Cand. Merc. Applied Economics and Finance

Master Thesis

LEVERAGE DECISIONS IN THE NORWEGIAN SHIPPING INDUSTRY

An assessment of the determinants of leverage, the impact on corporate performance and speed of adjustment in the Norwegian shipping industry

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Abstract

The shipping industry is largely dependent on external capital to finance its investments, and debt has historically been the most important source of external financing. However, during the last decade shipping companies have been provided with greater access to the open capital markets, allowing them to reach a wider range of financing options. Based on a sample of 16 publicly listed Norwegian shipping companies, this thesis aims to examine the determinants of capital structure decisions. In addition to this, we investigate if the Norwegian shipping companies exhibit a target leverage ratio, the effect of leverage on corporate performance and analyze the dynamics of speed of adjustment back to the target ratio.

In comparison to other industries, the shipping industry exhibits high leverage ratios. In addition to this, the Norwegian shipping industry has on average higher leverage ratios than the global shipping industry. Firm-level variables are discovered to have significant effect on the variation in leverage ratios in the Norwegian shipping industry. Asset tangibility has a positive relation to leverage and is concluded to be the most influential determinant. The market-to-book ratio and dividend payout exhibit an inverse relationship to leverage. As supply and demand fundamentals in the shipping industry is closely linked to macroeconomic conditions, the leverage ratio seems to behave countercyclically above the business cycle. The results indicate that the companies do not follow an explicit theory of optimal leverage ratio, but rather combine trade-off and pecking order in the attempt to achieve a target leverage ratio. The study finds little evidence for the market timing theory despite investors general perception on the opportunity to take advantage of the cyclical fluctuations.

The results indicate that leverage exhibits a significantly positive relation to corporate performance. Last, through the use of different panel estimators, the Norwegian shipping industry is observed to adjust more gradually back to the target leverage ratio subsequent to an economic recession than in an expansion. The lower speed of adjustment during recessions indicates that the cost associated with adjustment to target leverage is more expensive than the cost of deviation. The results are consistent with prior empirical research.

Key Words: Capital structure, determinants of leverage decisions, leverage ratio, trade-off theory, pecking order theory, market timing theory, agency costs, target leverage ratio, speed of adjustment, GMM-methodology, fixed effects, ordinary least squares, partial adjustment model.

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The capital structure in the shipping industry has proven to be complex. The shipping industry is characterized by high volatility, and changes associated with ship financing have in recent years captured the medias eye. Throughout our thesis, we want to elucidate how different factors can explain the leverage ratios in the Norwegian shipping industry, and whether Norwegian shipping companies differ from other companies. This study will attempt to give a more comprehensive picture of the financing decisions by accounting for firm-level variables, in addition to macroeconomic variables.

We hope that the report captures the readers interest and that it can contribute to greater insight into the current situation in the shipping industry.

We would also like to take this opportunity to extend our sincere appreciations to our supervisor, Tim Mondorf, for timely feedback, critical insight, educational discussions and valuable input throughout the writing process.

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1.0 Introduction

1.1 Topic and relevance

The leverage ratio is a widely studied topic within the field of corporate finance. Prior research has suggested a number of different frameworks to help explain the determinants of leverage. However, the behavior of leverage is not evident in an industry specific context. Shipping is a remarkably global industry, and subsequently the shipping industry is of significant importance for the development in the global economy. Roughly 90% of world trade is transported by the international shipping industry, consequently making seaborne transportation an engine for inclusive and sustainable growth and development (UNCTAD, 2017). Notably, from a corporate finance perspective, the shipping industry is historically characterized as highly leveraged. The industry which has previously heavily relied on traditionally bank financing, have experienced tighten loan restrictions from banks in recent years. However, the shipping companies access to the global capital markets have strengthened over the past decade, raising the choice of capital structure a topic of research as financing choices are decisive for firm value with respect to market disturbances. The shipping industry is extremely volatile, with large fluctuations in freight rates and vessel values. Drobetz et al., (2013) document that shipping companies tend to have a leverage ratio twice as high as other listed industrial companies. These finding are explained by the peculiar nature of the shipping industry compared to other industrial industries, making an examination of their financing decisions all the more interesting. High leverage during market booms might facilitate increased returns, but in the contrary, have large negative impact in the case where freight rates and vessel values heavily decline.

The capital structure of a firm is defined as the balance of different funding sources utilized to finance its operations, assets and future growth (Alexandridis, et al., 2018). Long-term financing can be obtained through equity (issuing shares), debt (borrowing), retained internal funding or a combination of them. There is one essential distinction between equity and debt financing. Equity refers to raising capital by selling ownership rights through company shares. Debt, however, refers to a core liability the company has to meet over a plausible time horizon. An important financial decision is therefore which funding approach that should be applied in order to maximize company value (Syriopoulos, 2010). Capital structure is closely linked to financial risk as it is a crucial factor in

connection with the rate of return on their investment, and following whether a company manage to survive an economic downturn in the market. The choice of financing is therefore a key financial management decision in light of taxation and market disturbances such as financial distress and information asymmetry, making the firms choice of capital structure decisive for firm value (Alexandridis, et al., 2018).

The Norwegian-controlled fleet is one of the world's largest, and Norway is accounted as one of the most advanced maritime nations. Measured in total fleet value, Norway is the world's 4th largest ship-owning country (Norwegian Shipowners' Association, 2020). A plural number of existing research investigate the capital structure decisions of globally listed shipping companies. Several emphasize the generally high leverage, and voice concern regarding the confident sentiment during market upswings (Albertijn, et al., 2011). However, limited studies have examined the choice of financing with respect to the Norwegian shipping industry and whether these results can demarcated be applied to the shipping industry in Norway. Consequently, it becomes interesting to investigate the capital structure decisions in Norwegian shipping companies and its effect on corporate performance.

1.2 Research Question

This thesis will examine the determinants of the choice of financing in the Norwegian shipping industry. As such, the explanatory power over the historical variations in aggregate leverage measures will be investigated. Furthermore, this study test whether publicly listed Norwegian shipping companies follow a target leverage ratio with respect to the development of the shipping market cycle. The object of this thesis is thus to answer the following research question;

Do publicly listed Norwegian shipping companies follow a target leverage ratio with respect to the development in the business cycle?

The approach applied concentrates on both the level of leverage and the capital structure decisions of shipping companies. Freight rates and vessel values are both highly volatile and dependent on the shipping market cycle. This study will address how the cyclicality of assets translates to the

leverage side of the company's balance sheet, and following how it affects the financing decisions. The shipping industry exhibits high asset tangibility and the industry specific characteristics, make the financing decisions connection to firm value of particular importance.

1.3 Research design

In order to create an organized methodology, the research onion model by Saunder, Lewis and Thornhill (2009) have been adapted (University of Derby, 2009). From a philosophical stance, this study has been conducted with realism through continuous research. This thesis aims to investigate if the companies follow a target leverage ratio. Several factors are affecting the companies' target leverage, and thus in order to detect the true relationship between these variables and the leverage measures the use of realism is considered applicable. Interaction between the researchers and the social reality is not considered to be evident, hence biased results are avoided. Furthermore, through the use of a deductive approach the research question is being answered based on the theoretical framework and relevant findings. Through the use of several regressions the impact from different factors are investigated with respect to leverage measures. Additionally, the theoretical framework is discussed with respect to our findings and comparable empirical researches are investigated in order to set our research in a broader context. An archival research is used to explore changes happening over a long period of time, and to further investigate and support the research question. Thus, the archival research is used as a strategy. The multi-method is applied to gather both quantitative and qualitative information. The quantitative study is based on data collected from the Bloomberg Terminal. Hence, a combination of cross-sectional and longitudinal data is being used to investigate outcomes and exposures for the sample data. Further, qualitative information is obtained through interviews in order to supplement the findings from the quantitative study (University of Derby, 2009).

1.4 Delimitations

It is expedient to limit the scope of this paper with respect to the research question. The object of this paper is to understand Norwegian shipping companies choice of financing, and which factors that might help explain such decisions. It is important to mention that the shipping industry is a fragmented industry and consists of a large number of small companies with concentrated

ownership, and thus limited access to capital markets (Stopford, 2003). Following, to greater analyze the capital structure decisions within the shipping industry the study should be limited to a specific segment of the market. This thesis investigates listed Norwegian shipping companies. As such, private companies are beyond the scope of this paper. The companies are defined to own, lease, charter or operate their vessels, and have a consolidated balance sheet. Given this financial structure, the companies will be in position to borrow as an enterprise and use their balance as security.

