total Exp Ratio	RPTs Fin 1	RPTs Fin 2
Payment default	1.000																
Net result	-0.179	1.000															
Net result margin	-0.261	0.220	1.000														
Net result ROA	-0.146	0.128	0.397	1.000													
Cash ratio	-0.057	0.167	0.061	0.026	1.000												
Working capital	-0.170	0.114	0.049	0.011	0.233	1.000											
Total assets	0.007	0.041	0.076	0.004	-0.091	-0.148	1.000										
Total assets logarithm	-0.166	0.085	0.153	-0.008	-0.018	-0.053	0.729	1.000									
Ratio lev 1	-0.015	0.056	-0.000	0.105	-0.022	-0.042	-0.063	-0.315	1.000								
Ratio lev 2	-0.016	0.036	0.025	-0.004	-0.039	-0.046	0.009	0.000	-0.004	1.000							
Ratio lev 3	0.077	-0.047	-0.159	0.147	-0.191	-0.123	0.021	-0.310	0.599	-0.047	1.00						
RPTs Oper Exp net ratio	0.056	-0.054	-0.114	-0.011	0.029	-0.017	-0.017	-0.089	0.011	-0.008	0.02	1.00					
RPTs Oper total Exp net ratio	0.056	-0.055	-0.115	-0.012	0.030	-0.017	-0.018	-0.092	0.011	-0.007	0.02	0.99	1.00				
RPTs Oper Exp Ratio	0.057	0.054	-0.113	-0.047	-0.053	-0.008	-0.059	-0.108	-0.008	0.018	0.10	-0.28	-0.28	1.00			
RPTs Oper Total Exp Ratio	0.051	0.053	-0.109	-0.050	-0.046	-0.002	-0.058	-0.100	-0.001	0.024	0.10	-0.28	-0.27	0.98	1.000		
RPTsFin 1	0.034	-0.101	-0.053	-0.036	0.058	0.011	-0.277	-0.175	0.007	-0.024	-0.03	0.19	0.21	-0.33	-0.33	1.0	
RPTsFin 2	0.039	-0.023	-0.072	0.069	-0.035	-0.064	-0.096	-0.323	0.861	-0.013	0.47	0.03	0.03	0.06	0.06	0.12	1.0
RPTsFin 3	-0.009	0.003	0.003	-0.011	0.015	0.023	-0.017	-0.002	-0.003	-0.008	-0.29	0.00	0.00	-0.00	-0.00	0.01	0.01

Notes: This table presents the pairwise linear correlations among the explanatory variables used

4.3 Model

Was used a logit model for estimating the probability of default of shipping company's and related party transactions. Defines a shipping company in default if has lost a payment of loan in the year is studied the financial statement anytime between 1993 and 2020. To avoid multicollinearity issues which may result in biased estimates, care is taken not to include simultaneously during estimation sets of variables which exhibit high linear correlations.

The estimated coefficients and the respective t-statistics for different specifications of the logit regression model described before are reported in Table 4. To assess the explanatory power of different categories of probability of default, models M1 to M8 include financial variables except M8 which include shipping freight variables. These models are estimated to assess the explanatory power of each of the above groups of variables on the probability of default, and not to bring out conclusions about the significance of individual variables in each group.

This role is assumed by Model M8 and it is the most parsimonious model, includes only statistically significant variables, which may come from any of models M1–M8. The final estimated model M8 has been specified by considering the maximization of McFadden's pseudo-R2 coefficient, the minimization of Schwarz's criterion, as well as the statistical significance of the estimated coefficients. In all models, two-way cluster adjusted standard errors are estimated to report unbiased standard errors, robust to autocorrelation effects. This adjustment leads to unbiased estimation of standard errors, thus leading to correct inferences regarding the significance of the explanatory variables and is carried out during estimation of the logit models in this study. Adding or removing variables from the model, multicollinearity issues may arise, which would lead to biased estimated coefficients and standard errors. To avoid such issues, variables with bilateral linear correlations more than 60% are not used simultaneously in the estimated models.

