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CAPITAL STRUCTURE OF SHIPPING COMPANIES LISTED IN THE AMERICAN STOCK EXCHANGE

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Table of contents

List of tables

List of figures

Περίληψη

Στόχος της παρούσα εργασίας είναι να αποτυπωθούν οι παράμετροι που διαφοροποιούν την απόφαση μιας ναυτιλιακής επιχείρησης για την κεφαλαιακή της διάρθρωση. Ενώ ένα μέρος της θεωρίας υποστηρίζει ότι ουσιαστικά η εταιρία θα πρέπει να είναι αδιάφορη για το εάν θα χρησιμοποιήσει ίδια κεφάλαια ή δανεισμό, ωστόσο ένα άλλο τμήμα θεωρεί ότι υπάρχουν σημαντικές διαφοροποιήσεις, τόσο στα κίνητρα, όσο και στα αποτελέσματα αυτής της επιλογής.

Στην συγκεκριμένη εργασία εξετάστηκαν τα στοιχεία Ελληνικών εισηγμένων ναυτιλιακών εταιριών bulk carriers, tankerships και containerships για την περίοδο 2008-2020. Στην ανάλυση χρησιμοποιήθηκαν διαφορετικά μοντέλα εξαρτημένων όσο και ανεξάρτητων μεταβλητών. Στην ανάλυση χρησιμοποιήθηκε linear regression με panel data.

Από την ανάλυση διαπιστώθηκε ότι η χρήση των δεικτών κερδοφορίας δίνει πιο αξιόπιστα αποτελέσματα αναφορικά με τις στατιστικά σημαντικές ανεξάρτητες μεταβλητές, ενώ επίσης υπάρχει διαφοροποίηση μεταξύ των dependent variables of book leverage.

Από την εργασία διαπιστώθηκε ότι το size και το tangibility έχουν στατιστικά σημαντική επίδραση στο book leverage, γεγονός που είναι αναμενόμενο, αφού η ανάπτυξη του στόλου απαιτεί σημαντικότατα κεφάλαια. Ωστόσο, καταγράφεται μια διαφοροποίηση μεταξύ των containerships και των bulk carriers,καθώς τα πρώτα χρησιμοποιούν περισσότερη μόχλευση απ’ όσο τα δεύτερα. Αυτό αιτιολογείται από το ότι τα bulk carriers έχουν καταγράψει ζημίες για σειρά ετών, με αποτέλεσμα να υπάρχει προβληματισμός από τις τράπεζες, άρα υπάρχει θέμα μείωσης της προσφοράς δανειακών κεφαλαίων και όχι της ζήτησης.

Λέξεις-κλειδιά: κεφαλαιακή διάρθρωση, θεωρίες κεφαλαίου, ναυτιλιακές εταιρίες, containerships, bulk carries.

Abstract

The aim of the study dy is to examine the parameters that differentiate a shipping company's decision on its capital structure. While one part of the theory argues that essentially the firm should be indifferent between using equity or borrowing, another part of the theory argues that there are significant variations in both the incentives and the outcomes of this choice.

In this paper, the data of Greek listed shipping companies bulk carriers, tankerships and containerships for the period 2008-2020 were examined. Different models of dependent and independent variables were used in the analysis. Linear regression with panel data was used in the analysis.

From the analysis it was found that the use of profitability ratios gives more reliable results regarding the statistically significant independent variables, and there is also a difference between the dependent variables of book leverage.

The paper found that size and tangibility have a statistically significant effect on book leverage, which is expected since the development of the stall requires significant capital. Moreover, a differentiation is recorded between containerships and bulk carriers, as the former use more leverage than the latter. This is justified by the fact that bulk carriers have been making losses for a number of years, which has led to concerns from banks, so there is a question of a reduction in the supply of loan capital rather than demand.

Keywords: capital structure, capital theories, shipping companies, containerships, bulk carriers, capital structure.

Chapter 1. Overview of theories of capital structure

1.1 General introduction

Capital structure theories attempt to explain how companies[1] - and especially listed companies - use the combination of different forms of capital to finance their investments and their overall operation. Clearly, the first theoretical contribution to the field by Modigliani and Miller (1958) showed that the value of the business is not determined by the decision regarding its capital structure between equity and debt, however since then a significant number of studies have been carried out regarding the optimal capital structure, where a number of conclusions, which in many cases are contradictory. Therefore, it is considered necessary to make a reflection of the various theories about the capital structure and then to analyze the parameters of a company's decision about this issue.

1.2 The importance of capital structure analysis

Capital structure has been the subject of academic research since the publication of Modigliani and Miller (1958) analyzes according to which the choice between debt and equity has no significant effect on the value of the company.

According to the first proposition of Modigliani & Miller's theorem, the equation holds:

$$V_U = V_L \qquad (1)$$

Where

V_U the value of the unlevered firm

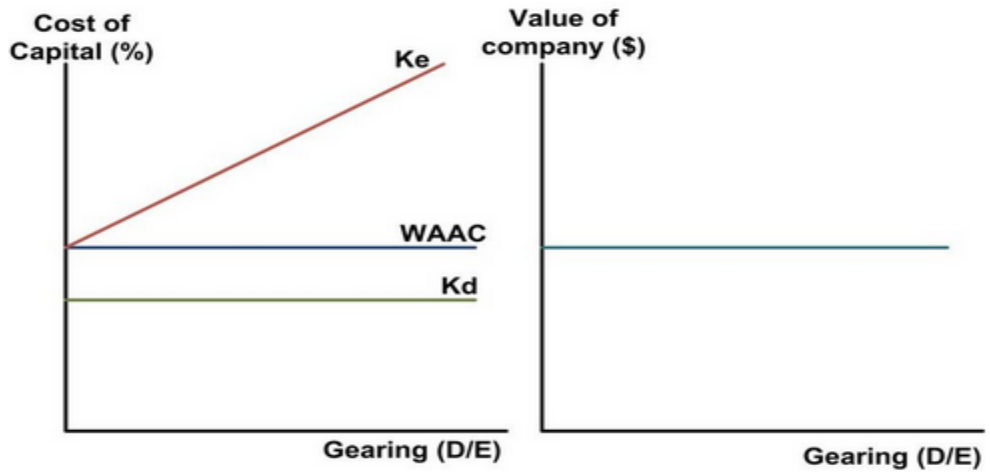
V_L the value of the levered firm

As presented in the next figure, the theory of Miller and Modigliani suggests that, since investors are rational, the required rate of return increases proportionally with the increase of gearing, i.e. cost of equity (Ke) and gearing (debt to equity D/E) have a linear relationship. In that sense, the increase of cost of capital offsets the advantages of the cheaper loans, hence the weighted average cost of capital (WACC) is unchanged. Ergo, the

[1] It should be noted that the literature reports differences in the parameters of the choice of capital structure between listed and non-listed companies (for example: Farooqi-Lind, 2006, Asker, Farre-Mensa & Ljungqvist, 2011, Hall & Joergensen, 2015).

value of the company is the same, regardless of the proportions of debt and equity in its capital structure.

Figure 1. Value of the company, levered and unlevered



Source Ahmeti & Prenaj, 2015, p. 5

However, it should be emphasized that this theory is valid insofar as there is a perfect market. Copeland (2013) notes that, either explicitly or implicitly, the validity of Modigliani and Miller's theorem has the following assumptions:

- There are no corporate and personal taxes.
- Operating cash flows are not affected by changes in the capital structure.
- There are no bankruptcy costs.
- All investors can borrow and lend at interest-free risk.
- There are no agency costs
- Companies issue only two types of receivables: risk-free debt and equity (with risk)
- All companies are considered to have the same business risk.
- There is a perpetual sequence of cash flows
- Capital markets are frictionless.
- The internal and external parts of the business have common and perfect information, at no cost

However, in reality, the above conditions are not met (Marney & Talbert, 2011; Bénassy-Quéré, et al., 2019), resulting in a deviation from what the Modigliani and Miller model predicts.

This is the first point of importance of the analysis of capital structure: what happens if some of the above assumptions do not apply? Will the equivalence of the value of the levered and unlevered firm holds?

The above issue is extremely important for businesses; if the equality of the value of the company with borrowing and without borrowing does not apply, then it means that there is an optimal capital structure, and any company that does not have this structure has disadvantages, such as the opportunity cost (Westen & Copeland, 1992; Shim, Siegel, Dauber & Querishi, 2014), which, in conditions of perfect competition, make companies less competitive and profitable. Also, the issue is extremely important for investors: if the equality of the value of the leveraged and non-leveraged company does not hold, then it means that there is a possibility of arbitrage, as shown by the following example:

Let two companies with the same risk and with identical operating cash flows. Suppose that one company uses only own funds, i.e. equity, while the second company uses equity and debt. If the value of the levered firm is less than the value of the unlevered firm, then buying a share of the unlevered company will cost less than buying the same share of the levered company, but the investor will have the same capital flow. This will push investors to buy the shares of the levered company, until the value of the two firms becomes equal (Focardi & Fabozzi, 2004; Lee, Finnerty & Song, 2006). Eventually the value of the companies will be equal - so the provisions of the Modigliani and Miller model will apply - but until then, the investor who has taken advantage of the arbitrage will have risk-free profits

To the above, another dimension must be added: if some of the conditions of the Modigliani and Miller model do not apply, how much will the value of a business will change if the firm changes its level of debt? Can the change in the value of the business be changed ex ante to the change of the loan? This question is crucial, as it should be included in the criteria of a company's strategic decision to expand since it is directly related to the cost of capital (Ogier, Rugman, & Spicer, 2004).

In addition to all this, other key issues arise: what are the other consequences that a company –but also, the whole sector- has - if some of the conditions of the Modigliani & Miller model do not hold? What should be considered in business strategy when strategic planning decisions, such as the ones of capital structure?

All of the above questions underscore how important it is to have a capital structure analysis. Especially in the case of ship-owning companies, the full analysis of the capital structure is even more important than other companies, because shipping is a capital-intensive industry, with the purchase of a ship costing many millions of dollars (Stopford, 2009; Thanopoulou, 2010; Petropoulos, 2011), therefore the change in the value should have been calculated in the company's decision to raise and use borrowed or own funds, and also the any impact on the administrative structure and the overall strategy regarding company's capital.

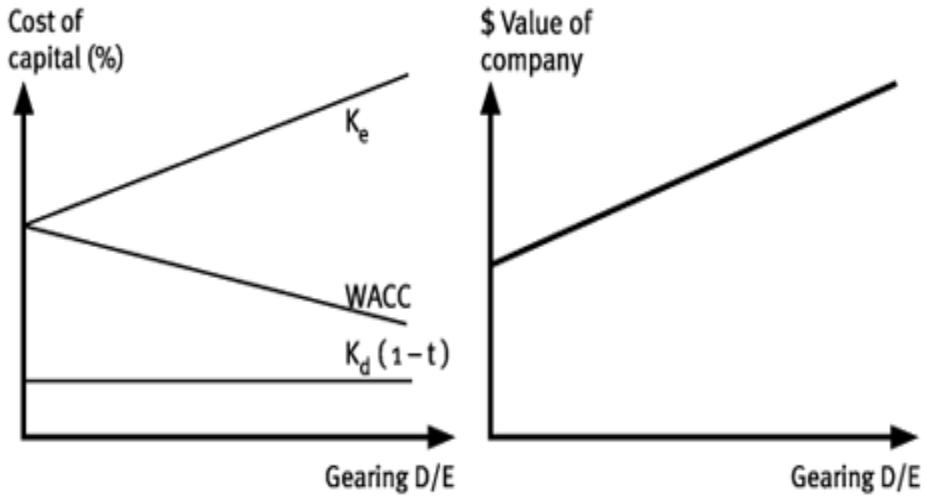
1.3 Equity and debt

As mentioned, Modigliani and Miller came up with the theory of capital structure, where financial leverage does not affect the market value of the company. However, also as mentioned above, their theory was based on very restrictive assumptions that do not apply in the real world. The fact that in reality there is the risk of bankruptcy - hence the cost of bankruptcy - and the tax treatment of interest payments, leads to the concept of "optimal" capital structure that maximizes the value of the business or minimizes the total cost of capital.

Taxation has been thoroughly investigated as a factor that determines the capital structure of companies. The key feature of taxation is that the payment of borrowing interest is deductible from corporate taxation. A company that pays taxes receives a partial offsetting interest in the form of lower taxes paid, i.e. a tax shield. Therefore, as Modigliani and Miller (1963) suggest, companies would use more debt in order to maximize their value, due to the tax shield.

This is presented in the next figure, in which the increase of the cost of equity Ke does not offset the advantages of the cheaper loans, hence weighted average cost of capital decreases as leverage increases, since there is a tax shield for the payments for debt. Hence, it is in the benefit of the company's value to increase its debt.

Figure 2. Value of the company with taxes



Source: Source Ahmeti & Prenaj, 2015, p. 7

In addition to corporate taxation, the case of personal taxes imposed on individuals is also analyzed. Miller (1977), under U.S. tax law, distinguishes three tax rates that determine a company's total value. These are the corporate tax rate, the tax rate levied on dividend income and the tax rate levied on interest income. According to Miller, the value of the company depends on the relative amount of each tax rate, compared to the other two. In addition to the fiscal aspects of the capital structure, there are also a number of other approaches that try to help explain the decisions regarding capital structure. These approaches examine the level of debt from the perspective of asymmetric information and agency costs. Jensen & Meckling (1976) identify the existence of agency costs that arise due to conflicts between managers and shareholders (agency cost of equity) or also between shareholders and debtors (agency cost of debt).

The agency cost of equity refers to the conflict of interest that arises between management and shareholders. In the event that the company's management makes decisions that may not be in the best interest of the company but in the interest of management and

shareholders believe that the decisions will not increase the value of their shares, then there is an agency cost of equity[2].

Agency cost of debt refers to the conflict that arises between the shareholders and the lenders of a business. Agency cost of debt arise when debtors set limits on the use of borrowed capital if they believe that management will take action in favor of shareholders rather than lenders. Although most agency cost of debt refer to listed companies (for example Vos & Forlong, 19996; Hol & van der Wijst, 2006), the analysis may also include non-listed companies (Ogier, Rugman & Spicer, 2004; Steijvers & Voordeckers, 2009); hence, this part of the analysis can be used whether the shipping company is listed, or it is private, or is considering being listed on a stock exchange, or examining to withdrawn from the stock market, by repurchasing shares.

So far we have assumed that the interests of the financing decisions taken by the managers are in the interest of the shareholders. However, as Myers (1984) points out, the full alignment of the interests of the two parties is unfounded in theory and impossible in practice. Managers are often interested in achieving goals that may deviate from maximizing corporate value. For the most part, managers will act in their own interests by seeking higher salaries, higher bonuses and in some cases even the immediate exploitation of the company's cash flows. Essentially, when these phenomena exist, then it is a transfer of value, from shareholders to managers. Thus, a conflict of interest between shareholders and managers is inevitable. Investors - shareholders will try to discourage these value transfers through various monitoring and control mechanisms, such as oversight by independent auditors, and there may even be a threat of acquisition. However, perfect control is extremely costly, without being fully guaranteed that such phenomena are unlikely to occur. Therefore, shareholders seek to rely on solutions that will not extract

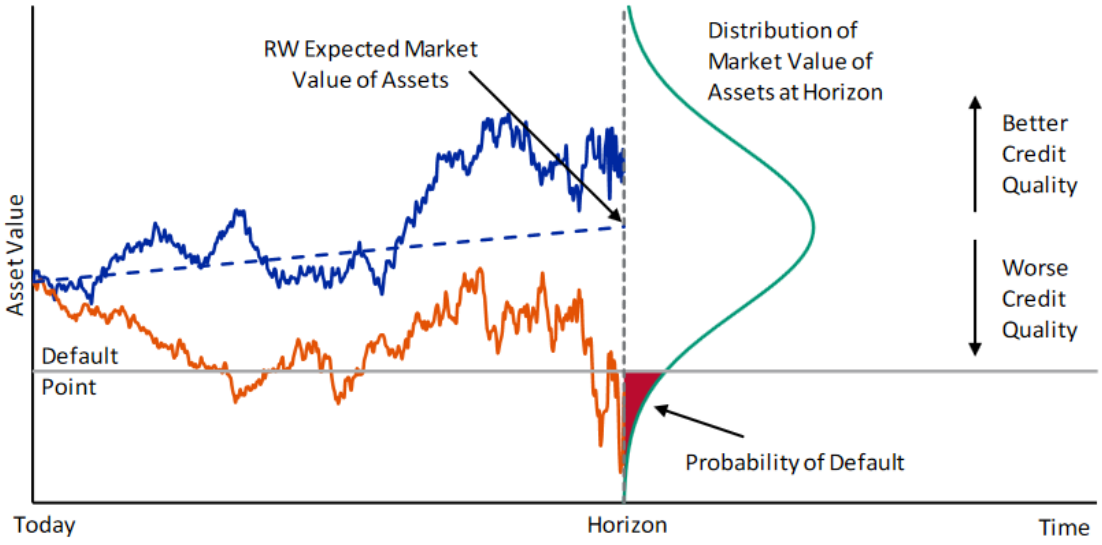
[2] It should be noted that literature mentions other categories of agency costs as well. Specifically, the agency cost of between owners is mentioned, where the shareholders who have the majority of shares the and control of the company do not assure the minority shareholders that they will ensure the benefits of the latter. Also, the agency cost of stakeholders is being mentioned, where the stakeholders, - i.e. the interested parties such as government suppliers, employees, customers, etc. - believe that the owners of the company are unjustifiably exploiting their position, acting against them or causing them damage (Ringe,2010; Kokkinis, 2018). However, the analysis of these categories of agency cost is beyond the scope of this paper

large amounts of value from the company and will monitor / control the activities of managers.