The analysis employs the use of proxies in order to investigate the relationship between leverage and a set of firm-level variables. However, the use of proxies for unobservable variables might reflect a number of underlying considerations, and thus the results are not necessarily unambiguous. Accordingly, it might arise a distinction between what is intended to examine and what in fact is being investigated. However, the supplement of qualitative perspectives might increase the probability to detect the industry specific dynamics that impact the leverage decisions, and circumvent the general shortcomings of the quantitative approach.

2.0 Theoretical framework

The theoretical framework provides the foundation for further research of the topic in question. Hence, in this chapter, existing theories on the choice of capital structure is critically assessed in order to properly answer the research question. Merton Miller and Franco Modigliani (MM) introduced the theory of investment in 1958. The theorem aims to describe the role of capital structure when determining firm value and has been the cornerstone for firm's capital structure. However, this theorem only applies under a set of assumptions, called perfect capital markets (Berk & DeMarzo, 2017, p.525). For this reason, three competing theories that can be considered as an extensive to the theory of investment will be presented in order to explain the incentives driving the choice of leverage ratios in Norwegian shipping companies; the trade-off theory (Kraus and Litsenberger, 1973), the pecking order theory (Myers and Majluf, 1984) and the market timing theory (Baker and Wurgler, 2002). Contrary to the theory of investment, they are based on the assumption of imperfect capital markets.

2.1 Trade-off theory

The trade-off theory weights the costs of financial distress from leverage against the benefits from the tax shield. The firms have an incentive to increase the amount of leverage in order to benefit from the tax savings, and the trade-off is therefore essential for firms to avoid increasing the leverage too much. Hence, the aim with the theory is for firms to exploit the optimal level of leverage. This level is found at the point where the risk of default is offset by the tax savings (Berk & DeMarzo, 2017, p.594).

The calculation of the present value of the financial distress costs are therefore a challenge with the theory. The calculation is affected by the following three factors; the discount rate, the costs connected with a firm in distress and the probability of default. The discount rate is dependent on the market risk of the firm. Following, the more negative a company's beta is the lower cost of capital. Thus, higher present value of financial distress costs. This is explained by the reasoning that the firm has high distress costs when it performs badly, and the beta of the distress costs will therefore be shown as negative. Secondly, the size of the financial distress costs are highly dependent on the industry. Firms that value human capital would thus have higher financial distress costs than those valuing physical capital. Human capital is more demanding to substitute and cannot be sold easily. The probability of default would be determined by the company's ability to meet its debt obligations. Higher debt-to-asset ratio is therefore affecting the risk of default, and the probability is increasing with respect to the volatility of asset values and cash flows. Utility companies are thus able to use higher debt levels because of steady cash flows, compared with for example shipping companies (Berk & DeMarzo, 2017, p. 594-596).

According to Syripoulos (2010) the financing decisions made by a firm will affect the market participants perception of the firm. A stock offering is signaling that the management is unsecure about the company's prospects, while a debt offering is considered as a positive signal. The rationality for the market participants is thus that a firm with positive prospects would use other financial sources than a stock offering. Companies should therefore not maximize its borrowing capacity in normal times. Hence, the firms should use less debt and more equity than proposed by the trade-off theory during these times.

2.2 Pecking order theory

The pecking order theory was introduced by Stewart Myers and Nicolas Majluf in 1984. The theory is based on asymmetric information, meaning that the managers have more knowledge about the companies compared to the capital markets. Thus, asymmetric information is affecting the decision between internal and external financing and equity securities compared to issuance of new debt. The pecking order is therefore explaining the order of financing choices. When financing new investments internal funds should be the primary choice, followed by external financing through debt and new issues of equity as last option. Sticky dividend policies are also followed by this theory. Reasoning in the fact that if capital expenditures are higher than the internally generated cash flow, the firm will invest in marketable securities or pay off debt. However, if the capital expenditures are lower, the firm will sell its marketable securities or lower its cash balance (Brealey, Meyers, & Allen, 2011, p.460-462).

The theory includes both internal and external equity implicating that there is no defined target debt-equity mix. Furthermore, the pecking order explains the reason behind the low level of debt within the most profitable firms. Financing investment with internal funds is sufficient because they do not need money from the outside. On the other hand, less profitable firms are forced to benefit from external financing, hereby debt, because the internal funds do not manage to cover the capital investments. The pecking order theory also elucidate the inverse intraindustry relation among financial leverage and profitability. Substantiate the fact that firms within an industry will have similar rates of investments due to firms investing to keep up with the growth in the industry. The least profitable firms would then borrow more because of lack of internal funding as a result of sticky dividend payouts. Research states that the pecking order is more applicable to explain the financing choice within large firms with access to the public bond market, as these firms hardly issue equity. Large firms desire internal financing and turn to debt markets if required. Contrary, younger growth firms have higher probability of using equity as external financing when required (Brealey, Meyers, & Allen, 2011, p.461-463).

2.3 Market timing theory

Baker and Wurgler (2002) presented a contrary theory, based on the cumulative outcome of earlier attempts to time the equity market, to explain the capital structure. Moreover, the market timing theory elucidates a regular and continuous effect by market timing on capital structure. The theory further explains how the capital structure of the firms behave with respect to if their share price is overvalued or undervalued. When the share price is overvalued the firm should issue new equity, and during the latter the firms should buy back shares. Hence, the fluctuations in share price affect the capital structure of the firm through corporate financing decisions. In similarity with the pecking order theory there is no target debt-equity ratio due to the equity decisions being dependent on the stock market conditions (Abeywardhana, 2017).

Furthermore, the market timing theory is based on the principle of exploring the current market conditions in both the equity and debt markets. The market with most favorable conditions should be used when financing new investments. If both markets show uncertainty, the firms should consider deferring issuance. Accordingly, compared to the pecking order theory and the trade-off theory the theory does not focus on the choice between financing with debt or equity (Frank & Goyal, 2007).

2.4 Agency cost theory

Jensen and Meckling (1976) define agency costs as the costs that arise as a result of the divergence of interests between owners and managers within a company. Managers are company decision makers, acting on behalf of owners which have entrusted money in the company. However, managers are inclined to maximize own utility rather than firm value, often at the expense of the company's risk aversion. Prior research by Jensen (1986) identifies the free cash flow as one source to agency cost problems. He underlines considerations with regard to managers ability to invest below cost of capital or with inefficient utilization, and that from an agency cost perspective, companies tend to increase leverage in order to reduce agency costs that rise in connection with the free cash flow problem. This, furthermore, indicates that leverage is used as a tool to free cash flow problems in order to motivate and discipline managers to higher efficiency and value-maximizing decisions. The problem of agency costs can be adapted to the capital structure puzzle

by describing the manners of the company stakeholders, and their influence on the utilized leverage as a consequence of core inefficiencies, dissatisfactions and financial distress. The optimal amount of leverage should minimize the total agency costs of both debt and equity.

As a company is subject to risk of default, agency costs develop as a disagreement between debt and equity holders, consequently arising agency costs of debt. Myers (1977) document that problems associated with excess debt or underinvestment come to light during defaults. Consequently, debt will have a negative impact on corporate performance and firm value (Myers, 1977). Stultz (1990) research suggest that either overinvestment problems diminish, or underinvestment intensifies as a result of debt financing. In general, a higher leverage ratio diminishes agency costs and boost corporate efficiency, and should help explain the pros and cons in connection with debt financing.

3.0 Relating capital structure theory to the shipping industry

This section will provide an overview, and a critical assessment of existing empirical studies investigating the practical relevance of the discussed theoretical framework. The different theories of capital structure are supported by a numerous amount of prior empirical research. However, no existing study has today reached an unanimous agreement on a theory that completely explain all dynamics behind the corporate choice of financing. The empirical research is often found to provide competing solutions to the question of how companies choose their capital structure, as such, it is a complex challenge to give a clear picture of how the leverage ratios will behave. Nevertheless, some clear resemblances can be drawn as they all coincide on the fact that capital structure is emphasized as time-varying and shaped by company- and industry specific factors. The different theories can be used as a foundation to analyze the variations in leverage. However, one should note that the optimal choice of leverage is determined based on numerous considerations most likely established in all three theories.