Table 4

Logistic regression estimates the probability of default and the related party -Dependent Variable: Payment Default

	M1	M2	M3	M4	M5	M6	M7	M8
Financial Specific Variables								
Constant	-2.8526***	-2.5473***	4.4158***	-7.8649***	-2.3970***	-2.6752***	7.5539	3.9858
	(0.1809)	(0.2230)	(1.6924)	(2.1754)	(0.2338)	(0.1648)	(6.2536)	(2.5565)
Net Result	-2.0000*	-	-	-	-	-	-	-
	(1.0600)							
Net Result Margin = Net Result/Gross Operating Revenues	-0.159***	-	-	-	-	-	-	-0.1286***
	(0.0610)							(0.0599)
Net Result ROA = Net Result/Total Assets	-0.0208	-	-	-	-	-	-	-
	(0.0318)							
Working Capital = Current Assets – Current Liabilities	-	-1.2000***	-	-	-	-	-	-1.6100***
		(4.01)						(4.2200)
Cash Ratio = Cash and Cash Equivalents + Restricted Cash	-	00.1708	-	-	-	-	-	-
Current + Restricted Cash non-current / Total Liabilities		(0.1475)						
Total Assets	-	-	1.0500	-	-	-	-	-
			(1.2900)					
Total Assets Logarithm	-	-	-0.3479***	-	-	-		-0.3348***
			(0.0845)					(0.1252)
Ratio Leverage 1 = Total Liabilities / Total Assets	-	-	-	-0.0023	-	-	-	-
				(0.011)				
Ratio Leverage 2 = Total Liabilities / Total Equity	-	-	-	-0.0047	-	-	-	-
				(0.018)				
Ratio Leverage 3 = Total Liabilities Logarithm / Total Assets	-	-	-	5.321***	-		-	-
Logarithm				(2.199)				
RPTs Operating Net Ratio = Expenses RPTs Operating Net /	-	-	-	-	2.9474***	-	-	-
Gross Operating Revenue					(1.0787)			
RPTs Total Net Ratio = RPTs Expenses Total Net / Gross	-	-	-	-	3.2743***	-	-	-
Operating Revenues					(1.2083)			
RPTs Operating Ratio = RPTs Operating Expenses / Gross	-		-	-	-6.8200	-	-	-
Operating Revenue					(4.6300)			
RPTs Total Ratio = RPTs Total Expenses / Gross Operating	-	-	-	-	-5.5400	-	-	-
Revenue					(3.5100)			
RPT Fin Ratio 1 = RPT Fin 1 / Total Assets	-	-	-	-	-	1.6100	-	-
						(1.8100)		
RPT Fin Ratio 2 = RPT Fin 2 / Total Assets	-	-		-	-	0.8925*	-	-
						(0.5588)		
RPT Fin Ratio 3 = RPT Fin 3 / Total Assets	-	-	-	-	-	-0.0295	-	-
						(0.1527)		
Shipping freight variables								
Clark sea Average Logarithm	-	-	-	-	-	-	-1.1049	-
							(0.6082)	
Baltic Dry Index Logarithm	-	-	-	-	-	-	-.04636	-
							(0.3114)	
McFadden pseudo-R^2	10.34%	4.34%	4.9%	1.6%	5.2%	0.9%	1.3%	14.38%
LR stat	30.607	13.048	14.875	4.903	15.48	2.82	3.95	42.59
[p-value]	[0.0000]	[0.0014]	[0.000.]	[0.026]	[0.003]	[0.419]	[0.1387]	[0.000]
Schwartz criterion	47.32	49.53	49.24	49.81	50.82	52.21	50.99	47.68

Notes: This table presents the results of the estimated logit regressions between the probability of defaults and different specifications of the econometric model described in methodology. T-statistics are reported in parentheses below the estimated coefficients. Statistical significance of the estimated coefficients is denoted with *, ** and *** for 10%, 5% and 1% significance levels, respectively. All standard errors reported are two-way cluster adjusted. Columns M1–M7 report estimates for specifications which test the explanatory power of individual groups of the probability of default and the related party (i.e., finance-specific variables, Shipping freight variables). Column M8 reports the most parsimonious model and includes all variables which are statistically significant in M1–M7, while minimizing Schwarz criterion and maximizing McFadden pseudo-R2. The latter is an indication of the goodness of fit of the estimated model. The Schwartz criterion assesses the explanatory power of each estimated model with smaller values indicating higher explanatory power of the repressors.

5. Empirical Results.

In Model 1 only profitability variables are included to estimate the probability of default. McFadden's pseudo R^2 is 10.34%. One profitability variable appears to be statistically significant explaining default, Net Result Margin and is defined as Net Result over Gross Operating Revenues. As said in hypothesis 1, is expected that profitability of a shipping company is negatively associated with the probability of default, which is confirmed by the negative sign they have.