A reliable method of control may be to use debt. The role of leverage will force managers to create and pay cash. Debt will reduce the amount of potential residual cash flows, after investment decisions, available to managers, because the debt presupposes interest payments that are mandatory and lead to cash outflows. Thus, debt can be considered as a tool to reduce the agency cost. In this case, the optimal capital structure will result from the balance between the costs of debt versus the benefits of debt. Thus, a company will choose this amount of debt that will minimize the total cost of the company.

Debt costs from the company occur only when there is a risk of default. If the debt is completely free from the risk of default, then the debtors will not worry about the cash flow, and the value or risk of the business. As presented in the next figure, default occurs if the price of the asset is below a pre-specified level –in that case, the Default Point (DP)- at a given future time, e.g., a year. Having in mind that the value of the assets has a fluctuation, forming a distribution at the time horizon, in a manner that the probability of default decreases when the asset value increases and is given by the integral of the distribution in below the Default Point.

Figure 3. Default Point and asset value in a given future time



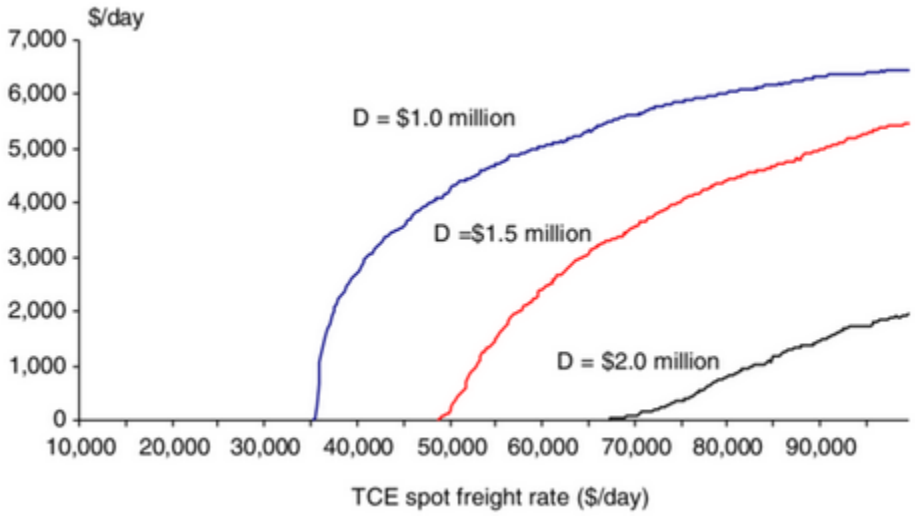
Source: Thompson & Jessop, 2018, p. 5.

Since the assets equals the sum of equity and debt, then, if there is a possibility of default, shareholders can win at the expense of debtors, if the probability of default has not been calculated and included in the cost of debt, as a risk premium (Damodaran, 2002; 2010). For example, after a debt is issued, a company may decide to restructure its assets, sell those with low business risk, and acquire assets that are more risky and therefore more likely to default, but also have higher expected returns. If there is the expected result, then the shareholders will receive most of the benefit, but if not, then most of the loss will be borne by the lenders, as there has been no previous adjustment of the borrowing rate due to the risk (if there was ignorance about the risk).

In addition, if the risk of default is significant, managers may make decisions that will benefit shareholders. For example, managers could increase their debt and pay cash to shareholders. Debt holders will therefore either provide capital that requires higher returns - in the form of higher interest rates - or demand more information about the company's actual investment opportunities and business processes, or impose restrictive conditions, through agency cost of debt. According to the above, all these alternatives result in agency costs. However, the optimal capital structure of the company will be formed at this specific level where the debt benefits that can be collected from the shareholders balance with the cost of the debt imposed by the debtors.

What should be highlighted is that default risk depends on the price that the company sells its goods, in the sense that, the higher the price, the higher the revenues and the profits[3], while as the price falls the lower the revenues and profits and the higher the probability of default. In that sense, as for a shipping company, the probability of default is related to the level of freight rates; thus, as freight rates decrease, the probability of default increases, leading to risk premium' increase. This relation between the level of freight rates, probability of default and risk premium is presented in the next figure. For a time charter of three years, when the freight rates is at $35,000 the trigger of the default is set at $1 million, when the freight rates are at $50,000 the trigger is being set at $1,5 million and with freight rates are above $65,000 the trigger of the default would be set at $2 million.

Figure 4. Triggers of the default and default risk premium at various freight rates



Source: Adland & SJia, 2008, p. 158.

[3] Under the assumption that the average cost is constant and all other factors remain unchanged, i.e. there are no economies or diseconomies of scale (Mankiw, 2012), all of the companies in the sector should have x-efficiency and allocative efficiency (Leibenstein, 1996; Sudit, 1996) accpanied with x-efficacy (Potts, 2007), perfect information (Leibenstein, 1997), and the coopetition should be at the level of the perfect market (Siostrom & Weitzman, 19996; Daraio & Simar, 2007). In the part of the research will be examined whether these criteria are being met, in order to find their impact on the shipping company's decision on capital structure.

In conclusion, the literature regarding capital structure has shown that the choice between equity and debt affects the value of the business. Therefore, reference will then be made to the theories and models on the basis of which the analysis for the optimal capital structure can be formulated.

1.4. Theories of capital structure

1.4.1. Trade-off theory

Determining the optimal capital structure is based on hedging between risk and return (Brigham & Houston, 2009).

In the theory of Bradley et al. (1984) the capital structure presupposes that companies have an optimal level of debt, in which the value of the company is maximized and receives tax benefits in the problems caused by possible bankruptcy.

Capital structure hedging theory assumes that lending is determined by three competing forces:

- the taxes,
- the cost of financial distress
- the cost of conflict of interest between managers-shareholders and shareholders-lenders (agency costs) (Baker and Wurgler, 2002).

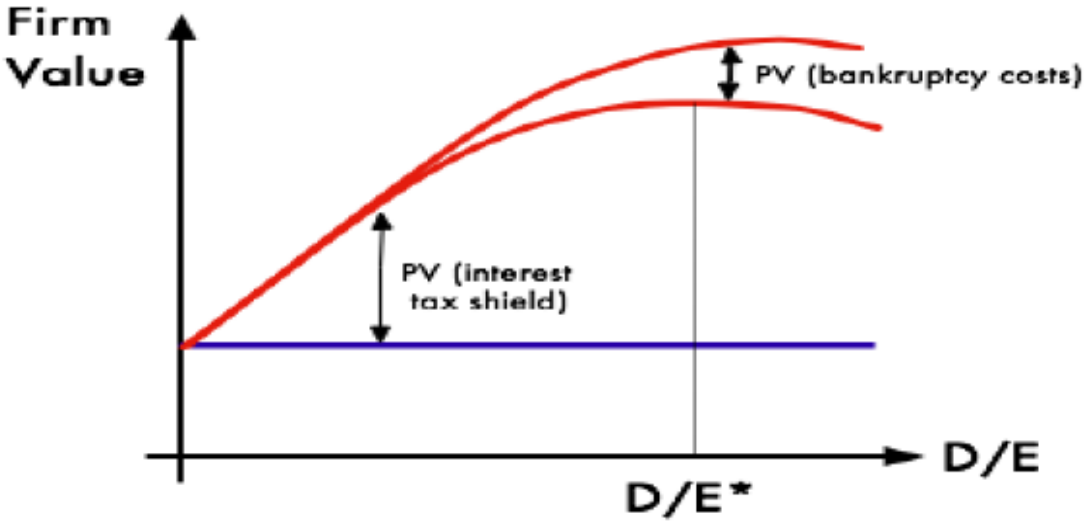
According to trade-off theory, corporate taxation favors lending, leading corporations to be financed by loan funds because of the advantage they offer. The advantage of borrowing is the tax relief from interest on loans, i.e., the tax shield. The value of the company is equal to the value it would have if it had only equity plus the present value of the tax exemption less the present value of the cost of financial hardship.

At low and medium leverage levels, the probability of bankruptcy is low, so that the present value of the cost of financial difficulty is small and debt savings in tax are predominant.

But after a point, the probability of default, which is the probability that the company will not be able to meet its obligations, increases and the cost begins to decrease the value of the business. If the business is not sure that it can benefit from tax savings on borrowing, the tax advantage of additional borrowing will disappear. Thus, according to hedging theory, the optimal level of debt for any company is to determine the point at which the present value of the tax savings for the use of the additional loan is offset by the present value of the cost of financial difficulties.

The following figure shows the compensation that exists between the present value of the tax subsidy associated with the increase in leverage and the present value of the bankruptcy costs. This provides a scenario in which companies will look for the optimal capital structure. This is the level at which tax benefits are maximized while minimizing the risk of bankruptcy resulting from the use of excessive debt.

Figure 5. Trade-off between interest tax shield and bankruptcy costs



Source: Brealey, Myers & Allen, 2007, p. 504

There are four main predictions of exchange theory:

- Companies will have a target level for the debt ratio and that this level will differ from business to business. This prediction is confirmed by Graham and Harvey

(2001) who report that the majority of CFOs surveyed agreed that they are pursuing a debt target.

- Companies with relatively safe tangible assets will be less exposed to the cost of bankruptcy, therefore are expected to have higher debt. In contrast, companies with risky intangible assets will be more exposed to bankruptcy costs and are expected to borrow less. This prediction is confirmed by a series of studies (Frank & Goyal, 2009; Qiu & La, 2010).
- Higher marginal tax rates will be associated with higher levels of leverage. This is due to the interest tax shield. Research by Mason (1990) as well as Graham (1996) found that companies with higher marginal tax rates were more likely to have higher debt ratios and companies with lower marginal tax rates were more likely to use equity compared to debt. The fact is that Fama & French (1998) in their analysis to determine the effect of taxation on corporate value do not find evidence that interest tax subsidy contributes to the market value of companies. Researchers say that if this is the case, there may be no incentive for businesses to add more debt to take advantage of interest rate tax breaks, so they conclude that taxes seem to play a modest role in explaining the company's capital structure.
- Companies with higher taxable income and relatively small tax deductions in addition to interest - such as the depreciation rate - will have more incentive to borrow. Therefore, in order to benefit from interest tax subsidies, companies with lower non-debt tax subsidies should be expected to borrow more. In contrast, companies with higher non-interest-bearing tax subsidies should have less debt in their capital structure.

1.4.2 Pecking order theory

The concept of optimal capital structure is also expressed by Myers (1984) and Myers & Majluf (1984) who relied on the concept of asymmetric information. Myers & Majluf (1984) make the hypothesis that managers act in the best interests of existing shareholders. Consequently, they refuse to issue devalued shares unless the transfer of value from "old" to new shareholders offsets by the net present value of the growth opportunity. This leads to the conclusion that the new shares will only be issued at a higher price than that imposed by the actual market value of the company. Therefore, an announcement of a new issue of

shares is immediately interpreted as "bad" news, in the sense that current investors have overvalued shares.

In addition, borrowers face less risk in the event of a possible incorrect valuation of the company, because the debt has the previous requirement for assets and profits, while equity, for the company, represents a residual requirement. This means that debt announcements should have a smaller downside effect on stock prices than equity announcements. Thus, if a company is able to issue debt, then any attempt to sell shares will reveal that the shares are overvalued.

In summary, pecking order theory suggests that companies will initially rely on internal capital, i.e., retained earnings, where there is no information asymmetry, then turn to lending if additional funds are required and finally will issue equity to cover any other capital requirements. Thus, according to pecking order theory, companies that are profitable and therefore generate high profits are expected to use less debt capital than those that do not generate high profits.

Another point of view that holds a key place in the pecking order theory is that the cost of issuing new bonds, combined with the existence of asymmetric information, is a key concern of managers. Thus, according to the specific theory of capital structure, the financial decisions of the company's managers shape the value that the shareholders will receive.

Therefore, companies follow a hierarchy in terms of their financing, initially preferring the least risky way of financing, i.e., the use of retained earnings and when they have no other choice, due to the lack of capacity for further lending, the most dangerous, namely the issuance of new shares.

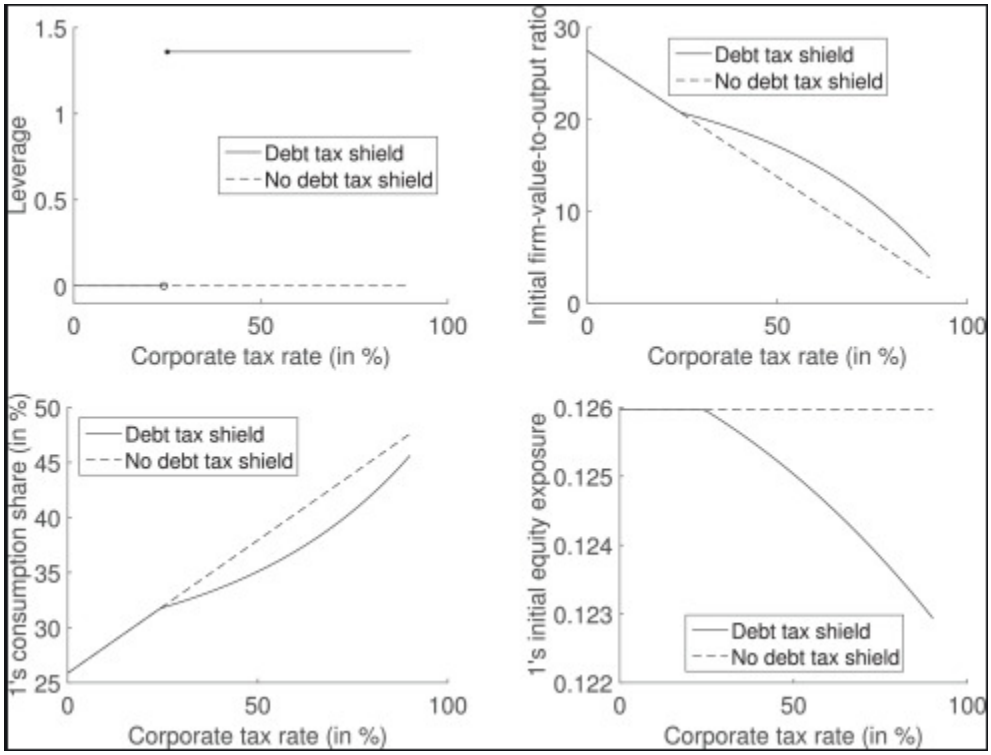
Of course, it should be noted that the issue of taxation should now also be mentioned, as it operates in direct relation to the issue of lending. Modigliani and Miller (1963) made changes to the capital structure model, adjusting the tax threshold. Because interest on debt is tax deductible, the company effectively reduces its tax bill as it uses more debt. As the debt-to-equity ratio increases, the market value of the business increases at the present value of the interest rate tax. This means that the cost of capital will not increase, even if

the use of leverage increases too much. Solomon (1963) argues that, in extreme leverage, the cost of capital must increase. This is because excessive debt levels will push markets to react by demanding higher rates of return. Therefore, to minimize the weighted average cost of capital, companies will avoid a net debt position and seek an optimal combination of debt and equity.

As presented in the next figure, there are four elements that should be examined in whether there is a tax shield or not and the impact of corporate tax:

Regarding the leverage, with no tax shield the debt would be zero, whatever the level of the tax rate since the debt is irrelevant to the value of the company. Instead, with a debt tax shield, the company would use debt instead of equity.

Figure 6. Impact of corporate tax rate –with and without tax shield, regarding leverage, value-to-output ratio, consumption, and initial equity exposure



Source: Fischer & Jensen, 2019, p. 162

Baxter (1967) provides two main reasons for the low debt ratios observed in leveraged companies. First, the debt interest rate is positively related to the debt-to-equity ratio. This

means that, as the company borrows more, creditors will demand a higher rate of return on borrowed funds. Second, higher debt levels could lead to the possibility of defaulting on interest payments, thus leading to bankruptcy. For these reasons, companies will seek a level of financing that maximizes tax savings caused by higher levels of debt and, at the same time, minimizes the possibility of bankruptcy.

However, several studies have confirmed the existence of an optimal debt-equity combination. This is based solely on the existence of market imperfections such as the transaction and the possible cost of bankruptcy. For example, Baumol and Malkiel (1967) use indifference curves to show that the introduction of transaction costs produces an imbalance in which the shareholder seeks an optimal point in the combination of debt and equity.