3.1 Determinants of the leverage ratio

Based on existing empirical research there is no document for an extensive theory proficient to explain all time-series and cross-sectional patterns of leverage. However, observable firm-level determinants have been identified by several studies (Drobetz et al, 2013; Merika et al, 2015; Frank and Goyal, 2009; Rajan and Zingales, 1995). Drobetz et al. (2013) examines the capital structure decisions of 115 globally-listed shipping companies. The analysis reviews the financing choice from an economic stance, particularly with respect to aggregate leverage measures, which represent the historic variations in shipping firms level of debt and assets. Intriguingly, the results reveal that shipping companies exhibit standard capital structure variables that exert significant impact on the cross-sectional variation on leverage ratios. Following Drobetz et al., (2013), a set of variables that are expected to have explanatory power over the variation in corporate leverage is extracted. The "standard factors" tangibility, market-to-book ratio, firm size and profitability are presented in section 8.1, and inspired by Rajan and Zingales (1995) which limit their study to these factors based on the consistent relation to leverage observed in prior research. In section 8.2 "additional factors" are presented, which include the factors suggested to exert influence on leverage measures by Frank and Goyal (2009). Tax is not included as a capital structure determinant for three reasons. First, the shipping industry is subject to industry-specific tax incentives. Many countries operate with a tonnage tax regime, where the payable tax is calculated based on vessel tonnage rather than actual accounting profits from vessel operations. Second, shipping companies tend to locate their activities or part of their activities in countries that offer efficient tax regimes. Last, Frank and Goyal (2009) nor Drobetz et al., (2013) do include tax in their "core model" of reliable capital structure determinants.

3.1.1 Standard factors

Profitability

Compared with other industrial firms, shipping companies seems to be similar in terms of profitability. With respect to the agency cost theory by Jensen and Meckling (1976), more profitable companies exhibit higher leverage ratios to reduce agency costs that occurs in accordance with the free cash flow problem. A positive relationship between leverage and profitability is predicted by the static trade-off theory, if higher income to shield and lower costs of financial distress for profitable firms are present (Drobetz et al., 2013). Furthermore, according to the pecking order

theory lower leverage ratios are hold by more profitable firms as a result of internal funding being preferred to debt funding. This assumption is consistent with prior research conducted by Rajan and Zingales (1995), Frank and Goyal (2009), Merikas et al., (2013) and Drobetz et al., (2013).

Firm size

In general, one would expect large companies to be more diversified, and thus face lower risk of insolvency. However, as noted by Stopford (2003) this is not the situation in the shipping industry, substantiating that most shipping companies tend to operate within one segment with same types of vessels, contributing to only moderate diversification benefits when expanding their fleet. The firm size is predicted to have an ambiguous connection to leverage. Trade-off theory implies a positive relationship between firm size and leverage as the possibility of default for larger firms tends to be lower and they are considered more diversified. In contrast, the pecking order theory regard firm size as a proxy for information asymmetry, suggesting an inverse relation between firm size and leverage. This is justified by the fact that larger firms usually provide more information to outside investors, and as such, adverse selection costs when issuing equity are lower. This conjecture of the pecking order theory is in line with prior research by Arvantis et al., (2012). However, most empirical studies support the trade-off theory, documenting a positive relationship between leverage and firm size (Rajan and Zingales, 1995; Frank and Goyal, 2009; Drobetz et al., 2013).

Market-to-book ratio

A firm's growth opportunities are strongly indicated by the market-to-book ratio, and following the market-to-book ratio serves as a proxy for growth options. From a trade-off perspective, one expects that firms with more growth opportunities are subject to suffer from increased cost of financial distress (Drobetz et al., 2013), suggesting a negative relationship between the market-to-book ratio and leverage. Further, as a result of higher financial distress costs the companies with high growth opportunities are subject to higher agency costs that are related to debt, due to an underinvestment problem making the companies subject to foreseen beneficial investment opportunities (Myers, 1977). Conversely, the pecking order theory indicates a higher leverage ratio for growth firms under the constraint that profitability is held constant. The majority of existing

research supports the conjecture of the trade-off theory, reporting a robust inverse relation between leverage and growth opportunities (Drobetz et al., 2013).

Tangibility

The level of a firms collateralizable value can be measured by asset tangibility. Firms with a higher ratio of asset tangibility are expected to have lower cost of financial distress as companies with a high level of tangible assets are subject to smaller loss of value in the case of insolvency. Fixed assets are expected to provide collateral for loans, and thus expand the healthy level of debt. Additionally, lower asymmetric information is likely as tangible assets are easier to value for the outside market. This conjuncture of the trade-off theory suggests a positive relation between tangibility and leverage. Opposite, the pecking order theory suggests a negative relationship between tangibility and leverage. Tangible assets with lower information asymmetry are accompanied with lower costs in connection with issuance of new equity. Most empirical research reliably support the conjecture of the trade-off theory (Drobetz. et al., 2013; Merikas. et al., 2013; Arvanitis et al., 2012; Rajan and Zingales, 1995; Frank and Goyal, 2009). However, predictions from both the trade-off theory and the pecking order theory is coextensive, emphasizing that high collateral values are reassuring the traditional lenders that the collateral will cover the debt.

3.1.2 Additional factors

Dividend payer

Whether the companies pay out dividends or not is another variable used to measure leverage. If the dividend payout is high it indicates that the retained earnings will be reduced, leading the firms towards external financing. A positive relationship between corporate leverage and dividends is found in the case where debt is preferred to equity. Contrary, a negative relationship can be detected in the event of the dividend payout signaling that firms are subject to market monitoring, resulting in reduced information asymmetry (Drobetz et al., 2013). Frank and Goyal (2009) document that dividend payers tend to carry lower leverage compared to non-dividend paying firms.

Asset risk

Asset risk measures the value of its assets in terms of volatility. The asset risk is according to Drobetz, et al., (2013) highly correlated with financial distress costs. Lower collateralizable value is therefore found in companies with more volatile assets, thus higher asset risk. Even though there are limited empirical evidence for the asset risk influence on the company's capital structure. Lemmon et al. (2008) and Gropp and Heider (2010) elucidate that asset risk can be applicated as a measure to explain corporate leverage.

Operational leverage

In line with the predictions of the trade-off theory, Aravanitis et al. (2013) find that growth opportunities are negatively related to market leverage, which elucidate that the cost of financial distress increase with higher growth options. The cost of financial distress is found to be closely linked to higher asset risk, this inverse correlation is the dynamic analog of the trade-off theory, which suggests that firms mitigate financial leverage by possessing lower operating leverage ratios, and vice versa. The level of operational leverage can according to Drobetz, et al., (2013) be explained through a positive function of the companies fixed production costs. The firms operating risk is reflected through the operating leverage. Hence, the higher operational leverage thus higher operational risk. A firm's business risk can therefore be measured through the use of the operating risk and the asset risk, as these variables can be seen as complementary in order to determine business risk. Furthermore, operating leverage is negatively correlated to leverage from a trade-off perspective.

Table 1. Theoretical perspectives

	Trade-off theory	Pecking order theory	Market-timing theory	Agency costs
Tangibility	+	-/+		-
Market-to-book	-	+	-	+
Profitability	+/-	-		+
Firm size	+	-		
Operating leverage	-			
Dividend payer	-	+/-		
Asset risk	-	+		
Macroeconomic cycled	+	-	-	

The table summarizes the expected relation between all firm-level variables and corporate leverage suggested by the trade-off theory, the pecking order theory, the market-timing theory and the agency cost theory.

3.2 The effect of leverage on corporate performance

Prior empirical research suggests a wide range of corporate performance measures. Some of the most consistently used accounting-based measures of corporate performance are ROA and ROE (Panatides, et al., 2010). However, the measures have been criticized to not inadequately incorporate the company value offered to shareholders. This is explained by the measures inability to consider the cost of capital and the redeployment value of assets. Additionally, the future earning potential are not emphasized (Panatides, et al., 2010). On the other side, Hutchinson and Gul (2004) and Mashayekhi and Bazazb (2008), argue that accounting-based performance measures effectively summarize the outcome of managers decisions, and should thus be chosen over market-based measures when examining the relationship between corporate governance and corporate performance. As such, return on assets (ROA) and return on equity (ROE) are included as dependent variables in order to investigate the effect of leverage and the determinants of leverage on firm efficiency. Margaritis and Psillaki (2009) document that the effect is not expected to be immediate nor unambiguous. Based on the agency cost theory, leverage is anticipated to exhibit a positive relationship to corporate performance. The positive effect of leverage on corporate performance appear as leverage is used as a tool to discipline managers. However, leverage can also have a negative relationship to corporate performance, which often arise as companies exhibit excessive high levels of leverage, consequently making them subject to significant financial constraints (Jensen and Meckling, 1976). Furthermore, Margaritis and Psillaki (2009) find evidence that tangibility is inversely related to corporate performance, reasoned in the fact that tangible assets limit the company's growth options, and thus, agency costs in connection with managers' decisions are reduced. In general, they argue that the agency cost theory indicates that increased leverage carries distinctly lower levels of agency costs, higher efficiency and last enhanced corporate performance (Margaritis and Psillaki, 2009).