Model 2 includes liquidity variables. The McFadden's pseudo R^2 is 4.34%. The Working Capital variable is statistically significant and is defined as Current Assets minus Current Liabilities. As said in hypothesis 3, the working capital of the shipping company is negatively associated with the probability of default, which is confirmed by the negative sign they have.

Model 3 includes Total Assets and Total Assets Logarithm. McFadden's pseudo R^2 4.9%. Total Assets Logarithm appears to be statistically significant.

Next model is 4 and includes leverage ratio variables. Because these three leverage ratios have a very high correlation between them, I examine each ratio separately with the payment default. As a result, the only statistically significant is Ratio Leverage 3 and is defined as Total Liabilities Logarithm over Total Assets Logarithm and McFadden's pseudo R^2 is 1.6%. As said in hypothesis 4, the higher financial leverage and the ratio of financial dependence is associated with a higher probability of default, which is confirmed by the positive sign they have.

Model 5 includes RPTs Operating ratios. McFadden's pseudo R^2 is 5.2%, is found that two ratios are statistically significant the RPTs Operating Net Ratio and the RPTs Total Net Ratio. As said in hypothesis 5, is expected that operating RTPs is related to the probability of default, which is confirmed by the positive sign they have.

Model 6 includes RPTs Financing ratios. McFadden's pseudo R^2 is 0.9 and the statistically significant is the RPT Fin Ratio 2. As said in hypothesis 6, is expected that financing RTPs is related to the probability of default, which is confirmed by the positive sign they have.

Model 7 includes shipping freight variables the Clarksea average logarithm and the Baltic dry index logarithm. McFadden's pseudo R^2 is 1.3% and none was statistically significant. Having evaluated the explanatory power of each category of probability of default as well as the potentially important variables from each group.

Model 8 reports the estimation results from the most parsimonious model. First assess the individual significance of each variable used, by estimating a logit regression. Next, i have modify the model by adding or removing variables according to their statistical significance and the likelihood ratio test, when at the same time seeks to maximize the McFadden pseudo-R^2, minimize the Schwarz criterion and avoid using simultaneously variables which exhibit high pair-wise linear correlations (>60%). This process ends when no further variables can be added or removed from the model based on the rules described above.

The variables found significant in the final Model 8 all have the a-priori expected sign and are the Result Margin, the Working Capital and the Total Assets logarithm. Model 8 is well specified and has a reasonable goodness of fit. The two-way adjusted clustering of the standard errors ensures that there are no issues of autocorrelation or heteroskedasticity in the panel data regression, the likelihood ratio (LR) test statistic strongly rejects the null hypothesis that all estimated coefficients are simultaneously equal to zero, McFadden's pseudo-R2 equals 14.58%. The variables that were found to be statistically significant in Models 1-7 as mentioned above are Net Result Margin, Working Capital, Ratio Leverage 3, RPTs Operating Net Ratio, RPTs Total Net Ratio, RPT Fin Ratio 2 which is used in our final Model 8, regarding related party transactions although there are indications based on the positive sign in Models 5 and 6, in the end their influence on the final Model 8 is not statistically significant and they cannot contribute substantial information to the probability of default.

6.Conclusion

In this study was examined if related party transactions affect the probability of default. The business transactions between maritime shipping companies listed on the stock exchanges and private companies, which are beneficially owned by the controlling shareholder of the public maritime shipping companies, can be broken down into two main types based on the nature of the business dealing, i.e., operating RPTs and financing RPTs. The operating RPTs emerge when the controlling shareholder of the public shipping company is providing services to the public maritime shipping company regarding certain operating activities through its privately-owned companies. The financing RPTs occur when the controlling shareholder of the public maritime shipping company is lending capital to the public maritime shipping company through its privately-owned special purpose entities.

Was collected a data set of 55 US public maritime shipping companies from the US SEC's archival data for the period 1993 to 2020, our study includes only maritime shipping companies listed on United stock exchanges. A logit model was used for estimating the probability of default of shipping company's and related party transactions. Models M1 to M7 are estimated to assess the explanatory power of each of the above groups of variables on the probability of default, and not to bring out conclusions about the significance of individual variables in each group. Model M8 bring out conclusions about the significance and it is the most parsimonious model, includes only statistically significant variables, which may come from any of models M1–M7.