Stiglitz (1972) then examined the effects of bankruptcy on company value, arguing that, under certain assumptions, there is an optimal capital structure. This argument is based on the fact that, in the absence of bankruptcy, nominal debt interest rates are independent of the debt-to-equity ratio. However, when there is a possibility of bankruptcy, the nominal interest rates of the debt increase, thus making the bonds riskier. Therefore, the market value of the company will depend on the probability of bankruptcy, even if transaction costs were ignored.

Kraus and Litzenberger (1973) in their model introduce corporate taxes and the possibility of bankruptcy - hence the cost of bankruptcy to the creditor - and confirm the existence of an optimal capital structure. Accordingly, Turnbull (1979) shows that the optimal capital structure of a company at the point of maximization of value will occur before the point of exhaustion of the company's debt capacity and this is the maximum amount of credit that can be extended by lenders. In addition, the theory states that the probability of bankruptcy increases the uncertainty of future tax savings and notes that this uncertainty is sufficient to cause an optimal capital structure, even if the cost of bankruptcy is not adjusted for risk.

Chapter 2. Financing of shipping companies

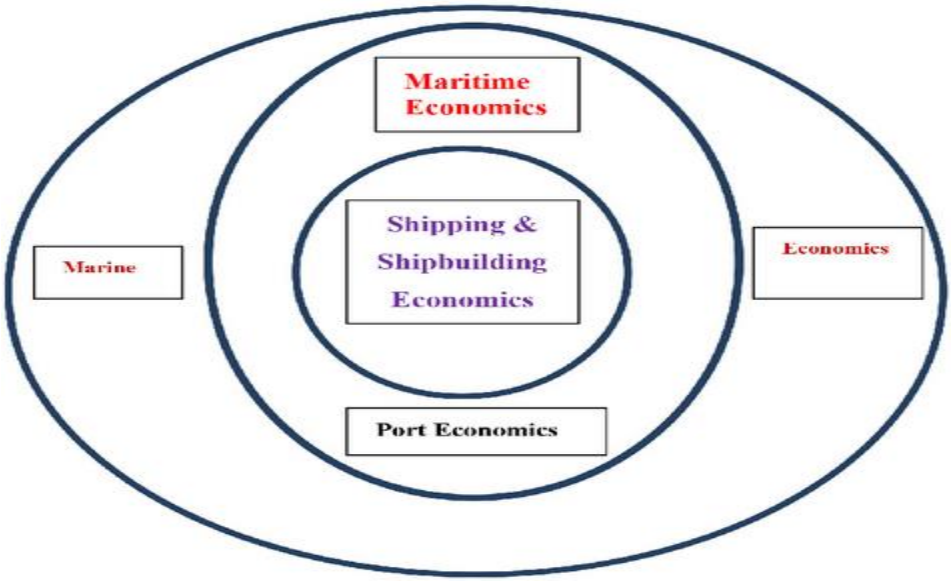
This chapter presents the forms of financing of shipping companies. Initially, the specific characteristics of each form of financing are reported, while the sizes and trends of shipping financing are also recorded. It should be noted, in the introduction, that the main reference to shipping financing is the purchase of a ship, i.e., the use of the financing concerns the change in the shipping fleet, with regard to:

- the number of ships
- the capacity of the ship and the fleet
- the composition of the fleet
- the age of the ship and the fleet

2.1 Basic elements of the shipping market

In order to identify and analyze the particular characteristics of shipping, one must have in mind the close relationship with international trade. In that sense, shipping economics is a part of maritime economics, i.e., the economics of maritime transport, which, in turn, is a part of the wider circle of maritime economics, including the whole international trade and geopolitics of the sea.

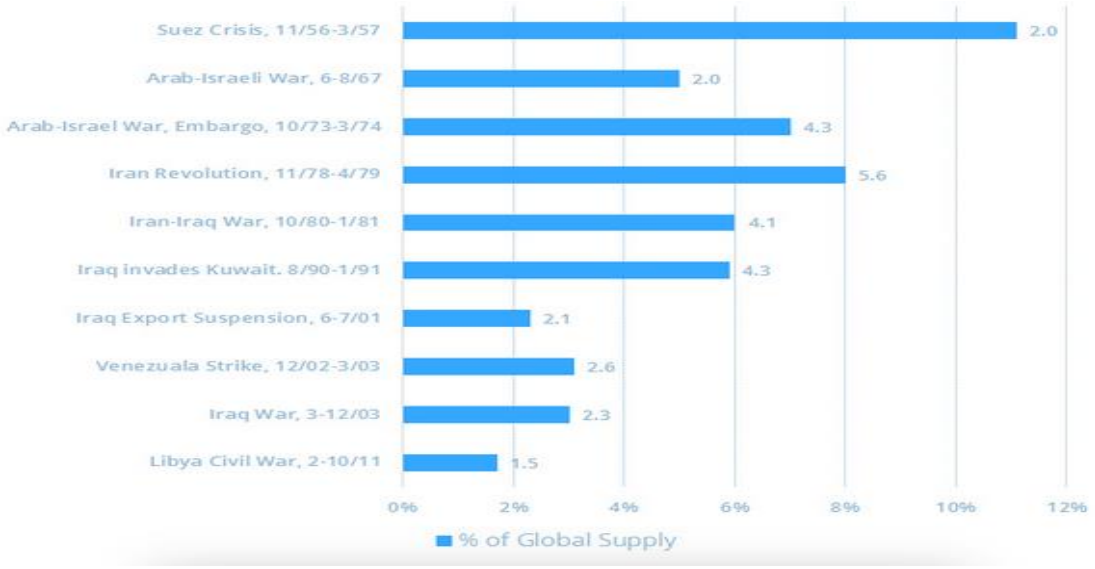
Figure 7. Marine economics, maritime economics and shipping economics



Source: Goulielsmos, 2018, p. 2201

First of all, shipping as a sector is particularly vulnerable, as it is very much influenced by external factors. These include the state of international trade, wars and other forms of conflict, the political economy and geopolitics of each region (Cafruny, 1985) the geographical and qualitative orientation of international trade, national shipbuilding policies, climatic conditions, and the occasional increased need for some goods, the abrupt change in the price of basic raw materials, etc. For example, the Suez crisis in 1957 the Arab-Israel war of 1967 (McConcile, 1999), the revolution in Iran in 1979 and the Gulf War in 1992 are examples of how the geopolitics have an impact of shipping, since each crisis creates a decline in oil production, as presented in the next figure.

Figure 8. Decline in oil production during Political Crises (millions of barrels per day)



Source: Aguilera & Radetzki, 2015, p. 24

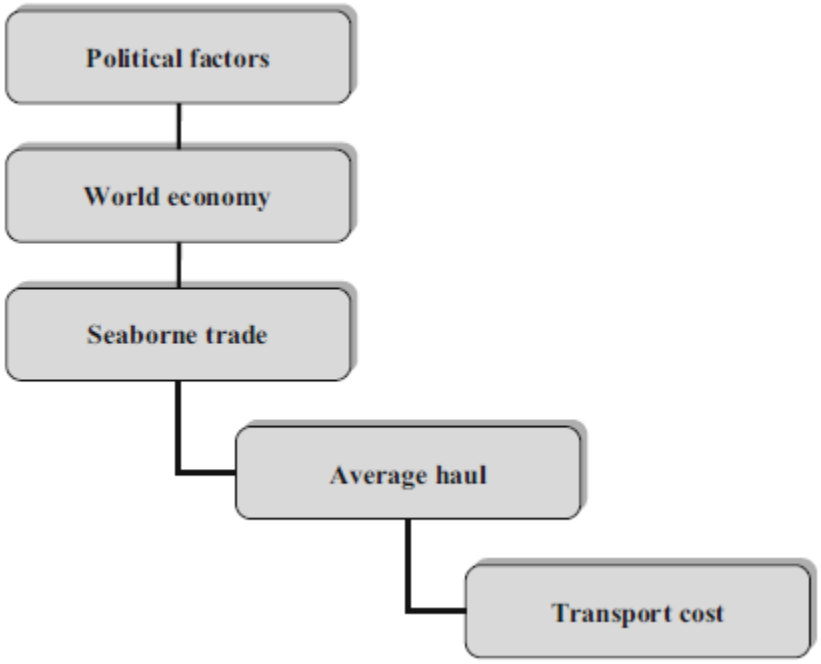
The impacts of these crisis to the shipping market were both direct and indirect; for example, during the aforementioned crises the freight rates had a very high volatility, leading to the high fluctuations of shipping companies' turnover and earnings, while, also, had a direct impact on the companies' strategy regarding their fleet, since the demand wanted to anticipate potential future crises of supply, by ordering higher quantities of oil, which, in order to be supported, needed vessels of larger capacity. The closure of the Suez Canal in 1957, the global economic crisis and the recent crisis of the Sars-Cov-2 pandemic

(Pelagides & Harambides, 2020; World Trade Organization, 2020; Notteboom, Pallis & Rodrigue, 2021) are events affected world trade in general and shipping in particular.

Shipping an industry directly related to business risk. In particular, shipping is said to be a high-risk business, as investment decisions in the shipping industry are a significant element of business uncertainty. This is due to a number of critical factors, including mainly the productive nature of shipping, its exposure to external factors, but also the circularity of freight rates and ship prices.

Additional business risk factors are the volatility of the price of fuel (Notebooom & Vermimmen, 2009), but also the cost of money, i.e., the borrowing rate, which fluctuates over the years. Business risk also arises from the charter agreements, a risk related to the contractor, i.e., if and to what extent the latter will meet its obligations under the contract. Further risks are piracy, but also the technological undertaken by the enterprise.

Figure 9. Factors affecting shipping market demand



Source: Ln, Lai & Chang, 2010

Additional features of the shipping market are the cyclicality and volatility of cash flows. More specifically, it is observed that the shipping market is highly volatile, which is largely

related to seasonality, market exposure to external factors, as analyzed above, but also to the nature of shipping as a secondary sector in relation to the international trade. Volatility is also due, as in any market, to the supply and demand of capacity, which in turn affects freight rates. The shipping cycle is being pictured in the diagram below.

Figure 10. Shipping market cycle

Source: Brauner & Illingworth, 2008, p. 72

Finally, a special feature of shipping is its increased need for capital. This is reasonably understood by the prices of ships. More specifically, a newly built VLCC tanker costs approximately $ 90 million (Euronav, 2020). It therefore becomes clear that only the purchase of a single ship requires a very high amount to be raised.

2.1 Historical review of the financing of shipping companies.

Shipping, due to its increased need for capital, but also its special characteristics, has always been focused on finding funds. The increased dependence of shipping on the capital market is directly proportional to the capital intensity and the cyclicality that characterizes the sector. Technological advances and the need to transport more and more goods have

led to the construction of larger and more technologically advanced ships, which in turn have turned shipping to the need to raise capital.

In particular, as Kavoussanos (2013) mentions, the market of shipping financing can be separated in eight phases:

In the first half of the 19th century, shipping companies relied mainly on equity financing, as they were family-owned. On the other hand, the banks lent only 20% of the value of the ship, receiving collateral on the ship. For this reason, bank loans were usually channeled into repairs and maintenance of the existing fleet.

In the second half of the 19th century, in the United Kingdom, with the Companies Act of 1862, there was a significant change in the financing of the shipping business, as it provided protection to investors from the claims of corporate creditors. This legal framework gave rise to the creation of small businesses and the participation of investors in them.

At the beginning of the 20th century, the above practice of private placements in shipping companies continued, while bank lending remained low. It is worth noting, however, that private placements and low bank financing could not provide shipowners with large profit margins.

The 1950s and 1960s saw a boom in bank financing, which was based on shipowners' collateral provided by charter agreements with major charterers. Greek shipowners, as well as Norwegians (Tenold, 2019), practiced the above practice to the fullest.

Subsequently, during the 1970s and 1980s, when the monopoly shipping company was developed, the financing changed form and turned to bank financing with collateral now on the ship itself - the sole asset of the single steamer company - and not on of the charter party. The only condition was often the possibility of registering a first mortgage on the ship. Thus, one could say that the ship, as an asset, was equated with real estate.

This boom in bank lending with collateral on board led to increased ship orders, which in turn led to oversupply and hence falling shipping and a recession that lasted from 1970 to 1986. The recession 1970 to 1986 led many shipping companies to bankruptcy, as the latter could not service their loans due to falling freight rates.

In the late 1980s and early 1990s, the practice of syndicated loans, which had disappeared during the recession, resumed. A syndicated loan is defined as the financing of a business by two or more credit institutions, which undertake a certain percentage of the financing, usually to cover investments and needs for more permanent working capital. Through syndicated loans, Banks could share the risk arising from borrowing large amounts of capital.

Finally, in the 1990s, shipping companies, from family and introverts, became more extroverted, even starting to turn to new corporate schemes and either seeking to enter the organized market (Stock Exchange), or to issue bonds.

After that, and in particular in 2007, when the global financial crisis began, banks were cautious about financing shipping companies, making these new forms of financing increasingly popular.

2.2 Shipping financing

As can be seen from the above brief historical background, shipping as an industry with various phases, which follow each other, sometimes extroversion and growth with a turn to loan financing and modern money markets and sometimes introversion phases, with low freight rates and difficulty of raising funds which are vital to the shipping business.

Traditionally, there are two ways of financing the shipping company, but also of each company, the financing through foreign and own funds, i.e., debt and equity.

First of all, it is worth noting that shipping financing (own and foreign capital), is the backbone of the shipping company, since together with the know-how and human resources, they lay the foundations for the creation of a successful shipping company and contribute to the development of its fleet. in the future, as without sufficient capital, the company cannot finance its fleet, therefore it cannot grow.

More specifically, the purpose of the shipping investment and therefore of the financing of the shipping company, can be the expansion of the fleet, the quality replacement of the ships, the entry in the shipping industry, the reconstruction of the existing ship and the increase of the available tonnage.

Nevertheless, the decision to finance is particularly difficult for the shipping company, as the latter is called upon to choose between different forms of financing with different implications for it, as will be discussed below.

However, choosing the right financing method is not a purely internal matter for the shipping company, which is heavily influenced by external factors, such as interest rates, market trends and the legal and fiscal environment within the which operates and develops the respective shipping company.

With regard to the fundamental strategic choice between own and foreign capital, a crucial fact is the nature of shipping as a high-intensity capital sector. This means that a large amount of capital is required to establish and operate a shipping company. Consequently, the amount of funds required makes it particularly difficult to finance it exclusively from own funds, as Greek shipowners have chosen in the past. Therefore, in order to enable investments, shipping companies turn to full or partial financing of the cost of their investments with foreign capital.

From the above it can be concluded that the shipping industry is capital intensive and in addition it is quite fluctuating, characteristics that make the financing of the shipping company different from other forms of financing of commercial companies.

In particular, the cyclicality of shipping should be further analyzed, as the latter is given special consideration and greatly affects funding. More specifically, when freight rates are high, then the liquidity of shipping companies increases, dragging the values of ships. Conversely, when freight rates are low, then there is a reduction in the liquidity of shipping companies and the values of ships.

The changes described above in the cash flows and the values of the ships increase the risk taken by the financial institution, which is called to finance the company, as it is evaluated at a specific time and the loan is repaid in the long run. This is easily understood, as during the loan (5-8 years) there may have been dramatic changes in the company's cash flow, with the result that the latter is no longer able to service its obligations.

These changes are called Shipping Cycles, regardless of their duration, they consist of four stages which are analyzed below.

Recession

The phase of recession is initially manifested by the existence of excessive capacity, i.e., there is a large supply of ships. As a result, freight rates are declining constantly, even below the operating costs of ships. The fall in freight rates is creating uncertainty in the market and therefore shipping companies are unable to find available sources of funding.

Recovery

In the recovery phase, the excess capacity described above is normalized and supply begins to meet demand. The above response creates a positive climate in the market, resulting in an increase in freight rates at least to levels higher than the operating costs of ships. The positive climate in the shipping markets also attracts the money and capital markets, which are more willing to finance shipping companies, resulting in improved liquidity of shipping companies.

Peak

At this stage, supply fully meets demand, and is increasing. This favors freight rates, which are rising sharply. Credit institutions and markets respond positively to the financing of shipping companies, resulting in an increase in liquidity and ship orders at shipyards.

Collapse

The increase in orders at shipyards sharply increases the supply of ships, as a result of which it exceeds the demand for transport work. Due to overcapacity, freight rates are falling, and market psychology is fraught with uncertainty, making re-financing of shipping companies particularly difficult.