Previous research has explained the disciplinary role of leverage to both increase corporate performance and cost of financial distress. However, González (2013) and Opler and Titman (1994) argue that companies with higher leverage experience significantly lower corporate performance in periods of economic depressions compared to their competitors which exhibit lower leverage. This argument is in line with the assertion that financial distress is more expensive than the potential

benefits of high debt financing. On the other side, Wruck (1990) underlines that benefits of financial distress foregone by suboptimal use of debt financing might encourage higher leverage. This is reasoned in that debt might serve as a driver for change in corporate governance, management and structure.

3.3 Speed of adjustment to target leverage ratio

Graham and Harvey (2001), Brounen et al., (2004) and Drobetz et al., (2006) find evidence that strongly imply that financial managers wish to follow a target leverage ratio. They argue that the objective is to preserve financial flexibility rather than minimizing the company's weighted average cost of capital. This is in line with the conjuncture of the pecking order theory. Most recent, Castro et al., (2016) conclude that the target leverage ratio vary across different stages of the business cycle and that different capital structure theories play different roles along the life cycle stages of companies in their sample of European listed companies.

Drobetz et al., (2013) estimate a GMM model, and report a 40.0% and 58.9% mean speed of adjustment for book leverage and market leverage in their sample of globally listed shipping companies. Additionally, they document that the shipping industry's speed of adjustment is significantly higher when deviating from the target leverage compared to other industrial companies. Furthermore, a substantially lower speed of adjustment is observed during bad macroeconomic states. Also using the GMM methodology, Lemmon et al., (2008) document a speed of adjustment of 25.0% per year for the book leverage regression in their US sample. Flannery and Rangan (2006) also applies an US sample and construct a partial adjustment model. They find evidence for a speed of adjustment of 30.0% per year. In addition to this, they document that market timing behavior considerations account for more than half of the observed changes in leverage ratios. In contrast, Huang and Ritter (2009) estimate a lower speed of adjustment also using US data. They report 11.0% for book leverage and 23.0% for market leverage.

Öztekin and Flannery (2011) investigate the different factors that determine the speed of adjustment across 37 countries. They argue that different countries differ in both costs and benefits associated with adjustment to the target leverage ratio. In line with the pecking order theory, the

findings indicate that companies from countries with strong legal institutions, effective financial institutions, and last, financial structures centered on the capital markets efficiency rather than intermediaries tend to carry 50% more rapid speed of adjustment back to the target leverage ratio. Issuance of debt or equity is less difficult and costly in these countries in contrary to countries with limited access to the capital markets, higher costs of adverse selection and low financial flexibility.

Hackbarth et al., (2006) findings suggest that the speed of adjustment show a positive relationship with the business cycle. They argue that the speed of adjustment is higher during periods of expansions than during recession. This is explained by the fact that shareholders optimal default policy changes with different threshold across the business cycle stages, and that default thresholds are counter-cyclical, which thus lead to higher rates of default during recessions. Consistent with Hackbarth et al., (2006), Cook and Tang (2010) and Halling et al., (2012) illustrate the relationship between speed of adjustment and the business cycle. Their findings confirm lower speed of adjustment during recession periods. Additionally, Halling et al., (2012) document that financially constrained companies suffer from even more pronounced effects.

Both Faulkender et al., (2012) and Elsas and Florysiak (2011) examine heterogeneity in the speed of adjustment in connection with firm-level variables. They document that large operating cash flows are amplified by higher adjustments to the leverage ratio in terms of speed and size, in particular for over-levered companies. These findings are in line with the trade-off theory, which suggests that large operating cash flows tend to be accompanied with lower cost of external debt financing, and thus lower cost of adjustment. Additionally, heterogeneity in the speed of adjustment is documented to depend on industry classification, firm size and growth options (Elsas and Florysiak, 2011).

4.0 Data and model variables

4.1 Sample description

The data sample are gathered from 16 public shipping companies listed on the Oslo Stock Exchange (OSE:OSLO) covered in the Bloomberg database. The dataset consists of 274 individual firm-year observations distributed over the period between 2000-2019. The long selection period is reasoned

by the opportunity to insure different stages in the shipping business cycle. The data obtained are on an annual basis, and denominated in US dollars. According to Menon Economics the shipping industry encompasses *"all businesses that own, operate, design, build, supply equipment or specialist services to all types of ships and other floating entities"* (Menon Economics, 2016). The industry is versatile and companies varies greatly. In order to obtain a refined and appropriate selection of companies, a more narrow definition of the industry is applied. The financial statements have been gathered from the Bloomberg database and the companies included in the empirical analysis are chosen based upon the "marine shipping" filter in the Bloomberg Industry Classification Systems (BICS) given the constraint that the company is listed on Oslo Stock Exchange. This approach implies that only Norwegian companies that operate or own commercial ships are included in the sample. All selected companies are primary or secondary listed with Norway registered as home state. In the purpose to account for the market value of the companies, only publicly listed companies with fully consolidated balance sheet data are considered. As such, the study is conducted on panel data, including both cross-sectional data and data of a unit for certain successive time periods. This data sample is further used in order to construct the specific firm-level variables. Table 2 provide an overview of the shipping companies included in this thesis.

Table 2. Company list.

Company name	Ticker	Firm-years	Market capitalization
American Shipping Co ASA	AMSC NO	15	1 824 556 800
Bonheur ASA	BON NO	19	8 208 655 360
BW LPG Ltd	BWLPG NO	10	8 111 813 632
BW Offshore Ltd	BWO NO	14	6 584 444 928
DOF ASA	DOF NO	19	461 644 160
FLEX LNG ASA	FLNG NO	11	3 252 046 080
Frontline Ltd	FRO NO	19	2 532 134 000
GC Rieber Shipping ASA	RISH NO	19	774 785 792
Golden Ocean Group Ltd	GOGL NO	19	5 289 037 312
Ocean Yield ASA	OCY NO	9	6 739 768 832
Odfjell SE	ODF NO	19	2 156 576 512
Prosafe SE	PRO NO	19	153 904 720
Solstad Offshore ASA	SOFF NO	19	212 527 040
Stolt-Nielsen Ltd	SNI NO	19	6 759 702 016
Wallenius Wilhelmsen ASA	WALWIL NO	10	7 142 011 392
Wilson ASA	WILS NO	17	964 924 032

The sample include 16 Norwegian publicly listed shipping companies. The table display firm-year observations for each company and their market capitalization per December 2019. All data are obtained from the Bloomberg Terminal.

4.2 Representativeness of sample

The data sample include only publicly listed companies. This is reasoned with the availability and validity of data. In addition to this, publicly listed companies are considered to behave more transparent and be more comparable with respect to capital structure decisions. Despite the somewhat limited data sample, there exist some incentives to assume that the selection of companies is representative for the Norwegian shipping industry. The inclusion of some large and significant players alongside a group of smaller "single-minded" companies should sufficiently capture the entire industry trend and patterns. Through an investigation of all industry players on Oslo Stock Exchange, this is validated. There is identified a total of 39 companies listed on the Oslo Stock Exchange which is categorized to own or operate within the shipping industry. The data sample includes 16 of these companies, which thus represent 41% of the total Norwegian industry.

The sample is a somewhat equally-weighted combination of large-, mid- and small-cap companies, with market capitalization values ranging between $15.3 million to $8.2 billion. Major companies, such as Bonheur ASA, BW LPG Ltd, Wallenius Wilhelmsen etc. are included in the data sample. Additionally, smaller and less diversified companies like DOF ASA, Prosafe SE and Solstad Offshore ASA. One strength in connection with variety in the company parametric is the opportunity to give a clear indication of the industry trends, and to adequately replicate the larger statistical population according to leverage ratios. One could argue that the data sample is partially chosen upon random sampling techniques, and thus represent an unbiased representation of the Norwegian shipping industry.

Offshore is the most prominent segment in our sample, including companies as Bonheur ASA, BW Offshore Ltd and DOF ASA, consistent with the offshore segments large position in the Norwegian market. Simultaneously, smaller segments of the market are accounted for such as dry bulk, RoRo-cargo and chemical through the companies; Golden Ocean Group Ltd, Odfjell SE and Wallenius Wilhelmsen ASA. It is worth mentioning that several of the companies operate within more than one segment. Therefore, a division of fleet value by segment is a difficult process. However, the

sample is concluded to sufficiently reflect the distributions by segments of the Norwegian shipping industry.