The variables that were found to be statistically significant in Models 1-7 as mentioned above are Net Result Margin, Working Capital, Ratio Leverage 3, RPTs Operating Net Ratio, RPTs Total Net Ratio, RPT Fin Ratio 2 which is used in our final Model 8.

Regarding related party transactions although there are indications based on the positive sign in Models 5 and 6 that the two ratios are statistically significant, the RPTs Operating Net Ratio and the RPTs Total Net Ratio. A positive sign means that the increase of transactions from these two ratios can increase the probability of payment default. But in the end, their influence on the final Model 8 is not statistically

significant and they cannot contribute substantial information to the probability of default.

These empirical findings contribute to the expansion of the literature as found that related party transactions finally do not affect the probability of payment default. Of course, this does not mean that there are no conflicts between controlling and minority shareholders, and it should be investigated to what extent RPTs affect the value of a company.

Specifically, if corporate leaders and regulators want to shield public companies against the transfer of resources to companies that are affiliated with controlling shareholders, they could foster large and independent boards of directors as well as promote large size companies. Investigation of conflicts between controlling and minority shareholders is essential given the increasing interest of maritime shipping companies in raising equity capital by becoming public companies. While this study has identified some variables to be statistically significant in Models 1-7 on the final Model 8 related party transactions can't show if affect the probability of default, isn't statistically significant and they cannot contribute substantial information to the probability of default.

Appendix

Table 5

Companies in the Data set.

No	Company	Ticker	Segment
1	Ardmore shipping	ASC	Product Oil
2	Capital Product Partners	CPLP	Diversified
3	Costamare	CMRE	Container
4	Danaos	DAC	Container
5	Diana Containerships/Performance shipping	DCIX	Container
6	Diana Shipping	DSX	Dry Bulk
7	Dryships	DRYS	Diversified
8	Dynagas LNG Partners	DLNG	LNG
9	Euroseas	EASEA	Diversified
10	Frontline	FRO	Crude Oil
11	Gaslog	GLOG	LNG
12	Global Ship Lease	GSL	Container
13	Golar LNG	GLNG	LNG
14	Golar LNG Partners	GMLP	LNG
15	Golden Ocean Group	GOGL	Dry Bulk
16	Hoegh LNG Partners	HMLP	LNG
17	Hornbeck Offshore Services	HOS	Offshore Support
18	Knot Offshore Partners	KNOP	Crude Oil
19	Matson	MATX	Container
20	Navigation Holdings	NVGS	LPG
21	Navios Maritime Acquisition	NNA	Diversified
22	Navios Maritime Holdings Inc	NM	Diversified
23	Navios Maritime Partners	NMM	Diversified
24	Nordic American Tankers	NAT	Crude Oil
25	Pangaea Logistics	PANL	Dry Bulk
26	Safe Bulkers	SB	Dry Bulk
27	Seacor Holdings	CKH	Diversified
28	Seanergy Maritime Holdings	SHIP	Dry Bulk
29	Seaspan Corp	SSW	Container
30	Ship Finance Intl	SFL	Diversified
31	Star Bulk Carriers	SBLK	Dry Bulk
32	Stealthgas	GASS	LPG
33	Teekay	TK	Diversified
34	Teekay LNG Partners	TGP	LNG
35	Teekay Offshore Partners	TOO	Diversified
36	Top Ships	TOPS	Product Oil
37	Tsakos Energy Navigation	TNP	Diversified
38	Euronav NV	EURN	Crude Oil
39	Globus Maritime Limited	GLBS	Dry Bulk
40	Pyxis Tankers	PXS	Crude Oil

41	Paragon Shipping	PRGN	Diversified
42	Boxships Inc	TEUFF	Container
43	Newlead Holdings Ltd	NEWLF	Diversified
44	Genco Shipping & Trading Ltd	GNK	Dry Bulk
45	Dorian LPG Ltd	LPG	Product Oil
46	DHT Holdings	DHT	Crude Oil
47	Eagle Bulk Shipping	EGLE	Dry Bulk
48	Diamond S Shipping Inc.	DSSI	Crude Oil
49	Omega Navigation Enterprises	ONE	Product Oil
50	Oceanfreight Inc	OFI	Dry Bulk
51	Overseas Shipholding Group	OSG	Crude Oil
52	Baltic Trading Ltd	BTL	Dry Bulk
53	General Maritime Corporation	GMC	Crude Oil
54	Excel Maritime Carriers LLC	EMC	Dry Bulk
55	Freeseas Inc	FREFF	Dry Bulk

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