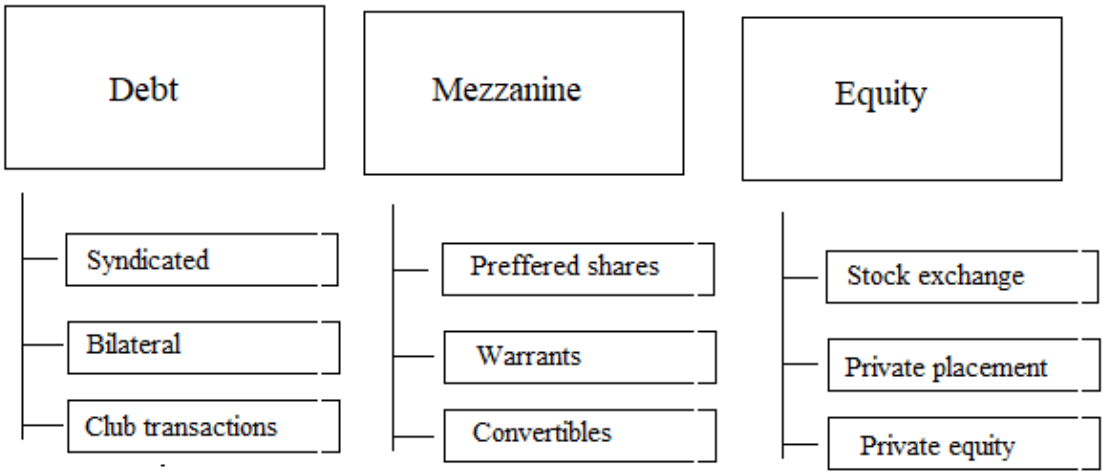
Shipping cycles directly affect shipping financing, as financial institutions in particular, as well as other investors, look at what stage of the shipping cycle we are at in order to finance shipping companies.

2.3 The capital structure of shipping companies

In order to examine the parameters of the decision of the shipping company regarding its capital structure, firstly we should examine the various types and forms of shipping finance. The main three sources[4] of capital in the financial markets for shipping companies are:

- Debt provisions
- Mezzanine finance
- Equity finance

Figure 11. Sources of capital for shipping companies



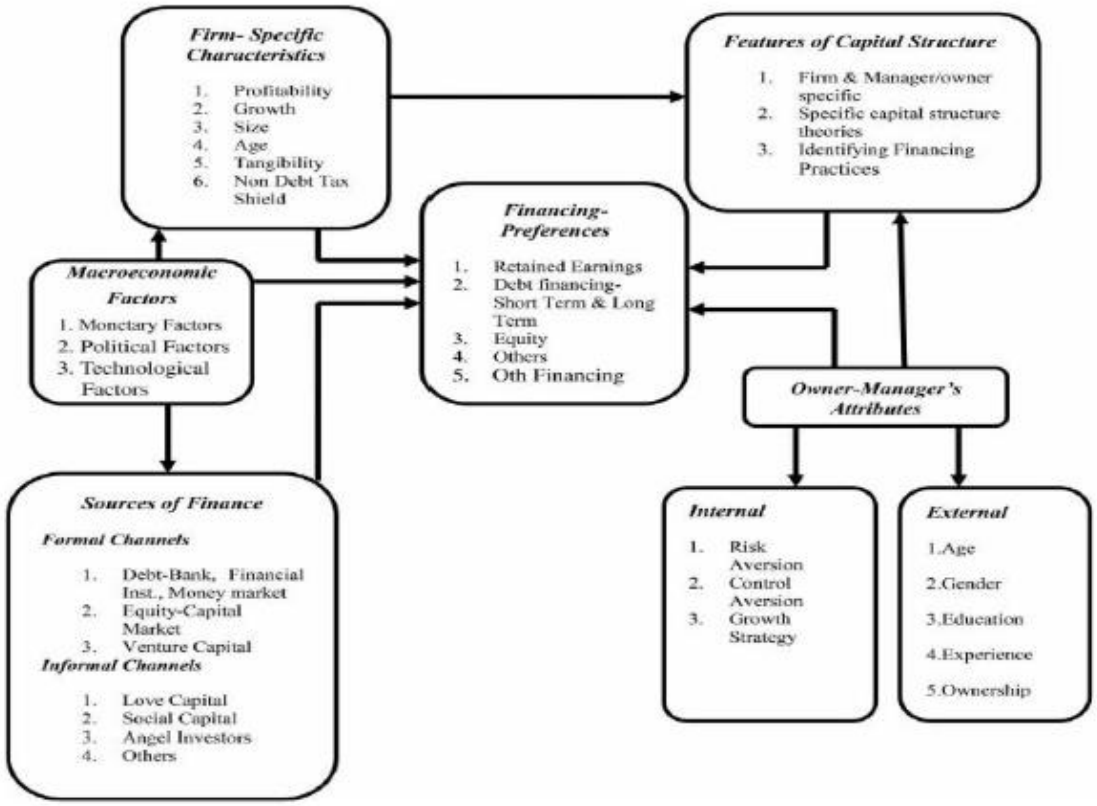
It should be noted here that the choice for the capital structure should not be understood as a decision exclusively of the shipping company; in fact, the decision is a combination of

[4]Branch & Stopford (1997) and Branch & Robarts (2014) also cite leasing as a type to raise capital for shipping companies. However, leasing is not a separate source of capital, but a type of financing, since it is a sub-form of debt; see Harwood (2006) and Grammenos & Papapostolou (2012).

various factors, that should all be mutually examined, because some of the factors act in opposition to other parameters, while others act in a supportive and uniform manner.

In a general framework, as pictured in the next diagram, the financing decision should examine various parameters, namely the firm-specific characteristics, the features of capital structure, the macroeconomic conditions, the characteristics of each source of finance, the owner-managers' attributes and the financial preferences

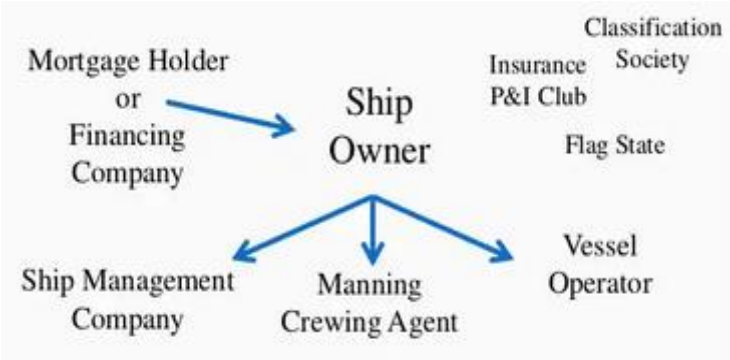
Figure 12. Framework of financing for enterprises



Source: Kumar & Rao, 2015, p. 108

In order to take the financing decision, the shipping company should, first of all, clarify that the vessel should not be considered as an asset belonging just to the company, but rather as an entity, having multiple functions and each function serves a different role regarding the ownership of the vessels. In that sense, the entities that are involved in the ownership of the vessel, include the one that provided the capital or the one who has the mortgage, the entities that confirm the legal provisions of the vessel, the company who operates the vessel, the crew agent and the company who have the management of the vessel, as pictured in the next figure[5].

Figure 13. Entities regarding the vessel's ownership



Source: Vandenberghe, 2013, p. 4

In each case, the decision regarding the financing would be different, since, for example, the ship owner might have different criteria of the financing decision than the vessel operator if these two are separate entities, while, as well, the bank's criteria for providing the capital are different than the criteria of a private investor.

As for that, those who provide the capital examine six characteristics of the shipping company for their decision to provide a loan, namely:

- The character / capacity
- The shipping company's capital,
- The company
- The condition,

[5] Although, in some cases, an entity can have multiple functions, i.e. the ship owner can also be the ship manager and the vessel operator.

- The collateral

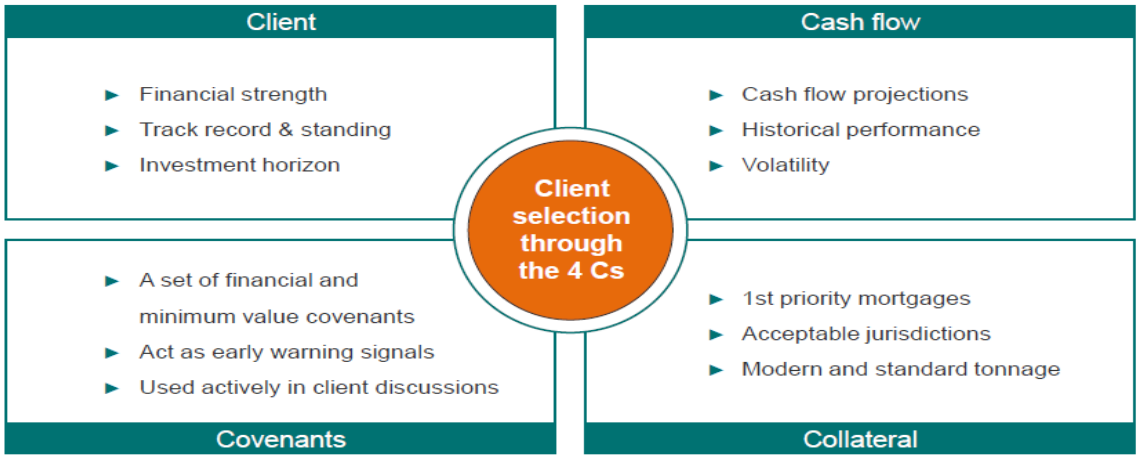
Figure 14. The six criteria to provide capital to a shipping company

Character/Capacity	Capital	Company	Conditions	Collateral
Head of Company, and Team Capacity and Integrity Company's Mission – goals Strategic Plan Strategies to Achieve them In Particular: – Investment & Finance – Chartering – Insurance – Technical – Cost Management – Risk Management – Creditors – Human resources Coherent Forward Looking & Learning from the Past	Shipowner/ Company's Head Shareholding Stake Financial Structure Analysis of Financial Statements Financial Ratio Analysis – Gearing Ratio (Total debt/total assets – Retained Cash Flow/ Net debt – Pre-Tax Funds Flow Interest Coverage – Hull to debt Cash Flow (Free Cash Flow to Debt) Cash Cushion (Cash Reserves)	Structure of Company Inflows: Forms of Employment Choice of Charterers Quality of Charterers Contracts with Charterers Effective Utilisation of Vessels Outflows: Operating Costs – Administrative – Technical – Insurance – Crew Voyage Costs Capital Costs Markets of Operation (1) Market Share (2)	Financial Markets Interest Rate Political Conditions and Governmental Decisions World Economy World Industrial Productions Seaborne Trade Specific Commodities Manufactured goods (Structural, Cyclical Changes) Shipping Markets Present and Future Demand & Supply Analysis Shipping Investment Cycle	Fleet's Composition Fleet's Condition Vessels' Economic Life Securities – Mortgages – Assignment of Income – Assignment of Insurance – Personal and Corporate guarantees
	Other Sources of Funds Banking Relationships Accounting Methods	1+2 = Company's Operating Position	Fragmentation of Markets Barriers to Entry Regulatory Framework: – Official International Organization(IMO) – Flag states – Port Authorities – ISM Code – OPA 90 Other Organisations' Requirements – Classification Societies – Insurance companies and P&I Clubs – Major Oil Companies	

Source: Grammenos, 2010, p. 735

Not all capital providers give an equal weight to each criterion of the above. For example, as presented in the next figure, in most cases, banks consider four criteria as crucial for their decision to provide a loan to a shipping company, i.e., the client the cash flow, the covenants and the collateral, as pictured in the next figure

Figure 15. Criteria of banking institutions



Source: Serck-Hanssen, 2012, p. 7.

It should be noted here that the choice for the capital structure should not be understood as a decision exclusively of the shipping company, but as a decision is taken by the shipping company in relation to:

- With the alternatives it has
- With the accessibility it has to each alternative
- With the availability of each alternative
- With the cost and benefit of each alternative.

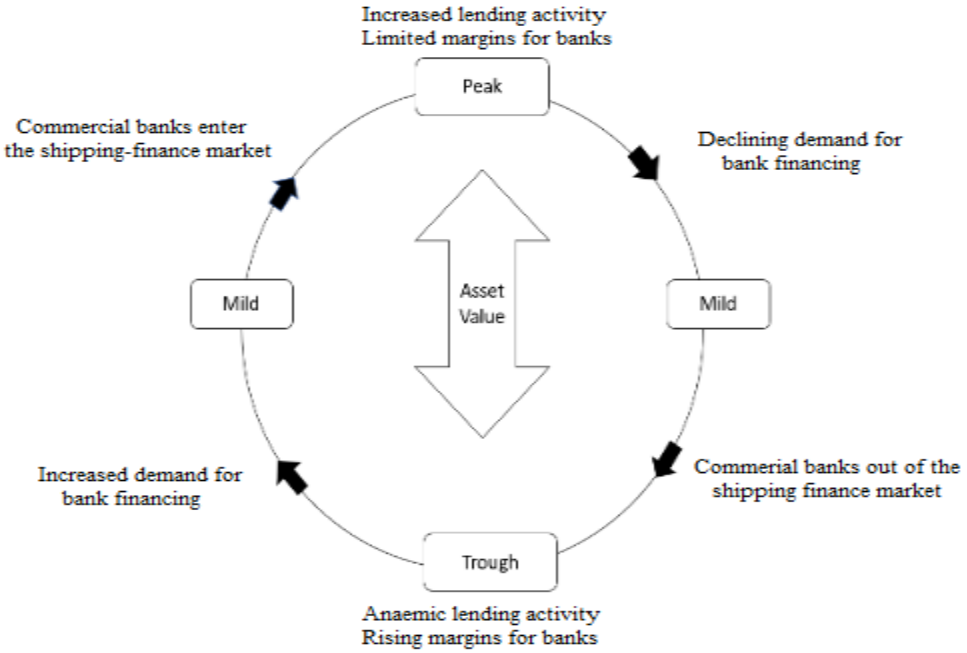
Before analyzing the above, an essential distinction must first be made between the use of each source of capital, in the light that each form of capital is more suitable for a specific objective of the shipping company. In general, a shipping company is looking for capital for the following reasons, either one of them or in combination:

- Fleet expansion
- Fleet replacement
- Fleet diversification / entrance to new markets

Regarding the shipping company, the choice of the type of financing has as a basic parameter the goals that the company has set, what it expects from its decision and the conditions that push it to make the decision for the acquisition of the ship.

Regarding the availability of the source of capital, it should be noted that banks, as well as other providers of capital, decide whether or not to provide capital to a shipping company according to the phase of the market of shipping finance; in fact, as pictured in the following figure, not only the shipping market has a market cycle,, but also the shipping finance as well, in the sense that the provision of capital –especially from banks- follows a market cycle, with peaks and throughts. Just before the peak and during the peak there is an increased lending activity; banks are competing to each other to provide the capital to the shipping companies, having narrower margins. The result is that shipping companies have higher number of vessels, i.e., the overcapacity begin to occur. After that, banks are less willing to provide capital to the shipping companies. Some companies have difficulties to meet their obligations, so bankruptcies begin. In that phase most commercial banks – those without any traditional connections with the shipping market- exit the ship financing activity. So, there are fewer banks in the financing market and margins begin to increase. In that phase the overcapacity is decreasing, and more shipping companies are willing to have a loan and the cycle begins again.

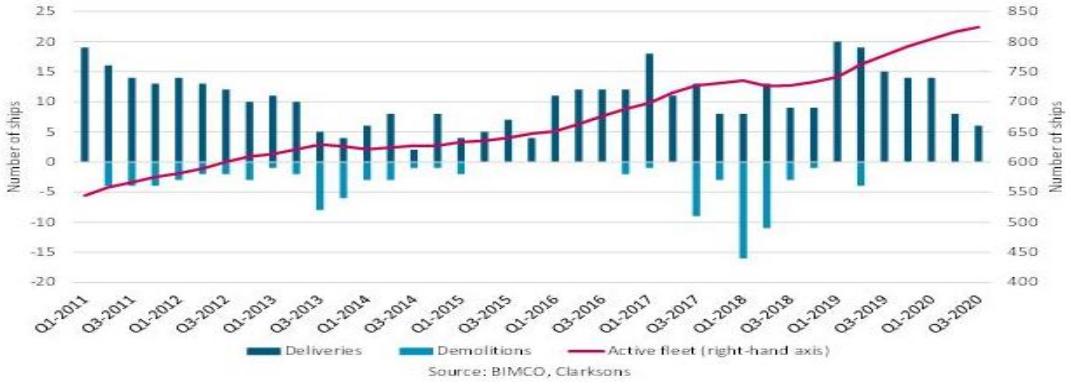
Figure 16. Cycle of the shipping market finance



Source Tsianakis, 2019, p. 5

The above factors are pictured in the next figures. As presented in the next chart, the fleet of VLCCs is constantly expanding, since the deliveries grow, and the demolitions decrease. One should notice that the expansion of the fleet could not have been realized without the funding. Hence, the capital provided to the shipping companies led to the expansion of the fleet.