4.3 Measuring leverage

A company's choice of capital structure can be complex, including different forms of debt and equity. Thus, there exist no obvious definition of the leverage measure appropriate for empirical research (Welch, 2011). Following Drobetz et al., (2013) and Frank and Goyal (2009), the ratio of debt to assets is used as an indicator of a company's leverage. According to Rajan and Zingales (1995), the ratio of total debt to assets capture debt in a narrower sense and is therefore a suitable definition of leverage. The ratio measures the proportion of debt a company use to finance its assets, and identify a company's dependence on debt to finance its day-to-day operations. The measure addresses the relationship between the cyclicality on the asset side of the shipping companies balance sheet to the liability side. One weakness with this measure of leverage is, however, that it fails to incorporate the influence of assets offset by specific nondebt liabilities (Rajan and Zingales, 1995).

Rajan and Zingales (1995) provide a comprehensive discussion of alternative leverage measures, where the advantages and disadvantages of each single measure are elaborated. The main regressions are later robustness tested against these alternative definitions of leverage. However, as in Drobetz et al., (2013), the findings are concluded to be significantly robust against alternative specifications of leverage, and as such, the ratio of debt to total assets is adapted in this analysis without further discussion.

The difference between book leverage and market leverage are relatively small. According to Frank and Goyal (2009) the market based leverage definition is preferred when the purpose is to analyze the capital structure. The market leverage definition takes the markets perception on company value and growth options into account. Furthermore, as argued by Borio (1990), the measure is typically employed as a result of its forward-looking nature (Alexandridis, et al., 2020). However, they further emphasize that the market leverage is volatile, and that measuring the market value of leverage can be problematic as not all debt is publicly traded (Frank and Goyal, 2009). The book

values are to a smaller extent exposed to irregular fluctuations in the market. Meyers (1977) argue that leverage should be measured based on book values as a firm's assets represent the underlying debt level. In contrary to the market based leverage definition, book leverage might be perceived as backward-looking, reasoned with the fact that the measure fails to reflect the company's actual debt capacity and financial solvency seen in connection with the current macroeconomic environment (Alexandridis, et al., 2020). Both book leverage and market leverage are employed as the dependent variable in the regression models throughout this thesis.

4.4 Definition of variables

The construction principles of the firm-level variables and the leverage measures are presented in appendix 2. Based on prior empirical research by Drobetz (2013), Frank and Goyal (2009) and Rajan and Zingales (1995), the following standard leverage variables are extracted; profitability, firm size, market-to-book ratio, tangibility, operating leverage, dividend payer and asset risk. All variables are calculated on the basis of data obtained from the Bloomberg Terminal. Profitability is calculated as the ratio of operating income before depreciation to total book value of assets. Firm size is calculated as the natural logarithm of total assets. The market-to-book ratio is calculated as the market value to the book value of assets. Tangibility is calculated as the ratio of property, plant & equipment to total book value of assets. Operating leverage is defined as the ratio of operating expenses to total assets. This is reasoned with the fact that operating costs of shipping companies include manning, repairs and maintenance, and accordingly they represent the fixed costs for the vessel to be operational. Consequently, the measure is particularly suitable for the shipping industry, and reflect to which degree the company can increase operating expenses by increasing assets. Dividend payer is defined as a dummy variable, equal to 1 if the firms pays dividends in a given year and 0 otherwise. The companies unlevered annualized standard deviation of the daily stock price return is used to measure asset risk.

4.5 Descriptive statistics

In context of the research question sought to answer, the machine learning software Stata, and the computer software Excel are used to analyze the dataset. In the preliminary process of this study, the data are prepared, and through querying, visualization and report methods a wider

understanding of the cross-sectional and time series patterns in the Norwegian shipping industry is captured. In order to maintain the validity of the research results, observation years containing missing values are excluded from the analysis. The observed skew of the variables is relatively low, and indicates limited asymmetry in the statistical distribution. The descriptive statistics of the firm-level variables are presented in table 3.

Table 3. Descriptive statistics

	Mean	SD	Median	25th	75th	Min	Max
Book leverage	0,498	0,197	0,502	0,412	0,595	0,070	0,814
Market leverage	0,525	0,215	0,552	0,398	0,667	0,053	0,866
Tangibility	0,720	0,171	0,745	0,659	0,823	0,397	0,919
Market-to-book	1,010	0,581	0,929	0,814	1,085	0,637	0,560
Profitability	0,094	0,094	0,094	0,056	0,126	-0,010	0,204
Firm size	7,191	1,044	7,509	6,362	8,026	5,459	8,442
Operating leverage	0,212	0,215	0,164	0,059	0,286	0,004	0,513
Dividend payer	0,656	0,476	1,000	0,000	1,000	0,000	1,000
Asset risk	0,121	0,398	0,066	0,026	0,080	0,017	0,278
Book assets ($)	1952,420	1407,981	1820,950	580,875	3056,700	235,100	4637,900

The table summarize the mean, the standard deviation, the median, the 25th percentile, the 75th percentile, the minimum and the maximum value of each variable. The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal.

The findings for the Norwegian shipping industry are put in a broader perspective by comparing them to prior research on capital structure on both related and unrelated industries. The statistics displayed are compared to those in Frydenberg (2004) for Norwegian manufacturing firms, in Drobetz et al. (2013) for globally listed shipping companies, in Mjøs (2007) for a sample of public and private Norwegian companies, and Arvanitis et al., (2012) for European shipping companies.

Both book leverage and market leverage ratios are on average slightly higher in the Norwegian shipping industry compared to the average European or globally listed shipping company. First and foremost, it is worth mentioning that the investigated sample period is different. However, the observation might imply that Norwegian shipping companies have greater access to debt capital. Nonetheless, the overall industry has experienced increased access to debt capital during recent year, which is elaborated in chapter 7.8. Additionally, the distribution across segments might help explain the differences. The sample is overweighed by offshore companies, a segment which have been embossed by bad macroeconomic conditions in recent year, consequently increasing leverage

ratios. Furthermore, figure 1 elucidates the observation, confirming slightly higher leverage ratios in the Norwegian shipping industry than in globally listed shipping companies (Drobetz et al., 2013) when examining the development of leverage ratios across similar sample years (2000-2010). The descriptive statistics indicates that the average company in our sample is larger in size than the globally listed ones, as such also more varieties, and therefore they might be able to lever more.

The mean value of book assets is $1.95 billion, while the median value is $1.82 billion, confirming only a small level of heterogeneity in size across the quartile portfolios. In line with the descriptive statistics, Mjøs (2007) find evidence that the shipping industry in Norway exhibits a higher ratio of book leverage compared to other listed companies in Norway. These findings are also supported by Drobetz et al., (2013) which document that both book leverage and market leverage tend to be substantially higher in the shipping industry compared to other industrial firms, confirming the assumption that capital intensive industries, such as shipping, often exhibit a larger degree of debt financing. In general, the shipping industry exhibits a large firm cash flow, and asset-appreciation beyond book values have historically been an important profit source. This can partly contribute to explain the substantial high book leverages observed in the shipping industry. The mean book leverage ratio, presented in table 3, is 49.8%, while the mean market leverage ratio is 52.5%. The Norwegian shipping companies exhibit great diversity in their chosen level of leverage, indicating that the Norwegian shipping industry is heterogeneous in the cross-section of leverage ratios. The sample companies are divided into quartile portfolios with respect to their individual mean in order to closer examine the heterogeneity in the cross-section of variables. Table 4 displays the mean quartiles for each variable based on the companies individual quartile portfolios. The ratio of book leverage range between 11.3% in the quartile minimum value to 63.8% in the quartile maximum value, while the ratio of market leverage range between 22.7% in the quartile minimum value to 65.0% in the quartile maximum value. Presumably, the high leverage ratios observed can also be explained by the high intensity of fixed assets in the shipping industry.

The sample exhibits high tangibility ratios, consistent with the assertion that shipping companies tend to carry high intensity of fixed assets. On average, tangible assets amount for 72.0% of total assets, which is higher than the mean tangibility value of globally listed shipping companies of 63.5%

(Drobetz et al., 2013). The minimum value of average tangibility ratio exhibited across the sample is remarkably 51.7%, while the maximum value is 86.2%. In comparison, the average listed Norwegian company and Norwegian manufacturing firm exhibit a significantly lower mean tangibility ratio of 35.0% and 35.9% (Mjøs, 2007; Frydenberg, 2004). These findings are consistent with the conjecture that the shipping industry is a capital intensive industry, which tend to carry large amounts of tangible assets.