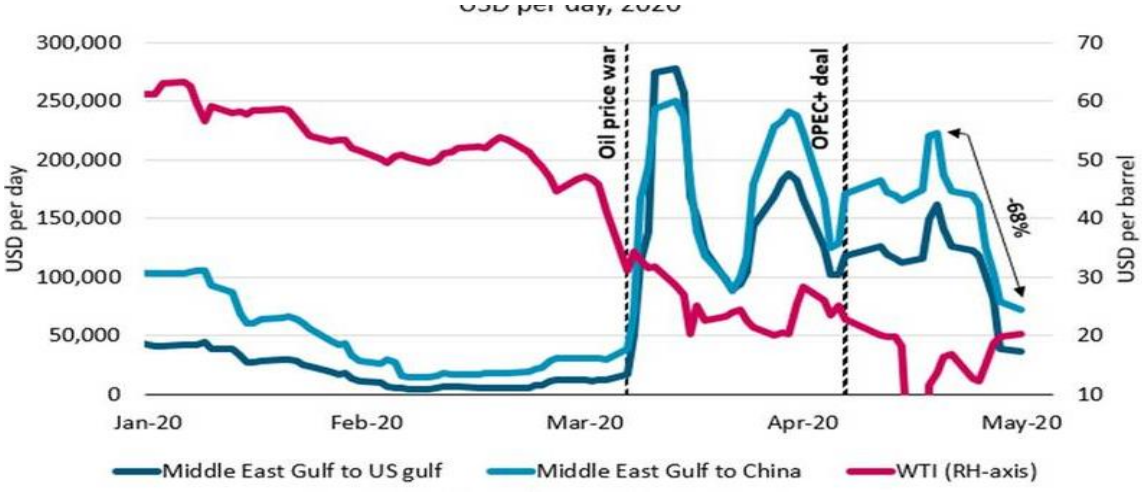
Figure 17. VLCC crude oil tanker fleet, 2011-2020



Source: data from BIMCO and Clarksons, illustration by Maritimes.gr

Now, as a result, as presented in the next figure, due to the overcapacity charter rates fell and banks have the risk to face losses and bankruptcies

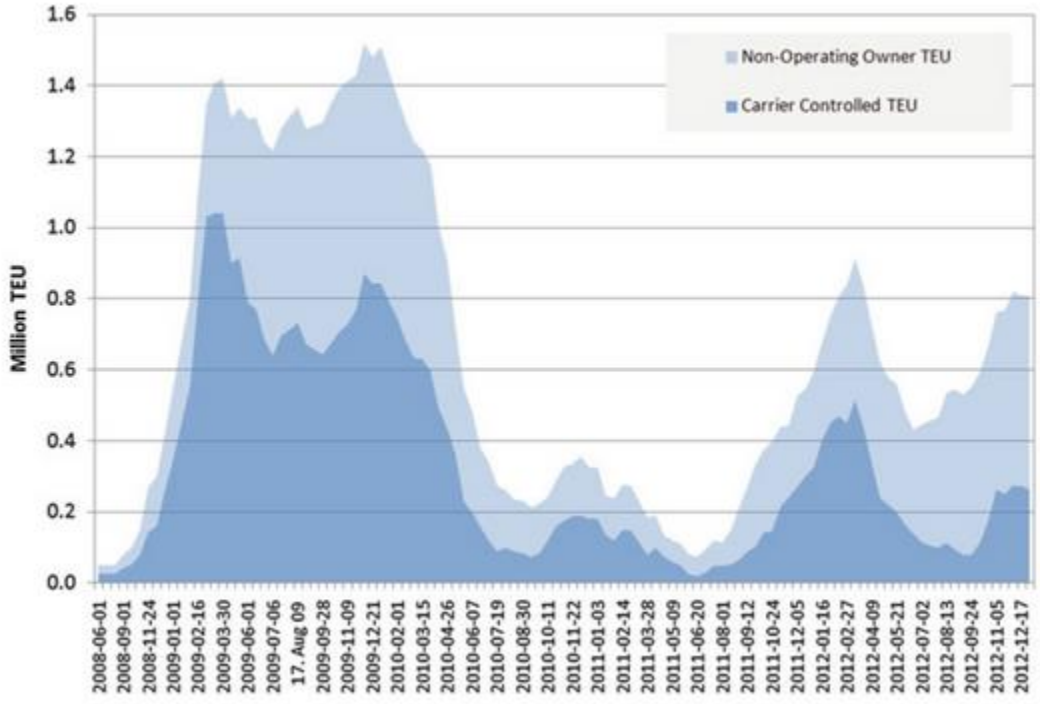
Figure 18. Charter rates of VLCC in USSD per day, various routes



Source: data from BIMCO, Clarksons and Marine Bunler Exchange, illustration by by Maritimes.gr

The same holds for the containerships in the previous phase of the market, where the idle capacity of the container ships was at very high levels, especially for independent companies (i.e., non-carrier controlled)

Figure 19. Idle container capacity



Source: Lemper & Tasto, 2015, p. 16

As bank lending is, over time, the most important way to raise funds for merchant shipping, the parameters regarding this type of capital will be considered first. Bank financing can be analyzed from two different perspectives:

The supply side of the loan, i.e., the parameters that banks are considering on their decision to provide the loan

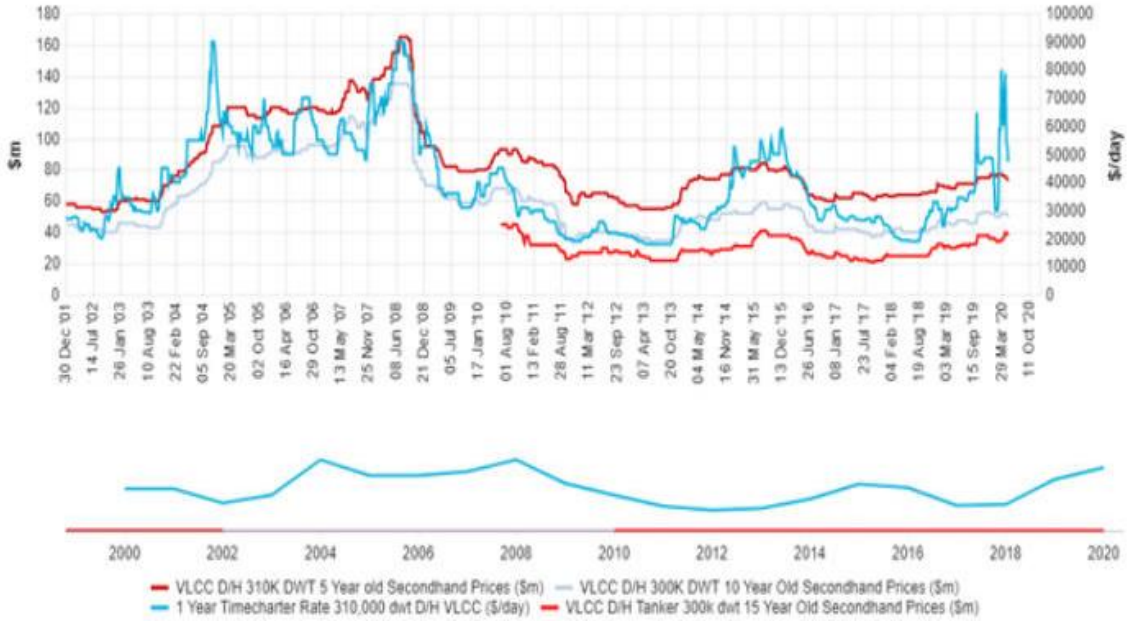
The demand side, i.e., the parameters that shipping companies examine on their decision to ask the loan.

One of the key points to note about the supply side is that the bank has as collateral the vessel for which the loan was granted, but this does not mean that the bank is insured

against any losses in the event of its failure shipping company to repay the loan. This is due to two interrelated conditions:

First, the price of second-hand records a significant change, as shown in the following graph. So, a bank that has financed a newly built ship, even at a rate of 60%, if it needed to sell it 5 years later, while in 2008 it could sell it at a price of over 140 million USD, in 2020 it could not to sell it for over 80 million USD

Figure 20. VLCC 310K DWT, 5-year price, mil. USD and $/day, 2002-2020



Source: Clarksons Research

Now, except of the above market cycle, there are exogenous factors leading the phase of the shipping finance. As presented in the next table, while until the min-50s the main source of finance was the cash that the shipping company had by holding the retained earnings, until the end of 1960s the shipping companies provided their time-charter contracts as collateral to the banks. Because in that manner the banks felt that were safe, more and more loans were being provided to shipping companies, leading to overcapacity. That led to the crisis of 1980s and 1990s, where the default rates were extremely high. Banks suffered huge losses and the whole market changed, setting a new relationship between banks and

shipping companies. In the ‘90s new forms of capital started to occur, while until the crisis of 2007 shipping companies started to use IPOs and private equity of funding sources.

Figure 21. Major phases of shipping finance

Period	Ship finance phase	Major characteristics	Shipping market environment
1945–mid-1950	Cash	Financing by retained earnings and cash liquidity – debt signalled weakness	Booming business
mid-1950–end-1960s	Charter back	Time-charter contracts collateral to bank finance; enhanced role of banks	Golden-age of growth; Up-swinging markets
early-1970s–start-1980s	Bubble	Ship vessel the favourable collateral to bank finance; extreme dwt overcapacity	Two oil crises; depression phase; market collapse; long-term impact
1980s–1990s	Distress	Extremely high default rates; extensive bank losses; disturbed relationships of banks vs. ship firms; reassessment of shipping risk	Profound demand–supply disequilibrium; business restructuring
1990s–2001	Convalescence	Reshaping of firms–bank relationships; further fund raising needs for shipping firms	Market consolidation; demand–supply convergence; gradual recovery; volatility
2002–2009	Super-cycle	Unique boom cycle; equity and bond markets attractive to shipping firms	Unprecedented earnings growth; the China factor; global financial crisis; overcapacity conditions

At this point we will refer to some parameters that affect the decision of the shipping company regarding its capital structure, as formulated in the literature.

Regarding debt, according to Leggate (2000) the raising of capital from the issuance of bonds contains the parameter that the bond coupon has a negative correlation with the credit rating. Thus, at a certain level of credit rating, the shipping company should give a bigger coupon than the average of companies with the same credit rating. Similarly, in the research of Grammenos & Arkoulis (2003) the bonds 'spread of shipping companies have negative correlation both to market conditions and to credit rating but have a positive correlation to the company's leverage.

Regarding the equity as source of finance, Vullinane and Gong (2002) found that IPOS are undervalued by almost 71%, due to the high level of uncertainty of the shipping market in comparison to other sectors. In their study, Merikas, Gounopoulos & Nounis (2009) fond that the IPOs of shipping companies globally are underpriced by almost 16% in the mid- to long-run, while they are also undervalued by as much as 18% in the first day of the listing. The same research shows that in periods of an active IPO market –i.e., when many firms of various sectors are being listed- then investors do not prefer the listing of the shipping companies, thus their shares are even more undervalued. The fact is that, as shown in the study of Lozinsksia et al (2017), a reason of the undervaluation is because overvaluation of shipping companies is positively correlated to bankruptcy of the shipping company. So, to undervalue the stock is a protection for investors.

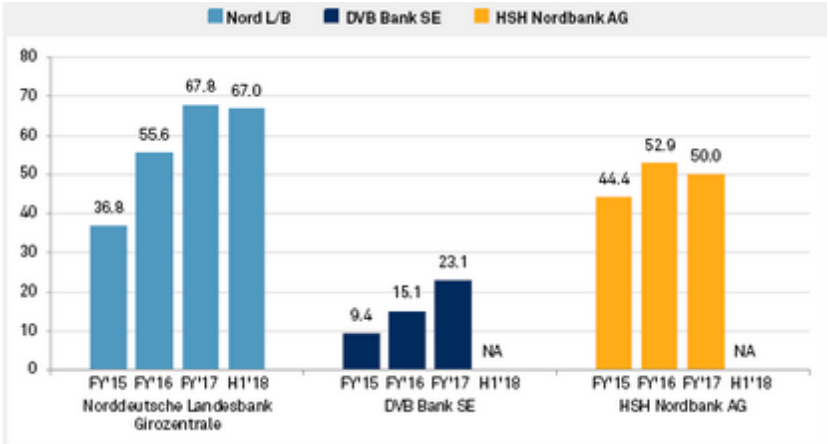
On the contrary, investors that have a knowledge of the shipping company since it is long-established, are more willing to participate in the IPO, hence the longer the company is in the shipping market, the less underpriced the share will be in the long run.

As for the New York exchanges, the study of Merikas, Gounopoulos & Karli (2010) for the period from 1987 to 2007 show that shipping IPOS are undervalued by 4.4%, while for the same period –in fact, from 1987 to 2008- Grammenos & Papapostolou (2012)) find the IPOs too be underpriced by 2.7%.

In general, Drobetz et al. (2013) found that asset tangibility is positively related to leverage in a higher rate than in other industries, while profitability, asset risk and operating leverage have a negative correlation to leverage. Although the vessel, as collateral, is risky, banks do consider the tangible assets as the key determinant (Lee & Park, 2018).

Gong et al. (2013) in their analysis found that Chinese banks use higher weighting to loan quality and security than in other industries and after the global financial crisis are reducing their sipping loan portfolio, due to the NPLs. In fact, NPLs can be considered as the key element of the choice of German banks as well, since, as presented in the next figure, in 2018 some banks have a ratio of 50% and even 67% of shipping NPLs to the total shipping loan provisions.

Figure 22. Shipping NPL exposure to total shipping loans, selected German Banks



Source: Chaudhry & Damyanova, 2018

Berg & Andreassen (1990)

Finally, the study of Faun & Topan (20016) find a a positive relationship between the capital structure and company's size and tangibility, and a negative relationship between capital structure and profitability and business growth perspectives. Of course, one should keep in mind that, as Berg & Andreassen (1990) note, the decision on capital structure differs among those who are risk averse and risk-lovers, since the former tend to adjust the capacity of their fleet toward a long-term mean, despite the market conditions of each short-term period, while the latter tend to expand their fleet even in volatile markets. Hence, it is

expected the former to hold more cash, and that explains why the shipping companies are recorder as having more cash than other industries (Ahrenda et al., 2018), but is also expected than the latter to have a higher tendency to borrow capital from banks.

Chapter 3. Methodology

3.1 Method of the analysis

3.1.1. Panel data analysis

In order for a company to meet its investment needs, it makes use of own and foreign capital. More commonly, when we say that a company uses its own funds, we mean that it uses its retained earnings, while otherwise, external financing can take the form of loans, debt securities, raising equity capital by issuing stocks, as well as hybrid securities.

The proportion of these two sources of funding is the subject of the study of the capital structure.

In order to examine the determinants of the capital structure, the analysis uses the panel data method. This analysis is a well-known statistical and econometric method of panel data analysis. The data used in a table analysis are observations that have been made in multiple time periods and take the form of regression of type:

$Yit = a + b_1X_{it} + b_2X_{it} + ... + + b_nX_{it} + e_{it}$

Where:

Yit: The dependent variable for i = 1 .... n and t are the time periods in which the investigation took place.

Xi: The independent variable of which each change affects the dependent variable Y.

a: The slope of the line

bi: Coefficients between the dependent and independent variable, showing how much the dependent variable changes when the independent increases by one unit.

I: Each data unit investigated and used in the sample.

t: The time periods in which the sample is studied

eit: Random measurement error of the spatial unit i at time t.

where y is the dependent variable, x is the independent, i is each unit, t are the time periods where the search took place, the slope of the line and e the error. Specifically for the index t we should mention that, in addition to informing us about the time periods in which the research was implemented by showing us the time changes of the unit-factors, it shows us in essence the number of units that have been collected for the conduct of research.

3.1.2 Dependent variables

Drobetz et al. (2013), following Welch (2011), mention that there are so many forms of equity, debt, and hybrids that the definition of debt-to-equity is not obvious, therefore empirical research should use more specific ratios for the leverage analysis.

According to Frank & Goyal (2009), a company's foreign capital is defined as the sum of its long-term and short-term liabilities to its total assets. This parameter has been used as a dependent variable in the control of the capital adequacy of shipping companies and in the research of Drobetz et al. (2013). Hence, the formula of the Book Leverage (BL1) is:

$$\text{Book leverage 1} = \frac{Total\ liabilities}{Total\ book\ assets}$$

Another form of leverage is that could be used takes into account the debt instead of the liabilities, in the sense that debt provides a more accurate insight regarding the use of external funding for a firm. This factor has been used by Drobetz et al. (2013). The formula for this second type of leverage (BL2) is:

$$\text{Book leverage 2} = \frac{Debt}{Net\ book\ assets}$$

3.1.3 Independent variables

The independent variables of the research are:

A. Profitability.

According to the trade-off theory, a company's profitability is positively related to its leverage. On the contrary, pecking order theory suggests negative relationship between profitability and leverage. Syriopoulos and Tsatsaronis (2011), Tsionas et al. (2012), Andreau et al. (2014) as well as Paun & Topan (2016) use Return on Assets (ROA) and Return on Equity (ROE), while Drobetz et al. (2013) use another indicator.

The profitability in the current analysis uses the following indicators:

Profitability 1 (PR1) ratio has been used by Drobetz et al. (2013)

$$PR1 = \frac{Operating\ income\ before\ depreciation}{Total\ assets}$$

ROA has been used by Paun & Topan (2016)

$$ROA = \frac{Net\ profit}{Total\ assets}$$

ROE has also been used by Paun & Topan (2016)

$$ROE = \frac{Net\ profit}{Shareholders\ equity}$$

B. Size

According to trade-off theory, the size of a business is positively related to its leverage. In contrast, pecking order theory suggest a negative relationship between size and leverage. In general, although research has shown contradictory results on the effect of size on capital correction, size undoubtedly influences decisions about a company's capital structure.

Berger et al. (1997) Wald (1999) and Drobetz et al. (2013) measure the size of a business as the physical logarithm of its total assets.

Paun & Topan (2016) use two ratios for the size: the sales volume ratio, by dividing its company sales to the total sales and the total assets ratio, by dividing the total assets of each company by their total assets.

Regarding the sales volume ratio, the shipping companies of the sample do not serve the same sector, since other companies have bulk carriers, others have tankerships, containerships, etc., or a combination of the above this ratio cannot be used in a unique manner.

Hence, the current analysis will use the above factor:

SZ: Natural logarithm of total assets

C. Tangibility.

According to Rayan & Zingales (1995) and Fank & Goyal (2009), the fixed assets of a company are considered as a measure of its secured value and according to trade-offe theory have a positive correlation with its leverage because they reduce information asymmetry and representation costs, increasing its borrowing capacity. On the other hand, Pecking order theory suggests a negative relationship between fixed assets and leverage due to less costly equity issues.

Drobetz et al. (2013) as well as Paun & Topan (2016) for tangibility (TB) uses the ratio:

$$\text{Tangibility (TB)} = \frac{Fixed\ assets}{Total\ assets}$$

E. Growth

According to trade-off theory, a business's growth opportunities are negatively related to its leverage. On the contrary, for pecking order theory growth opportunities are positively related to leverage. In any case, it is true that the possibilities of sustainable development significantly influence the decisions for the capital structure of the company.

Paun & Topan (2016) use the market value to equity ratio in order to measure growth opportunities, by dividing the Market value of the company by Shareholders' equity. The problem is that the ratio is useful only for listed companies, while the current study

examines the behavior of the capital structure even before the company's listing to the stock market.

Since growth opportunities can be assessed through the annual change in operating profits, the current analysis uses the annual profit and loss method, and the signs are adjusted according to changes in operating income / loss.

F. Operating leverage

Drobetz et al. (2013) uses the operating leverage as the ratio of operating expenses to total assets, by stating that operating expenses represent to a high degree the whole fixed costs.

G. Taxation

As highlighted in the previous chapters, there is a wide discussion whether taxes have or have not any impact on the company's decision regarding capital. While most shipping companies have tax exemption, the analysis will use the taxation factor, as stated by Paun and Topan (2016)

Taxation (TX) = = $\frac{EBIT-EAT}{EBIT}$

3.1.4 The sample of the study

The sample of the study includes the following shipping companies, separated in three main categories: containerships, tanker ships and bulk carriers.

Containership companies

Costamare. The company is one of the biggest independent owners of containerships, having a history of 47 years. The company has 81 containerships of various sizes, being chartered by the largest charterers, like Cosco, Evergren, MSC and Hapag Lloyd. The company listed in the New York Stock Exchange in 2010, under the symbol CMRE.

Danaos. The company established in 1972 in Piraeus and has 65 containerships. The company is among the largest independent charter owners of containerships. Danaos listed in NYSE in 2006 under the symbol DAC.

Capital Product Partners. The company has a fleet of 15 containerships and one bulk carrier. The company listed in NASDAQ in 20007, having the symbol CPLP

Dry bulk shipping companies

Diana Shipping. The company has 36 dry bulks of various types, from traditional ones, like Capesize and Panamax, to innovative ones, like Newcastlemax, Post-Panamax\ and Kamsarmax. Diana listed in NYSE in 2005 under the symbol DSX.

Navios. The company was established in 1954 as a subsidiary of United States Steel. After a period of time, the company became fully independent, privately owned bulk carrier transport. Navios has 44 bulk carriers of various types. The company listed in NYSE in 2005 under the symbol NMM

Globus maritime. The company was incorporated in 2006 and has eight dry bulk carriers. Globus listed in NASDAQ in 2008 under the symbol GLBS.

Star Bulk Carriers. The company established in 2006 and has a fleet of 128 bulk carriers. Star Bulk Carriers got listed in NASDAQ in 2007 under the symbol SBLK.

Tanker ship companies

Tsakos Energy Navigation. The company has a history of more than 50 years, having a fleet of 65 tanker ships of various sizes and is listed in NYSE in 2002.

Stealth Gas. The company has a fleet of 54 tanker, LPG and JV vessels and got listen in NASDAQ in 2007 under the symbol GASS.

Chapter 4. Findings

4.1 Findings for the containership shipping companies

4.1.1. Descriptive statistics and variables' correlations of containership companies

First, there is an overview of the descriptive statistics of the dependent and the independent variables of each company.

For CMRE, both book leverage ratios are rather high, over 60%, which is a sign that company uses debt, but in a smaller percentage then the own capital. As for the profitability, in all three variables of the profitability the company has positive indicators, but there is a not so efficient use of the company's assets, since both PR1 and ROA are rather small. Tangibility is high, as expected, since the higher percentage of the assets are the vessels. Regarding growth, the fact is that the company, although it has profits and positive operating income, after 2015 records a decrease in both accounts, thus growth has a negative sign. Regarding taxation, there is a difference between income before and after taxes, resulting in a rather high taxation ratio.

Table 1. Descriptive statistics, CMRE

	Mean	St.Dev.	Max	Min
BL1	0,70	0,15	1,01	0,51
BL2	0,62	0,15	0,84	0,35
PR1	0,07	0,02	0,11	0,02
ROE	0,16	0,19	0,75	-0,01
ROA	0,04	0,02	0,07	0,00
SZ1	3,38	0,09	3,48	3,24
TB	0,86	0,03	0,91	0,80
G	-5,84	42,68	55,96	-112,79
TX	0,49	0,11	0,85	0,39

As for the Danaos, the company uses debt to a high degree, so both of the leverage indicators are rather high. Company's profitability ratios are low, with a use of equity and assets that could be improved. The problem with profitability is being recorded in the

growth variable as well, with the variable having a minus sign. Taxation is high since there are differences between EBIT and earnings after tax.

Table 2. Descriptive statistics, DAC

	Mean	St.Dev.	Max	Min
BL1	0,82	0,09	0,92	0,62
BL2	0,72	0,11	0,83	0,49
PR1	0,06	0,02	0,08	0,00
ROE	0,02	0,30	0,53	-0,75
ROA	0,01	0,04	0,06	-0,12
SZ1	3,52	0,07	3,63	3,43
TB	0,93	0,03	0,98	0,85
G	-10,50	73,26	96,83	-198,98
TX	0,68	0,97	2,68	-1,72

Capital Product Partners uses the lower debt among three companies, with both leverage ratios having a rather low value. By taking into account that the company's tangible assets increased –i.e. the company expanded its fleet- it is a clear sign that the management's decision was to use own capital rather than use leverage.

Table 3. Descriptive statistics, CPLP

	Mean	St.Dev.	Max	Min
BL1	0,53	0,19	1,00	0,36
BL2	0,45	0,14	0,70	0,21
PR1	0,13	0,07	0,28	0,01
ROE	0,06	0,13	0,29	-0,30
ROA	0,02	0,06	0,07	-0,17
SZ1	3,04	0,14	3,20	2,83
TB	0,84	0,13	0,94	0,42
G	-8,29	43,29	45,70	-126,52
TX	0,50	1,16	3,59	-1,47

For the subsector of the containerships, leverage ratios are in the middle level, showing the companies do not use as much debt as the increase of the value of the assets. Return on equity has higher value than return on assets, showing that companies use the equity to create profits, but on the other hand, the lower PR variable and ROA is an indication that a part of the total fleet has not been fully used.

Table 4. Descriptive statistics, containership companies

	BL1	BL2	PR1	ROE	ROA	SZ1	TB	G	TX
Mean	0,68	0,60	0,09	0,08	0,02	3,31	0,87	-8,21	0,56
St. Dev.	0,19	0,17	0,06	0,22	0,05	0,23	0,09	55,00	0,88
Max	1,01	0,84	0,28	0,75	0,07	3,63	0,98	96,83	3,59
Min	0,36	0,21	0,00	-0,75	-0,17	2,83	0,42	-198,98	-1,72

The next issue to be examined is whether there are correlations between the independent variables, so that there should be a notice in the case that variables are interconnected. The only rather strong and statistically significant correlation is between the PR1 ratio (Operating income before depreciation /Total assets) and size, having a correlation coefficient of -0.676 ($p=0.000<0.05$). This is an indication that the increase of the fleet's capacity and/or the number of vessels is not accompanied by a similar increase in the operating income. On the other hand, the value of the correlation is rather low, hence this indication cannot be lead to general conclusion.

Table 5. Correlations between independent variables, containership companies

Correlations

		PR1	ROE	ROA	SZ	TB	G	TX
PR1	Pearson Correlation	1	,186	,235	-,676**	,241	,345*	-,177
	Sig. (2-tailed)		,257	,149	,000	,139	,031	,282
	N	39	39	39	39	39	39	39
ROE	Pearson Correlation	,186	1	,773**	-,122	,023	-,008	-,545**
	Sig. (2-tailed)	,257		,000	,460	,888	,961	,000
	N	39	39	39	39	39	39	39
ROA	Pearson Correlation	,235	,773**	1	-,030	,040	-,078	-,784**
	Sig. (2-tailed)	,149	,000		,857	,809	,638	,000
	N	39	39	39	39	39	39	39
SZ	Pearson Correlation	-,676**	-,122	-,030	1	,221	-,038	,015
	Sig. (2-tailed)	,000	,460	,857		,176	,820	,927
	N	39	39	39	39	39	39	39
TB	Pearson Correlation	,241	,023	,040	,221	1	,297	-,067
	Sig. (2-tailed)	,139	,888	,809	,176		,067	,687
	N	39	39	39	39	39	39	39
G	Pearson Correlation	,345*	-,008	-,078	-,038	,297	1	-,121
	Sig. (2-tailed)	,031	,961	,638	,820	,067		,464
	N	39	39	39	39	39	39	39
TX	Pearson Correlation	-,177	-,545**	-,784**	,015	-,067	-,121	1
	Sig. (2-tailed)	,282	,000	,000	,927	,687	,464	
	N	39	39	39	39	39	39	39

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The next issue to be addressed is to examine whether there are correlations between the independent variables and the dependent ones, in order to prevent conclusion that would have been impacted by a correlation between the variables. Tangibility is the only variable that has a statistically significant correlation, with a value of 0.633 and this correlation is on the second dependent variable (Debt/Net book assets). This is expected, since, as

mentioned in the previous sections, in order to buy or built a vessel the shipping company needs external financing, due to the so high cost. Table 6. Correlation between dependent and independent variables, containerships

		BL1	BL2
BL1	Pearson Correlation	1	,936**
	Sig. (2-tailed)		,000
	N	39	39
BL2	Pearson Correlation	,936**	1
	Sig. (2-tailed)	,000	
	N	39	39
PR1	Pearson Correlation	,083	,052
	Sig. (2-tailed)	,615	,753
	N	39	39
ROE	Pearson Correlation	,147	,133
	Sig. (2-tailed)	,373	,421
	N	39	39
ROA	Pearson Correlation	,054	,031
	Sig. (2-tailed)	,746	,850
	N	39	39
SZ	Pearson Correlation	,351*	,412**
	Sig. (2-tailed)	,028	,009
	N	39	39
TB	Pearson Correlation	,542**	,633**
	Sig. (2-tailed)	,000	,000
	N	39	39
G	Pearson Correlation	,205	,255
	Sig. (2-tailed)	,211	,117
	N	39	39
TX	Pearson Correlation	,055	,070
	Sig. (2-tailed)	,737	,671
	N	39	39

4.1.2 Regression analysis of the first dependent variable

Now, the next issue to be addressed is to examine whether the independent variables have an impact on the dependent variable. For this, regression analysis is being conducted, having the form of:

$Yit = a + b_1X_{it} + b_2X_{it} + ... + + b_nX_{it} + e_{it}$

Where:

Yit: The dependent variable for i = 1 .... n and t are the time periods in which the investigation took place.

Xi: The independent variable of which each change affects the dependent variable Y.

a: The slope of the line

bi: Coefficients between the dependent and independent variable, showing how much the dependent variable changes when the independent increases by one unit.

I: Each data unit investigated and used in the sample.

t: The time periods in which the sample is studied

eit: Random measurement error of the spatial unit i at time t.

where y is the dependent variable, x is the independent, i is each unit, t are the time periods where the search took place, the slope of the line and e the error

Hence, the regressions of the research are as follows:

Regression 1: BL1 = PR1 + SZ + TB + G + TX

Regression 2: BL1' = ROE + ROA + SZ + TB + G + TX

Regression 3: BL2 = PR1 + SZ + TB + G + TX

Regression 4: BL2' = ROE + ROA + SZ + TB + G + TX

As for the first dependent variable Book Leverage 1, model summary of the regression shows that the value of the simple correlation R is moderate (R=0.643), lower than the

significant value of 0,7 but higher than the non-critical value of 0.45. The value of the R-square is low, indicating that only 41% of the total variation of the Book Leverage 1 can be explained by the independent variables.

Table 7. BL1 linear regression with PR1, containerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,642[a]	,412	,323	,15963

a. Predictors: (Constant), TX, SZ, G, TB, PR1

The next table provides an indication of whether the regression can predict the dependent variable and fits to the data. The significance value of the ANOVA is 0.03<0.05, indicating that the model can statistically significant predict the outcome

Table 8. ANOVA, BL1 with PR1, containerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,589	5	,118	4,625	,003[b]
	Residual	,841	33	,025		
	Total	1,430	38			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, SZ, G, TB, PR1

From the next table we can conclude that only the size is a statistically significant factor of the leverage, having a statistically significance of 0.021<0.005.

Table 9. Linear regression coefficients, BL1 with PR1, containerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1,584	,578		-2,738	,010
	PR1	1,273	,773	,385	1,647	,109
	SZ	,449	,186	,535	2,415	,021
	TB	,748	,364	,338	2,055	,048
	G	,003	,052	,008	,054	,957
	TX	,030	,030	,139	1,010	,320

a. Dependent Variable: BL1

Based on the regression analysis, the function of the regression is:

BL1 = - + 1.584 * PR1 + 1.273 * SZ + 0.0449 * TB + 0.003* G + 0.030 * TX

Now, it should be examined whether there are differences on using the ROE and ROOA instead of the PR1 ratio. By using this combination, the value of the R-square is in the same levels, hence it does not provide any improvement.

Table 10. BL1 linear regression with ROE and ROA, containerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,659[a]	,435	,329	,15895

a. Predictors: (Constant), TX, SZ, G, TB, ROE, ROA

The statistical significance is decreased in comparison to the previous model ($p=0.04<0.05$), but still the model can statistically significant predict the outcome.

Table 11. ANOVA, BL1 with ROE and ROA, containerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,622	6	,104	4,101	,004[b]
	Residual	,808	32	,025		
	Total	1,430	38			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, SZ, G, TB, ROE, ROA

In this model, there are two indicators having a statistically significant impact on the book leverage 1 ratio: the size ($p=0.0447<0.05$) and the tangibility ($p=0.04<0.05$).

Table 12. Linear regression coefficients, BL1 with RIE and ROA, containerships

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1,050	,420		-2,499	,018
	ROE	,235	,185	,276	1,273	,212
	ROA	,372	1,254	,090	,297	,769
	SZ	,241	,117	,287	2,069	,047
	TB	,999	,319	,451	3,132	,004
	G	,045	,052	,128	,865	,393
	TX	,069	,050	,317	1,388	,175

a. Dependent Variable: BL1

Based on the regression analysis, the function of the regression is:

BL1 = -1.050 + 0.235 * ROE + 0.372 * ROA + 0.241 * SZ + 0.999 * TB + 0.045 * G + 0.069 * TX

4.1.3. Analysis of the second dependent variable

Now we will examine the second dependent variable, BL 2 (Debt/Net book assets). The model summary shows that the value of the simple correlation R is rather high (R=0.730). The value of the R-square is rather low, indicating that the 53.3% of the total variation of the dependent variable can be explained by the independent variables.

Table 13. BL2 linear regression with PR1, containerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,730[a]	,533	,462	,12999

a. Predictors: (Constant), TX, SZ, G, TB, PR1

The ANOVA table shows that the model can statistically significant predict the outcome (p=0.00<0.05)

Table 14. ANOVA, BL2 with PR1, containerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,637	5	,127	7,536	,000[b]
	Residual	,558	33	,017		
	Total	1,194	38			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, SZ, G, TB, PR1

The coefficients tables shows that size and tangibility are the variables having an impact on the Book Leverage 2 ratio on a statistically significant level (p=0.012<0.05 and p=0.005<0.05 respectively).

Table 15. Linear regression coefficients, BL2 with PR1, containerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1,601	,471		-3,398	,002
	PR1	,932	,629	,308	1,480	,148
	SZ	,402	,151	,524	2,656	,012
	TB	,882	,296	,436	2,976	,005
	G	,018	,042	,057	,432	,668
	TX	,030	,024	,153	1,247	,221

a. Dependent Variable: BL2

By using ROE and ROA instead of the PR1, the significance of the prediction remains the same as in the previous combination (Table 16), and with the ANOVA showing that the model is good to fit the data (p=0.00<0.05) ((Table 17)

Table 16. BL2 linear regression with ROE and ROA, containerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,758[a]	,574	,494	,12608

a. Predictors: (Constant), TX, SZ, G, TB, ROE, ROA

Table 17. ANOVA, BL2 with ROE and ROA, containerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,686	6	,114	7,188	,000[b]
	Residual	,509	32	,016		
	Total	1,194	38			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, SZ, G, TB, ROE, ROA

In this model, as well as in the previous one, the only two indicators having a statistically significant impact on the dependent variable is the size (p=0.009<0.05) and the tangibility (p=0.00<0.05).