Table 4. Quartile means

	Min	25th	Median	75th	Max	Total
Book leverage	0,113	0,424	0,498	0,582	0,638	0,495
Market leverage	0,227	0,471	0,537	0,614	0,650	0,530
Tangibility	0,517	0,682	0,752	0,785	0,862	0,724
Market-to-book	0,810	0,897	0,965	1,061	1,194	0,978
Profitability	0,040	0,083	0,085	0,099	0,133	0,094
Firm size	5,767	6,551	7,405	7,774	8,153	7,197
Operating leverage	0,009	0,077	0,180	0,222	0,567	0,201
Asset risk	0,178	0,266	0,339	0,815	5,258	1,171

The table states the quartile means for the firm-level determinates of leverage. According to their individual variable mean each sample firm is sorted into quartile portfolios (Min, 25th, 75th, max). The reported quartile means are calculated based on these portfolios. The data sample consists of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal.

The mean market-to-book ratio is 1.01, and this variable exhibits moderate cross-sectional variation; ranging between 0.81 in minimum value to 1.38 in maximum value. The market-to-book ratio in Norwegian shipping companies is corresponding to the global shipping industry, indicating similar growth opportunities. Drobetz et al., (2013) document that the shipping industry exhibits significantly lower growth opportunities compared to other industries in the G7 countries. In general, shipping companies exhibit relatively low market-to-book ratios compared to other industries, suggesting significant valuation discounts in the shipping industry. This is explained by the fact that it is a capital intensive industry that require a significant amount of capital to be invested in assets every year (Albertijn, et al., 2016). In the sample period, the average Norwegian shipping company is for several short periods of time rated below its book value (see figure 1).

On the other side, with regards to profitability, shipping companies are more equivalent to other industries. Profitability in Norwegian shipping companies are only slightly higher compared to other

industrial companies in Norway (Mjøs, 2007). Profitability for the median Norwegian shipping company is 9.4%, which is equivalent to the mean value of 9.4%, indicating insubstantial divergence in the quartile portfolios. These results are in line with the findings of Drobetz et al., (2013) for globally listed shipping companies and Arvanitis et al., (2012) for European listed shipping companies with mean profitability ratios of 11.3% and 11.4%, complementing the fact that shipping is a truly global business with limited local influence factors with respect to earning potential.

In contradiction with existing theory, higher levels of financial leverage are found to carry distinctly higher levels of operating leverage. These results also contradict with Drobetz et al., (2013) findings for globally listed shipping companies. The mean operating leverage ratio is only 0.21 for Norwegian shipping companies, accompanied by an even lower median value of 0.16. Moreover, the assets of Norwegian shipping companies are very volatile. The average company exhibits an asset risk of 12.1%, supporting the assertion that the shipping industry is exposed to significant asset price risk (Drobetz et al., 2013). However, the finding is lower than the findings for globally listed shipping companies of Drobetz et al., (2013), which report a mean asset risk of 19.9%.

The dividend payer dummy variable has a mean of 65.6, indicating that 65.6% of the shipping companies in the sample pay out yearly dividends to their shareholders. This is in contradiction to the number of dividend paying firms in all Norwegian companies (Mjøs, 2007), and in Norwegian manufacturing firms (Frydenberg, 2004). However, payout ratios in the shipping industry tend to be relatively similar compared to those of other industrial firms (Mjøs, 2007). Frank and Goyal (2009) conclude that dividend paying companies tend to carry lower leverage, which is in line with the interpretation of the descriptive statistics. The observed dividend payout patterns indicate that the companies do not face financial constraints. However, investors within the shipping industry might prefer dividend payouts as a result of the accompanying tax benefit (Drobetz et al., 2013).

Table 5. Correlations

	Book leverage	Market leverage	Tangibility	Market-to-book	Profitability	Firm size	Operating leverage	Dividend payer	Asset risk
Book leverage	1,000								
Market leverage	0,849	1,000							
Tangibility	0,297	0,273	1,000						
Market-to-book	-0,072	-0,288	-0,239	1,000					
Profitability	-0,089	-0,217	0,033	0,373	1,000				
Firm size	0,304	0,445	0,052	-0,339	-0,104	1,000			
Operating leverage	0,288	0,280	0,030	-0,019	0,034	-0,150	1,000		
Dividend payer	-0,143	-0,172	-0,102	0,013	0,223	0,156	-0,218	1,000	
Asset risk	-0,088	-0,124	-0,203	0,014	-0,072	-0,096	0,019	-0,104	1,000

The table provides the pairwise correlation coefficients for all firm-level variables. The data sample consists of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal.

Table 5 report the pairwise correlation between all numeric variables in the data sample. The presence of multicollinearity between the variables in the dataset is rejected through the conduction of a test based on variance inflation factors (VIF-test). Multicollinearity can lead to inaccurate estimates, and furthermore result in an unreliable model where coefficients easily can be misinterpreted.

Tangibility shows a positive relationship to leverage, supporting the conjecture of the trade-off theory. According to Drobetz et al., (2013), high profitability and high market-to-book ratios tend to be accompanied by lower levels of leverage. The correlation matrix illustrates the same negative relation for the Norwegian shipping industry. Operating leverage is positively correlated with financial leverage, indicating that increased operating leverage are followed by increased financial leverage. Thus, the generally accepted belief that the shipping industry exhibits high operating leverage in addition to high financial leverage is confirmed (Kavussanos and Visvikis, 2006). This observation contradicts with the findings of Dobretz et al,. (2013) for globally listed shipping companies, which document an inverse relationship between operating leverage and financial leverage. Firm size shows a positive relationship to both book leverage and market leverage.

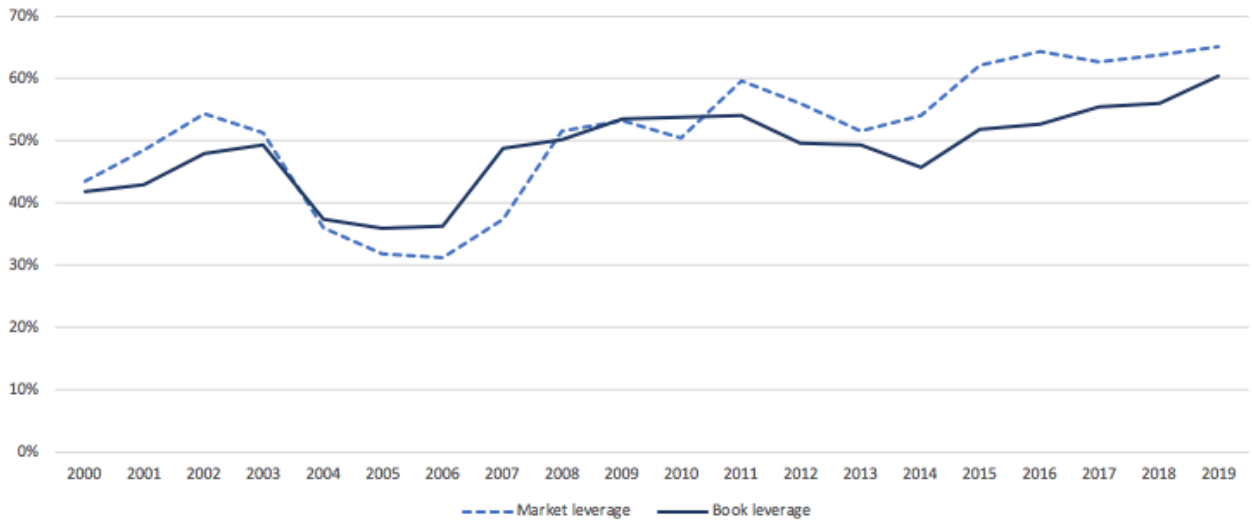
All correlation patterns show the same directional movements for the book leverage and the market leverage definitions. Profitability displays an inverse correlation to leverage. During non-recessionary periods, high leverage values could be complemented with boosted corporate performance. Opposite, during periods of recession, which are generally characterized by market leverage values above book leverage, high leverage measures might indicate excessive levels of debt

that potentially inhibit profitability. The relation between the market-to-book ratio and leverage is not monotonic. High market-to-book ratios tend to be accompanied by lower leverage, indicating decreasing secondhand values which consequently push asset values downwards.

4.6 Development of leverage measures

Figure 1 gives an overview of the development in mean leverage ratios during the sample period. The leverage ratios move in relatively similarly patterns and a modest increase in both leverage ratios can be observed over the twenty-year period. The curve reaches a minimum point in 2005, where it subsequently gradually rises prior to the global financial meltdown in 2008. The development of leverage ratios are confirmed to picture realistic levels by Martin Hjemdal (2020), investment banker at Fearnley Securities, which address the often aggressive financing policy in publicly listed companies where they utilize high leverage in order to maximize capital and make large investments. He underlines that, if something, he expected the leverage ratios to be even higher (Hjemdal, 2020).

Figure 1. Mean leverage ratios over the sample period.

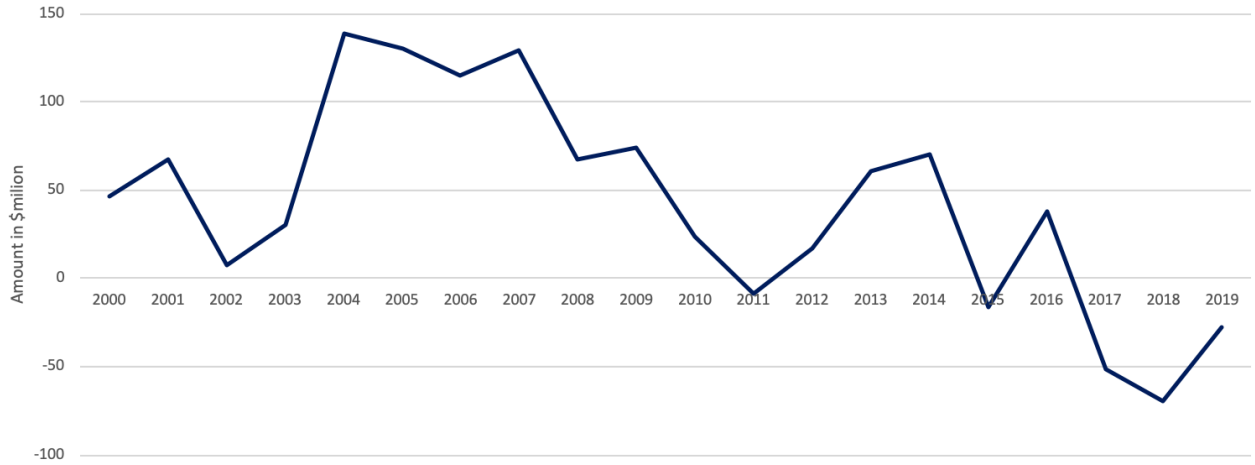


The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal. Book leverage is measured as the ratio of total debt (short- and long-term debt) to book value of assets. Market leverage is measured as the ratio of total debt (short- and long-term debt) to market value of assets.

The modest leverage ratios before 2008 can be explained by the robust market conditions with strong earning potentials (see figure 3), enhancing the motivation to issue equity over debt. This is

further emphasized by figure 2 that displays the average net income for the Norwegian shipping companies during the sample period. The inverse relationship detected in the correlation matrix (chapter 4.5), is thus confirmed by the company's actual performance. Exemplified by the increase in net income during 2003-2008, a period categorized by advantageous macroeconomic conditions (figure 3). Liquidity flows into the market and the fleet operates at full speed. Secondhand prices rise above 'book value', might even above newbuilding prices, elucidating the optimism in the market as investors want to buy ships today rather than later. This stage is characterized by excess ship demand over supply capacity of vessels and following the shipbuilding orderbook increase. At the same time, the underlying robust earnings caused book values to increase significantly as the debt level did not change considerably. Shipowners are motivated to invest in new capacity during upswings, thus also increasing the need of additional debt. However, the debt level does not change in the same speed. The strong appreciation in assets values are visible significantly faster compared to the speed shipping companies manage to refinance. This is reasoned with the fact that the cyclical fluctuations intensify with the delay between economic decisions and their implementation. The market responds slowly to fluctuations in the demand patterns, and consequently this introduces a time-lag into the response to upsurge in demand (Stopford, 2003, p.119). The time-lags make the upturns and downturns in the shipping market more extreme and cyclical. In anticipation of an upswing in the market, shipowners' contract on a higher level in order to take advantage of the cyclical boom. However, these ships take several years to build, and might therefore be delivered at a point embossed by surplus capacity and recession. Hence, explaining the increase in leverage ratios (Hjemdal, 2020). Investors often behave irrational, and with strong overconfidence in times of expansion, consequently increasing leverage.

Figure 2. Development in net income over the sample period



The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal.

In the aftermath of the 2008 financial crisis, one could expect the leverage ratio to increase further. After the financial crisis, freight rates fell by almost 80% (see figure 3), and following secondhand values heavily declined, consequently weakening both the cash flow and balance sheet. However, accounting based book values do not change significantly. Martin Hjemdal (2020) argue that this observation is explained by the fact that the companies do not write down asset values subsequently. If the companies would have reduced the asset values accordingly to the decrease in market values, several would have experienced a strong increase in leverage ratios, and consequently face risk of bankruptcy due to the inability to comply with loan requirements.

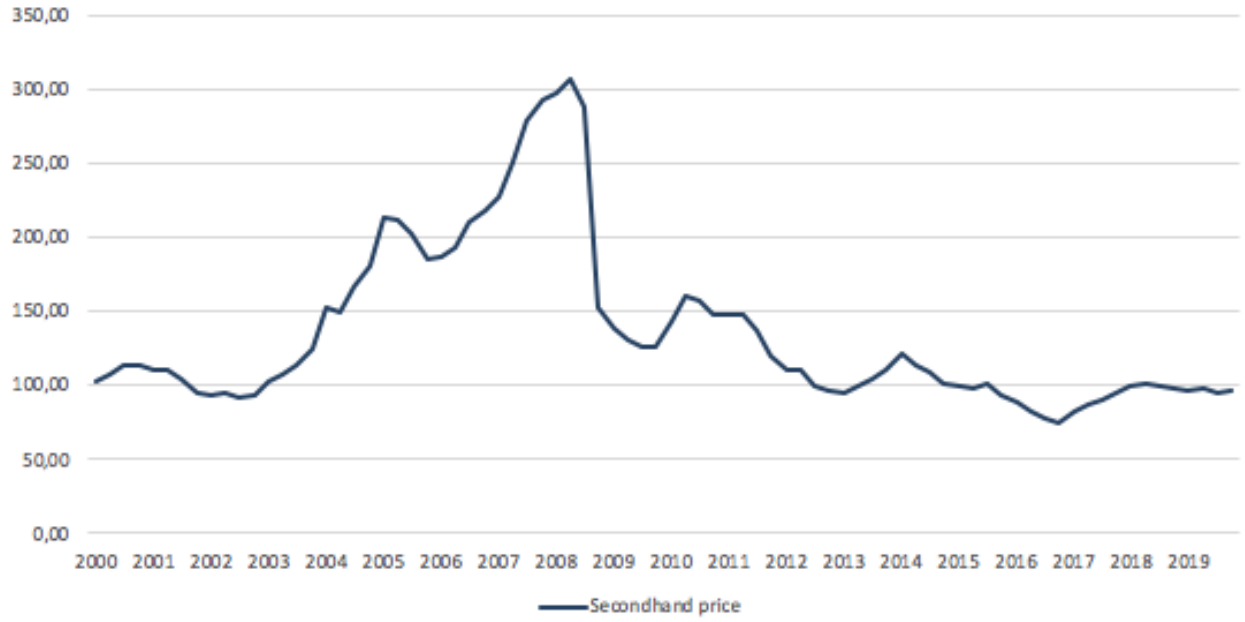
The book leverage ratio is for the main part of the observation years lower than the market leverage ratio, indicating that equity capital in the Norwegian shipping industry is in general valued below its book value by investors (figure 1). This can be explained by times of recession in the shipping industry, and reflects the effect of depressed equity and asset values. Corporate performance is strongly dependent on the shipping market cycle (e.g., with respect to the level of activity in the market, freight rates and/or vessel values), elucidating the fact that different stages of the business cycle, offer different return potentials (see figure 3). The shipping industry has since the 2008 financial crisis been embossed by modest freight rates (figure 3), and following weak secondhand

values (figure 4), consequently affecting the stock market value. However, consistent with economic intuition, during upturns in the market book leverage is greater than the market leverage. This inference is also indicated in the year between 2004 and 2007, which can be defined as a global boom period. The relationship pattern between market and book leverage is observed to be similar for the global shipping industry in Drobetz et al., (2013) for the comparable years. Interestingly, our graph peak around year 2010, equally as in Drobetz et al., (2013) analysis. Additionally, a modest peak is observed in 2016. Seen in the context of the development in freight rates (see figure 3) and secondhand values (see figure 4) they correspond to the maximum leverage points. The years prior to the peaks are characterized as periods of economic expansion in the shipping industry, thus encouraging shipowners to invest in new capacity, and following lever more. Intriguingly, the leverage ratios do not ease back significantly subsequently to the peak in 2010. However, a shift in the pattern between the leverage ratios occur. As the market is once again embossed by low freight rates and surplus capacity, the market leverage ratio rises above the book leverage ratio.