Table 18. Linear regression coefficients, BL2 with ROE and ROA, containerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1,235	,333		-3,705	,001
	ROE	,226	,146	,290	1,543	,133
	ROA	,256	,995	,067	,257	,799
	SZ	,257	,092	,334	2,775	,009
	TB	1,060	,253	,524	4,189	,000
	G	,051	,041	,159	1,237	,225
	TX	,066	,040	,330	1,665	,106

a. Dependent Variable: BL2

4.2 Findings for the bulk carrier companies

4.2.1. Descriptive statistics and variables' correlations of bulk carrier companies

First, there is an overview of the descriptive statistics of the dependent and the independent variables of each company.

For DSX, the book leverage ratios are very low, at 39% and 34% respectively, which a clear sign that the company does not use foreign capital for its operations. Tangibility is high, as expected. The profitability of the company is negative, both in terms of ROE and ROA and in terms of the PR1 ratio. Growth is negative, since the company after 2012, has constant losses instead of profits. The taxation is negative, which is a positive sign, since the company has losses, hence no tax is applicable.

Table 19. Descriptive statistics, DSX

	Mean	St,Dev,	Max	Min
BL1	0,39	0,17	0,74	0,24
BL2	0,34	0,13	0,61	0,21
PR1	0,00	0,10	0,12	-0,29
ROE	-0,04	0,25	0,29	-0,82
ROA	-0,01	0,14	0,21	-0,41
SZ1	3,24	0,12	3,43	3,03
TB	0,83	0,07	0,93	0,71
G	-8,60	189,95	522,24	-395,67
TX	-0,01	0,65	1,44	-1,42

For Navios, leverage could be considered as small, since the company uses a percentage of about 50% of foreign capital. The company has a positive ROE, ROA and profitability ratio, although it should be highlighted that this is only because of the higher values of the previous years, since the company from 2016 to 2010 has losses. Tangibility is rather high. Regarding growth, is negative due to the losses. Regarding taxation, there is a difference between income before and after taxes, resulting in a positive taxation ratio.

Table 20. Descriptive statistics, NMM

	Mean	St,Dev,	Max	Min
BL1	0,51	0,13	0,76	0,35
BL2	0,46	0,11	0,73	0,31
PR1	0,05	0,05	0,15	-0,02
ROE	0,06	0,12	0,38	-0,10
ROA	0,03	0,05	0,10	-0,04
SZ1	3,07	0,27	3,43	2,51
TB	0,83	0,08	0,93	0,69
G	-2,28	32,40	46,15	-74,51
TX	1,08	1,38	4,61	-0,31

As for the Globus, the company uses some leverage, but not in a level that could be indicated as high. The key problem is that, for the whole period of the study, only in five years the company had profits. Hence, profitability ratios are negative, as well as the growth ratio. Tangibility is lower in comparison to the other companies.

Table 21. Descriptive statistics, GLBS

	Mean	St,Dev,	Max	Min
BL1	0,60	0,11	0,78	0,40
BL2	0,53	0,18	0,91	0,19
PR1	-0,01	0,04	0,08	-0,06
ROE	-0,53	1,03	0,35	-3,68
ROA	-0,06	0,16	0,15	-0,50
SZ1	2,49	0,53	3,43	1,96
TB	0,87	0,12	0,98	0,49
G	-0,81	13,32	22,23	-32,20
TX	0,38	0,58	1,48	-0,61

Star Bulk uses its own capital instead of foreign capital, since both leverage ratios are low. The company has losses instead of profits, resulting to negative profitability and growth ratios.

Table 22. Descriptive statistics, SBLK

	Mean	St,Dev,	Max	Min
BL1	0,46	0,09	0,67	0,31
BL2	0,42	0,09	0,63	0,29
PR1	-0,05	0,13	0,06	-0,43
ROE	-0,25	0,72	0,24	-2,69
ROA	-0,09	0,24	0,15	-0,89
SZ1	3,12	0,32	3,51	2,55
TB	0,87	0,04	0,93	0,81
G	4,75	192,89	315,30	-424,20
TX	1,12	5,31	18,00	-7,36

For the subsector of the bulk carriers, leverage ratios are rather low, hence the companies do not use leverage. The companies had losses, resulting to negative profitability ratios.

Table 23. Descriptive statistics, bulk carrier companies

	BL1	BL2	PR1	ROE	ROA	SZ1	TB	G	TX
Mean	0,49	0,44	0,00	-0,19	-0,03	2,98	0,85	-1,74	0,64
St. Dev.	0,15	0,15	0,09	0,68	0,17	0,45	0,09	136,57	2,82
Max	0,78	0,91	0,15	0,38	0,21	3,51	0,98	522,24	18,00
Min	0,24	0,19	-0,43	-3,68	-0,89	1,96	0,49	-424,20	-7,36

The next issue to be examined is whether there are correlations between the independent variables, so that there should be a notice in the case that variables are interconnected. There is no strong correlations, i.e. having values higher that 0.75 or lower that -0.75, hence all variables could be used without the problem of correlation effects.

Table 24. Correlations between independent variables, bulk carrier companies

Correlations

		PR1	ROE	ROA	SZ	TB	G	TX
PR1	Pearson Correlation	1	,071	,172	-,024	-,303*	,513**	,054
	Sig. (2-tailed)		,617	,224	,866	,029	,000	,702
	N	52	52	52	52	52	52	52
ROE	Pearson Correlation	,071	1	,663**	,073	-,107	-,297*	,015
	Sig. (2-tailed)	,617		,000	,607	,449	,032	,914
	N	52	52	52	52	52	52	52
ROA	Pearson Correlation	,172	,663**	1	,219	-,063	-,432**	,043
	Sig. (2-tailed)	,224	,000		,119	,659	,001	,761
	N	52	52	52	52	52	52	52

SZ	Pearson Correlation	-,024	,073	,219	1	,026	-,075	,007
	Sig. (2-tailed)	,866	,607	,119		,855	,597	,959
	N	52	52	52	52	52	52	52
TB	Pearson Correlation	-,303*	-,107	-,063	,026	1	-,038	,104
	Sig. (2-tailed)	,029	,449	,659	,855		,789	,464
	N	52	52	52	52	52	52	52
G	Pearson Correlation	,513**	-,297*	-,432**	-,075	-,038	1	,107
	Sig. (2-tailed)	,000	,032	,001	,597	,789		,448
	N	52	52	52	52	52	52	52
TX	Pearson Correlation	,054	,015	,043	,007	,104	,107	1
	Sig. (2-tailed)	,702	,914	,761	,959	,464	,448	
	N	52	52	52	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Now should be examined whether there are correlations between the independent variables and the dependent ones. Tangibility is the only variable that has a statistically significant correlation, with a value of 0.599 and this correlation is on the second dependent variable (Debt/Net book assets). As in the containership case, this value is expected, under the same reasoning stated above.

Table 25. Correlation between dependent and independent variables, bulk carrier companies

		BL1	BL2
BL1	Pearson Correlation	1	,836**
	Sig. (2-tailed)		,000
	N	52	52
BL2	Pearson Correlation	,836**	1
	Sig. (2-tailed)	,000	
	N	52	52
PR1	Pearson Correlation	,020	-,053
	Sig. (2-tailed)	,890	,711
	N	52	52
ROE	Pearson Correlation	-,363**	-,316*
	Sig. (2-tailed)	,008	,023
	N	52	52
ROA	Pearson Correlation	-,325*	-,371**
	Sig. (2-tailed)	,019	,007
	N	52	52
SZ	Pearson Correlation	-,166	-,312*
	Sig. (2-tailed)	,241	,025
	N	52	52
TB	Pearson Correlation	,473**	,599**
	Sig. (2-tailed)	,000	,000
	N	52	52
G	Pearson Correlation	,161	,132
	Sig. (2-tailed)	,254	,353
	N	52	52
TX	Pearson Correlation	-,040	-,096
	Sig. (2-tailed)	,779	,497
	N	52	52

4.2.2 Regression analysis of the first dependent variable

The regressions of the research for the first dependent variable are as follows:

Regression 1: BL1 = PR1 + SZ + TB + G + TX

Regression 2: BL1' = ROE + ROA + SZ + TB + G + TX

For the first dependent variable, model summary shows that only 30.5% of the total variation of the Book Leverage 1 can be explained by the independent variables.

Table 26. BL1 linear regression with PR1, bulk carrier companies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,552[a]	,305	,229	,13452

a. Predictors: (Constant), TX, SZ, PR1, TB, G

The significance value of the ANOVA is 0.04<0.05, hence the model can statistically significant predict the outcome

Table 27. ANOVA, BL1 with PR1, bulk carrier companies

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,364	5	,073	4,029	,004[b]
	Residual	,832	46	,018		
	Total	1,197	51			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, SZ, PR1, TB, G

From the next table we can conclude that only tangibity is a statistically significant factor of the leverage, having a statistically significance of 0.021<0.005.

Table 28. Linear regression coefficients, BL1 with PR1, bulk carrier companies

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,130	,229		-,569	,572
	PR1	,196	,245	,121	,799	,428
	SZ	-,056	,041	-,167	-1,351	,183
	TB	,931	,230	,530	4,040	,000
	G	,000	,000	,119	,816	,419
	TX	-,006	,007	-,113	-,909	,368

a. Dependent Variable: BL1

Now, it should be examined whether there are differences on using the ROE and ROOA instead of the PR1 ratio. By using this combination, the value of the R-square is in the same levels with the previous combination.

Table 29. BL1 linear regression with ROE and ROA, bulk carrier companies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,603[a]	,364	,279	,13009

a. Predictors: (Constant), TX, SZ, ROE, TB, G, ROA

The statistical significance increased in comparison to the previous model ($p=0.02<0.05$), but still the model can statistically significant predict the outcome.

Table 30. ANOVA, BL1 with ROE and ROA, bulk carrier companies

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,435	6	,073	4,287	,002[b]
	Residual	,762	45	,017		
	Total	1,197	51			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, SZ, ROE, TB, G, ROA

As in the previous combination, only tangibility has a statistically significant impact on Book Leverage 1 ratio (p=0.00<0.05).

Table 31. Linear regression coefficients, BL1 with RIE and ROA, bulk carrier companies

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,067	,215		-,312	,757
	ROE	-,051	,036	-,228	-1,420	,162
	ROA	-,070	,156	-,078	-,450	,655
	SZ	-,046	,041	-,137	-1,121	,268
	TB	,806	,212	,459	3,801	,000
	G	8,504E-5	,000	,077	,572	,570
	TX	-,005	,007	-,088	-,727	,471

a. Dependent Variable: BL1

4.1.2. Analysis of the second dependent variable

Now we will examine the second dependent variable, BL 2 (Debt/Net book assets). The model summary shows that the value of the simple correlation R is rather high (R=0.720).

The value of the R-square is rather low, indicating that the 51.9% of the total variation of the dependent variable can be explained by the independent variables.

Table 32. BL2 linear regression with PR1, bulk carrier companies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,720[a]	,519	,466	,10826

a. Predictors: (Constant), TX, SZ, PR1, TB, G

The ANOVA table shows that the model can statistically significant predict the outcome ($p=0.00<0.05$)

Table 33. ANOVA, BL2 with PR1, bulk carrier companies

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,581	5	,116	9,914	,000[b]
	Residual	,539	46	,012		
	Total	1,120	51			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, SZ, PR1, TB, G

The coefficients tables shows that size and tangibility are the variables having an impact on the Book Leverage 2 ratio on a statistically significant level ($p=0.03<0.05$ and $p=0.000<0.05$ respectively).

Table 34. Linear regression coefficients, B2 with PR1, bulk carrier companies

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,198	,184		-1,077	,287
	PR1	,150	,197	,096	,762	,450
	SZ	-,103	,033	-,317	-3,093	,003
	TB	1,118	,185	,658	6,029	,000
	G	,000	,000	,103	,847	,401
	TX	-,009	,005	-,179	-1,725	,091

a. Dependent Variable: BL2

By using ROE and ROA instead of the PR1, the significance of the prediction remains the same as in the previous combination (Table 35), and with the ANOVA showing that the model is good to fit the data ($p=0.00<0.05$) ((Table 36)

Table 35. BL1 linear regression with ROE and ROA, bulk carrier companies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,751[a]	,564	,506	,10413

a. Predictors: (Constant), TX, SZ, ROE, TB, G, ROA

Table 36. ANOVA, BL1 with ROE and ROA, bulk carrier companies

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,632	6	,105	9,717	,000[b]
	Residual	,488	45	,011		
	Total	1,120	51			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, SZ, ROE, TB, G, ROA

In this model, as well as in the previous one, the only two indicators having a statistically significant impact on the dependent variable is the size ($p=0.009<0.05$) and the tangibility ($p=0.00<0.05$).

Table 37. Linear regression coefficients, BL2 with ROE and ROA, bulk carrier companies

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,167	,172		-,974	,335
	ROE	-,020	,029	-,092	-,695	,491
	ROA	-,163	,125	-,187	-1,306	,198
	SZ	-,090	,033	-,275	-2,716	,009
	TB	1,022	,170	,601	6,015	,000
	G	4,509E-5	,000	,042	,379	,706
	TX	-,008	,005	-,152	-1,515	,137

a. Dependent Variable: BL2

4.3 Findings for the tanker shipping companies

4.1.1. Descriptive statistics and variables' correlations of tanker ship companies

TNP uses a moderate percentage of external capital, since almost 50 percent the total assets are due to debt and liabilities. As for the profitability, in all three variables of the profitability the company has positive indicators, but there is a not so efficient use of the company's assets, since both PR1 and ROA are rather small. Tangibility could be valued as rather high. As for growth, is negative, due to the fact for a number of years the company recorder losses instead of profits. Taxation is very high, due to the big difference between EBIT and net earnings.

Table 38. Descriptive statistics, TNP

	Mean	St,Dev,	Max	Min
BL1	0,58	0,05	0,65	0,50
BL2	0,54	0,05	0,60	0,43
PR1	0,02	0,01	0,04	-0,01
ROE	0,03	0,08	0,22	-0,10
ROA	0,01	0,03	0,08	-0,04
SZ1	3,45	0,05	3,53	3,39
TB	0,86	0,04	0,94	0,81
G	-6,36	55,84	114,01	-96,69
TX	5,01	14,01	53,35	-0,82

As for the Stealth Gas, the company uses low debt, and has profitability –all profitability and growth ratios ars positive- hence there is a difference to the other case of the low debt that are connected to losses. Tangibility is high, and taxation is not so high, which is a positive indocator.

Table 39. Descriptive statistics, GASS

	Mean	St,Dev,	Max	Min
BL1	0,47	0,06	0,57	0,37
BL2	0,43	0,05	0,50	0,34
PR1	0,05	0,08	0,32	0,00
ROE	0,02	0,04	0,09	-0,04
ROA	0,01	0,02	0,05	-0,02
SZ1	2,93	0,08	3,02	2,80
TB	0,90	0,03	0,94	0,85
G	0,04	79,73	208,20	-194,60
TX	0,86	0,56	2,12	0,23

For the subsector of the tanker ships, leverage ratios are in the middle level. Profitability ratios are positive but low, while growth is negative.

Table 40. Descriptive statistics, tankership companies

	BL1	BL2	PR1	ROE	ROA	SZ1	TB	G	TX
Mean	0,52	0,48	0,03	0,02	0,01	3,19	0,88	-2,41	2,93
St. Dev.	0,08	0,08	0,06	0,06	0,02	0,27	0,04	69,18	10,13
Max	0,65	0,60	0,32	0,22	0,08	3,53	0,94	208,20	53,35
Min	0,37	0,34	-0,01	-0,10	-0,04	2,80	0,81	-194,60	-0,82

The next issue to be examined is whether there are correlations between the independent variables, so that there should be a notice in the case that variables are interconnected. The only rather strong and statistically significant correlation is between the PR1 ratio and growth ratio, having a correlation coefficient of -0.644 (p=0.000<00.05). This is an indication that one aspect of the profitability, namely the operating profits, is related to the growth of the net profitability.

Table 41. Correlations between independent variables, tankership companies

Correlations

		PR1	ROE	ROA	SZ	TB	G	TX
PR1	Pearson Correlation	1	-,106	-,132	-,311	,116	,644**	-,058
	Sig. (2-tailed)		,608	,519	,122	,571	,000	,780
	N	26	26	26	26	26	26	26
ROE	Pearson Correlation	-,106	1	,985**	-,003	-,210	-,193	-,466*
	Sig. (2-tailed)	,608		,000	,988	,304	,346	,016
	N	26	26	26	26	26	26	26
ROA	Pearson Correlation	-,132	,985**	1	-,063	-,182	-,236	-,453*
	Sig. (2-tailed)	,519	,000		,760	,373	,246	,020
	N	26	26	26	26	26	26	26
SZ	Pearson Correlation	-,311	-,003	-,063	1	-,491*	-,069	,161
	Sig. (2-tailed)	,122	,988	,760		,011	,737	,432
	N	26	26	26	26	26	26	26
TB	Pearson Correlation	,116	-,210	-,182	-,491*	1	,087	,019
	Sig. (2-tailed)	,571	,304	,373	,011		,672	,926
	N	26	26	26	26	26	26	26
G	Pearson Correlation	,644**	-,193	-,236	-,069	,087	1	,082

	Sig. (2-tailed)	,000	,346	,246	,737	,672		,692
	N	26	26	26	26	26	26	26
TX	Pearson Correlation	-,058	-,466*	-,453*	,161	,019	,082	1
	Sig. (2-tailed)	,780	,016	,020	,432	,926	,692	
	N	26	26	26	26	26	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The next issue to be addressed is to examine whether there are correlations between the independent variables and the dependent ones, in order to prevent conclusion that would have been impacted by a correlation between the variables. Size is the only variable that has a statistically significant correlation with both the leverage ratios (R=0,527, p=0.006<0.05 for BL1 and R=0,589, p=0.002<0.05 for BL2), but the value of the correlation is not significant.

Table 42. Correlation between dependent and independent variables, containerships

		BL1	BL2
BL1	Pearson Correlation	1	,968**
	Sig. (2-tailed)		,000
	N	26	26
BL2	Pearson Correlation	,968**	1
	Sig. (2-tailed)	,000	
	N	26	26
PR1	Pearson Correlation	,152	,047
	Sig. (2-tailed)	,457	,819
	N	26	26
ROE	Pearson Correlation	,158	,056
	Sig. (2-tailed)	,440	,786
	N	26	26
ROA	Pearson Correlation	,111	,011
	Sig. (2-tailed)	,588	,959
	N	26	26
SZ	Pearson Correlation	,527**	,589**
	Sig. (2-tailed)	,006	,002
	N	26	26

TB	Pearson Correlation	-,184	-,109
	Sig. (2-tailed)	,368	,596
	N	26	26
G	Pearson Correlation	,016	,031
	Sig. (2-tailed)	,939	,879
	N	26	26
TX	Pearson Correlation	,289	,322
	Sig. (2-tailed)	,152	,109
	N	26	26

4.1.2 Regression analysis of the first dependent variable

As mentioned in the previous parts of the analysis, the regressions of the research are as follows:

Regression 1: BL1 = PR1 + SZ + TB + G + TX

Regression 2: BL1' = ROE + ROA + SZ + TB + G + TX

Regression 3: BL2 = PR1 + SZ + TB + G + TX

Regression 4: BL2' = ROE + ROA + SZ + TB + G + TX

As for the first dependent variable Book Leverage 1, model summary of the regression shows that only 50.6% of the total variation of the Book Leverage 1 can be explained by the independent variables.

Table 43. BL1 linear regression with PR1, tankerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,712[a]	,506	,383	,06508

a. Predictors: (Constant), TX, TB, G, SZ, PR1

The next table provides an indication of whether the regression can predict the dependent variable and fits to the data. The significance value of the ANOVA is 0.01<0.05, indicating that the model can predict the outcome.

Table 44. ANOVA, BL1 with PR1, tankerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,087	5	,017	4,104	,010[b]
	Residual	,085	20	,004		
	Total	,172	25			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, TB, G, SZ, PR1

From the next table we can conclude that only the size is a statistically significant factor of the leverage, having a statistically significance of 0.021<0. 05

Table 45. Linear regression coefficients, BL1 with PR1, containerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,202	,469		,430	,672
	PR1	,657	,336	,479	1,954	,065
	SZ	,127	,053	,480	2,392	,027
	TB	-,129	,435	-,057	-,298	,769
	G	,000	,000	-,326	-1,350	,192
	TX	,002	,001	,254	1,382	,182

a. Dependent Variable: BL1

Now, it should be examined whether there are differences on using the ROE and ROOA instead of the PR1 ratio. By using this combination, the value of the R-square is in the same levels, hence it does not provide any improvement.

Table 46. BL1 linear regression with ROE and ROA, tankerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,652[a]	,425	,244	,07203

a. Predictors: (Constant), TX, TB, G, SZ, ROE, ROA

ANOVA shows that this combination cannot predict the outcome (p=0.073<0.05)

Table 47. ANOVA, BL1 with ROE and ROA, tankerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,073	6	,012	2,345	,073[b]
	Residual	,099	19	,005		
	Total	,172	25			

a. Dependent Variable: BL1

b. Predictors: (Constant), TX, TB, G, SZ, ROE, ROA

In this model, there are two indicators having a statistically significant impact on the book leverage 1 ratio: size (p=0.037<0.05) and the taxation (p=0.041<0.05).

Table 48. Linear regression coefficients, BL1 with ROE and ROA, tankerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,065	,488		-,134	,895
	ROE	1,571	1,480	1,162	1,061	,302
	ROA	-2,167	3,573	-,674	-,606	,551
	SZ	,125	,055	,469	2,247	,037
	TB	,188	,444	,082	,422	,677
	G	2,424E-5	,000	,021	,111	,913
	TX	,003	,002	,434	2,190	,041

a. Dependent Variable: BL1

4.1.3. Analysis of the second dependent variable

Now we will examine the second dependent variable, BL 2 (Debt/Net book assets). The model summary shows that, in fact, only a small fraction of the total variation of the dependent variable can be explained by the independent variables.

Table 49. BL2 linear regression with PR1, tankerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,619[a]	,383	,229	,06778

a. Predictors: (Constant), TX, TB, G, SZ, PR1

The ANOVA table shows that the model cannot predict the outcome (p=0.066<0.05)

Table 50. ANOVA, BL2 with PR1, tankerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,057	5	,011	2,485	,066[b]
	Residual	,092	20	,005		
	Total	,149	25			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, TB, G, SZ, PR1

The coefficients tables shows that none of the variables have an impact on the Book Leverage 2 ratio on a statistically significant level.

Table 51. Linear regression coefficients, BL2 with PR1, tankerships

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,096	,430		-,223	,826
	PR1	,387	,308	,303	1,257	,223
	SZ	,141	,049	,570	2,890	,009
	TB	,124	,398	,059	,312	,758
	G	,000	,000	-,210	-,885	,387
	TX	,002	,001	,248	1,373	,185

a. Dependent Variable: BL2

By using ROE and ROA instead of the PR1, the significance of the prediction is very low, but, on the contrary, the model is good to fit the data (p=0.038<0.05).

Table 52. BL2 linear regression with ROE and ROA, tankerships

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,688[a]	,473	,307	,06425

a. Predictors: (Constant), TX, TB, G, SZ, ROE, ROA

Table 53. ANOVA, BL2 with ROE and ROA, tankerships

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,071	6	,012	2,847	,038[b]
	Residual	,078	19	,004		
	Total	,149	25			

a. Dependent Variable: BL2

b. Predictors: (Constant), TX, TB, G, SZ, ROE, ROA

In this model, none of the factors have an impact of leverage, except of size (p=0.008<0.05)

Table 54. Linear regression coefficients, BL2 with ROE and ROA, tankerships

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,344	,435		-,789	,440
	ROE	1,182	1,320	,939	,895	,382
	ROA	-1,525	3,187	-,509	-,479	,638
	SZ	,146	,049	,590	2,955	,008
	TB	,384	,396	,181	,970	,344
	G	2,267E-5	,000	,021	,117	,908
	TX	,003	,001	,413	2,175	,082

a. Dependent Variable: BL2

Chapter 5. Conclusion and discussion

5.1 Conclusion

A number of conclusions are drawn from the above analysis.

The first conclusion concerns the use of the parameters used. The dependent variables used in the analysis were Book Leverage 1

$$\text{Book leverage 1} = \frac{Total\ liabilities}{Total\ book\ assets}$$

and Book leverage 2

$$\text{Book leverage 2} = \frac{Debt}{Net\ book\ assets}$$

Both of these parameters have been used in the analysis of Drobetz et al. (2013) giving almost similar results.

In the present analysis, a differentiation between which of these two parameters is recorded, with Book Leverage 2 providing somewhat more reliable results than Book leverage 1. The first thing to note about this is that while Book Leverage 1 uses total liabilities as the numerator, Book leverage 2 uses purely borrowing. There is an important difference between these two parameters: while in the case of companies in other sectors the company may have received goods without paying directly, having a debt balance, shipping companies may indeed purchase goods, such as spare parts, but the amount is relatively small compared to total liabilities

Here a differentiation should be made with regard to credit risk and risk taking in general, in order to better explain the differentiation between the two parameters, i.e. Book leverage 1 and Book leverage 2. According to Stopford (1999), decisions concerning shipping investments include decisions on new investments, i.e. ordering and buying new ships, decisions on buying or selling used ships, decisions on scrapping any inefficient ships and decisions on how to efficiently employ the available fleet. The risk involved in the above decisions is shipping risk, which is in some cases assumed not by the (shipowners) but by the customers themselves, i.e. the owners of the cargoes they wish to transport.

In such a case, the shipowners' objective is to reduce transport costs. However, when the risk is also assumed by the shipowners when the latter are also the owners of the cargo, there is exposure to inflation, exchange rate and interest rate risks, but also to risks relating to the engineering and technological requirements for the ship. The shipowner is also exposed to a risk related to the ability of the customer (charterer) to pay the agreed freight. Where charterers can estimate with relative accuracy the cargo they want to carry and do not want to be exposed to fluctuations in freight rates, they can either carry out the transport with their own fleet or conclude long-term time charters with other shipowners.

So, while in one case the shipowner will have more total liabilities than total debt, in the other case the total debt will be the largest part of the total liabilities. The issue, though, is that, in essence, shipowners will always prefer to have a larger fleet and transport the goods than to own the cargo. This means that almost always the largest proportion of total liabilities will be borrowing, and it is bank borrowing that will lead to the conclusion about the efficiency of management. In this light, the finding of better integration of results in Book leverage 2 than in Book leverage can be seen as consistent with what the theory identifies.

Another distinction noted is in the use of the different profitability parameters. Three indicators were used in the analysis:

$$\text{PR1} = \frac{Operating\ income\ before\ depreciation}{Total\ assets}$$

$$\text{ROA} = \frac{Net\ profit}{Total\ assets}$$

$$\text{ROE} = \frac{Net\ profit}{Shareholders\ equity}$$

ROE and ROA ratios in the literature are usually used together and have net profit as the main parameter, while in the first ratio the main parameter is operating income.

It is precisely here that there is an important distinction that should be pointed out in order to make it clear why there are such differences in the results of the two different alternative models.

Operating income and the cash flow is of paramount importance for the growth and viability of a business. Although high revenues provide a picture of the financial health of the firm, they can be misleading (Bierman & Smidt, 1986). Even if a firm is earning profits, it may not be able to grow without cash and this is because in order to generate new sales it will need to have higher inventories, hence higher purchases of materials, which may be covered by supplier credits, but most of them will have to be repaid within the year, hence cash flow is required (Khan and Jain, 2006). The lack of cash flow, in addition to the difficulty of dealing with operating costs, also creates a negative image to potential investors and significantly reduces financing prospects.

Thus, the viability of a company is often determined by its ability to generate positive long-term cash flows, with inflows exceeding outflows (Megginson and Smart, 2009). By delaying the payment of debts or prudently allocating resources, companies can survive for a short period of time despite incurring losses. However, in the long run, companies need to earn enough cash to meet their needs. Therefore, cash flow management is crucial to maintain a healthy business: after all, the most common cause of bankruptcy is the inability to repay debts (Alessandrini, 2018).

he importance of cash flow can be illustrated by the following rationale: if the cash of the firm is not generated by its normal operation, i.e. its main activity, then the viability of the firm is at risk. Thus, as illustrated in the following graph, stable and viable firms do not invest more cash than they generate through their normal operations, whereas, on the contrary, financially unsustainable firms invest more cash than they generate, thus necessitating the external raising of capital. These companies will be unable to maintain their operations and simultaneously repay their debts and will eventually go bankrupt.

Therefore, given the above, it would be expected that operating profits would give a better picture of the capital structure, in the sense that operating profits would reduce the need for external capital.

A second important reason why it is so important to be able to predict the development of operating income and the future cash flows is that the dividends of the company are essentially derived from profits but are a component of cash flow. Through the present value relationship, which links asset prices today to future returns and future dividend growth, dividend growth and return predictability are two sides of the same coin (Cochrane 2008). Thus, the forecast of future cash flows directly affects the current share price through the forecast of the dividend that the company will pay.

In addition, it should be noted that there is an increasing requirement for market participants to obtain cash flow forecasts from both financial analysts and companies (Fond and Hung, 20003), as they find that earnings analysis alone is not sufficient and does not provide all the valuable information to be able to adequately forecast future cash flows. Furthermore, Barth, Cram and Nelson (2001) argue that cash flow forecasting is fundamental to the valuation of the firm and that cash flow is a primary valuation method.

So, again under this rationale, based on the preceding literature analysis to challenge Miller and Modigliani's theorem, normally shareholders are not indifferent between dividend with interest payment or dividend with tax payment, preferring the latter due to asymmetric information.

However, on the other hand, there is a strong counter argument that using profitability ratios gives a better description of the company's operations and its need or not to use debt capital. Specifically, in Dechow, Kothari, and Watts' (1998) research where a time series analysis was conducted, with annual data, it was found that earnings had a higher predictive ability than cash flow. Also, Greenberg, Johnson and Ramesh (1986), in their research showed that for the majority of firms, current earnings were a better predictor of future cash flows than operating income and current cash flows. Furthermore, it was shown that earnings were a better predictor both at the one-year lag level and at the level of several years, up to ten years. An important study is that of Ball and Nikolaev (2020), in which it is highlighted that a number of studies show that operating cash flow consistently dominates earnings as a predictor due to misuse in reporting earnings. The analysts emphasize that the substantive test of the FASB's proposal requires equating earnings with operating cash.

According to the analysts, once non-operating components not related to operating cash are excluded from earnings, so that operating accruals correct for the time constraints of cash from operations, earnings dominate the ability to forecast operating cash. Researchers believe that operating cash is a distorted measure of operating earnings, and accruals reduce the distortion

From the present analysis, it was found that when ROE and ROA are used as parameters instead of the index that includes operating profits, the reliability index of the other parameters that have statistical significance increases.

Regarding the other conclusions, the paper found that asset structure seems to positively affect the leverage of the firm which is consistent with the theory of hedging. Thus, supporting the view that when a firm's fixed assets increase, its leverage increases due to a reduction in information asymmetry and agency costs, leading to an increase in its borrowing capacity. This is also consistent with the hypotheses that put fixed assets as the most important factor affecting leverage, since in our sample the coefficient of fixed assets is also close to unity

Growth opportunities seem to have a positive effect on the firm's leverage which is in line with the hierarchy theory. Normally we would expect a negative effect of growth opportunities on the leverage ratio due to increased agency costs and financial distress costs. In our sample the influence of growth opportunities appears small, which is due to the losses recorded.

An important point should be made here: the paper found a significant differentiation between bulk carriers and containerships in terms of the extent of leverage. While the average leverage ratio in the Book leverage 1 ratio is at 68%, for the bulk carriers is at 0.49, while a similar picture is for the Book leverage 2 , having a value of 60% for containerships and 44% for bulks.

This is precisely a point worth paying attention to, in conjunction with the profitability and the growth parameter. Bulk carriers have recorded continuous losses and have negative profitability and growth indicators. In contrast, containerships have low but positive profitability. Of course, the regression did not find an effect of growth on the capital

structure, but another aspect should be considered: the reason for the lower leverage of bulk carriers may be due precisely to the fact that they have recorded losses for a number of years, so that any bank would not be willing to lend to a company that is accumulating losses. On top of that, by lending to a company, the bank has the ship as collateral, but there are important parameters to be considered:

Second-hand Prices: the resale price of a second-hand vessel is a point of interest for both shipowners and other financiers (e.g. lenders) because it reflects a large part of the asset value of shipping companies. While it is observed that in the last months of a cycle the level of freight rates falls dramatically, the prices of second-hand ships reach a higher point. Of course, the age of ships also affects their value, apart from the phase of the shipping cycle.

Rise in the volume of scrapping and age of ships: at this stage there is a large volume of ships that are decommissioned and also scrapped. This is because the first of the level of freight rates leads to a decrease in the profits of shipping companies, hence a decrease in cash flows and consequently a decrease in the value of their assets, i.e., ships which are the most important assets. Thus, ship owners, in order to reduce costs and adapt to lower freight revenues, are forced to decommission or even dismantle part of their fleet. Moreover, at the end of this stage, because orders are low, the majority of the fleet consists of older and older vessels. Therefore, on the basis of the above, the divergence in the capital structure of containerships from bulk carriers can be explained by a reduction in the supply of credit and not by a reduction in the demand for credit by shipping companies.

A final finding is that a firm's size seems to positively affect the firm's leverage. This is consistent with hedging theory, arguing that the larger the size of a firm, the lower the probability of default, increasing its borrowing capacity.

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