Figure 3. Quarterly weighted average of freight rates

The figure displays the average quarterly freight rate $/day. The data are obtained from the ClarkSea Index. The ClarkSea Index is a weighted average index of earnings for the main vessel types where the weighting is based on the number of vessels in each fleet sector. The sample period is from 2000 to 2019 and the freight rates are denominated in USD.

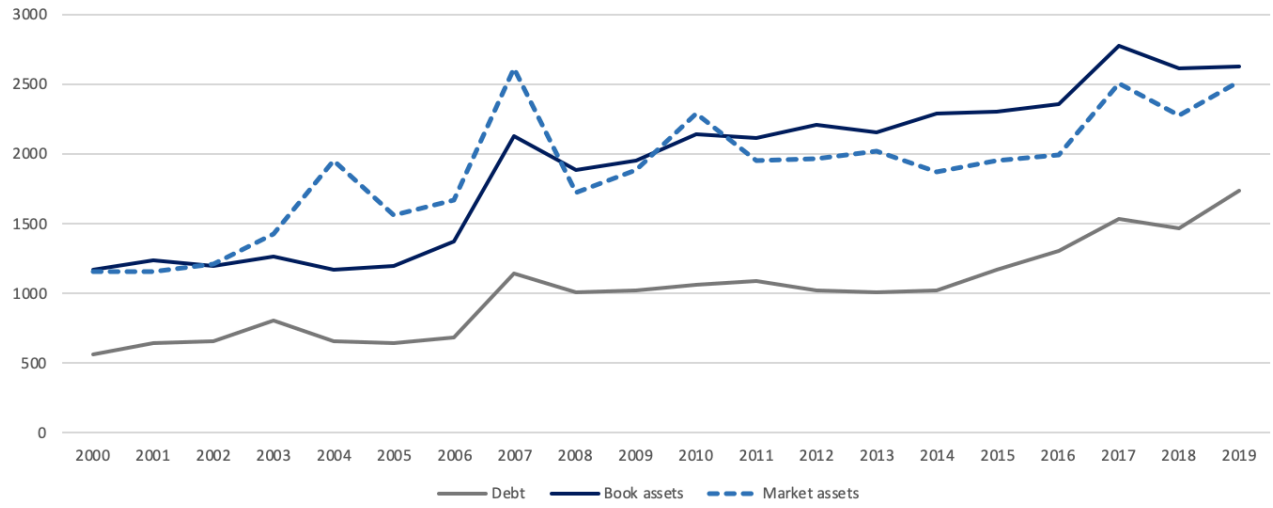
Figure 4. Quarterly average secondhand price



The figure displays the average quarterly secondhand price. The data are obtained from the Clarkson Research Services Limited All Ships Secondhand Price Index. The index is a weighted average index of earnings for the main vessel types where the weighting is based on the number of vessels in each fleet sector. The sample period is from 2000 to 2019 and the secondhand prices are denominated in million USD.

In general, an average leverage ratio varies less than the individual leverage ratios. To examine if the individual companies vary equally around the trend, an individual graph is created for each company in the selection (see appendix 3). A significant increase in the market leverage ratio between year 2006-2008 are observed for all companies listed during the period. In addition to this, several companies experience another peak around year 2016. After the boom period in 2015, a significant decrease in freight rates characterized the market. These observations confirm the conjecture that companies raise their leverage ratios during good macroeconomic conditions.

Figure 5. Average debt and asset values over the sample period.



The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal.

The development in leverage ratios are composed of changes in different factors. In order to further investigate the changes in leverage ratios, the development in debt, book value of assets and market value of assets on a yearly basis are illustrated in figure 5. Not surprisingly, there is a substantial increase in assets observed in 2006 and 2007. This observation supports the findings by DeAngelo and Roll (2015) indicating that large leverage changes is normally observed in connection with substantial increases in asset growth, and around deviations from periods of stability in leverage measures. Accordingly, several segments experienced great earnings in the following period up until the financial crisis. As expected, the average debt and asset values spike at the same points in time, elucidating the fact that good macroeconomic conditions encourage capital investments. The increase in debt are reflected through the increase in assets. However, there is a larger increase in assets, supporting the assumption that robust earnings contribute to increased equity values, and thus a relative decrease in leverage.

4.7 Dataset limitations

The dataset includes firm observations during the period 2000 to 2019. However, there exist a substantial number of missing observations, consequently reducing the number of valid data points. For example, the dataset contains only 269 observation of the profitability measure even though the set includes 274 data points. It is concluded that the number of firm observations each year is sufficient to cover the capital structure trends within the Norwegian shipping sector. The secondary data was obtained from financial statements in the Bloomberg database. The data set is limited to the degree of precision in the data collected from Bloomberg. The data should be considered verifiable, nonetheless the Bloomberg Industry Classification Systems is worth mentioning as another potential shortfall.

Data collection and compilation of data is a crucial part of the analysis. However, the data sample was gathered in the preliminary process of the thesis, and thus no final conclusion with respect to the limitations nor scope to the selection of companies was yet decided. A more careful selection of companies could have been applied, based on the constraints that we have deemed appropriate to the statistical appraisal of the Norwegian shipping industry and assessment of previous empirical research. The critical reader should consider the matter stated with regard to the size and the representativeness of the sample and observations.

Despite the fact that the data sample include publicly listed shipping companies, the available publicly released financial statements are not adequately detailed to use in this analysis (i.e. information related to the construction of variables). This makes us unable to make large corrections or changes to the data sample after the Covid-19 situation. To increase the validity of the data set, a larger data sample, potentially including all Norwegian shipping companies, could have been obtained to greater capture the diversity in the industry. However, the sample is concluded to sufficiently cover publicly listed Norwegian shipping companies.

Another potential shortfall of the data sample is the presence of survivorship bias. The data sample is concentrated on companies that is still publicly listed. As such, the selection process fails to incorporate the impact of companies that have gone bankrupt during the period. These companies

are in general likely to exhibit higher leverage ratio, and thus the possibility of an underrated average leverage ratio across the Norwegian shipping industry exists in our sample.

The variable rating probability are discarded from the analysis as we are not able to obtain sufficient information online to construct the variable. From the critical assessment of prior literature on capital structure determinants, rating probability is identified as a significant factor affecting the variation in corporate leverage. Drobetz et al., (2013) concluded that rating probability is an important attribute in connection with explaining the level of leverage. Furthermore, Faulkender and Petersen (2006) underline that factors measuring the constraints on companies' ability to issue public debt should be included when estimating a firms target leverage. They document that a company's debt capacity is reflected through the ability to increase leverage, and argue that access to new supply of debt will motivate the company's level of leverage. Credit rated companies exhibit easier access to the debt capital markets, and consequently these companies will lend more. On the other side, credit rated companies also tend to exhibit lower cost of information asymmetry, and consequently use debt financing less frequently from a pecking order perspective. However, Frank and Goyal (2009) document this effect to be ambiguous. They argue that reduced costs associated with adverse selection encourage use of the capital markets, thus possibly increasing the company's levels of debt. As such, the data sample might suffer from omitted variable bias, which arise when variables of significant importance are left out of the statistical modelling. Furthermore, the possibility of missing variable bias arising from the omission of other important variables cannot be excluded. This possibility is difficult to hedge against, however, the examination of previous research to identify the most influential factors in connection with leverage decisions is considered to reduce the possibility of such bias.

One could question the optimality of the market value of assets calculation, and as such, the market leverage ratio. The market values could have been calculated more precisely by investigating the individual vessels of each company, and value them equally to the secondhand value of the vessels with similar age at the given point of time. This is, however, a difficult and time-consuming analysis. The market value of assets are extremely volatile, and the calculation could potentially create larger fluctuations in the average market leverage ratios and greater

reflect the cyclicality of the overall shipping industry. Specifically, might cause the market leverage to substantially increase subsequent to periods of economic recession, in particular the aftermath of the 2008 financial crisis. We conclude, as prior empirical research, that the employed calculation sufficiently represents the actual market values.

5.0 Research methodology

The objective of this chapter is to describe the quantitative methods used in the analysis. Prior research applies a diverse specter of quantitative methods in order to conclude on which factors that have explanatory power in connection with the choice of capital structure. A static panel data analysis using pooled ordinary least squares (OLS) method is performed by Rajan and Zingales (1995), Frank and Goyal (2009), Drobetz et al., (2013), Frydenberg (2004) and Arvanitis et al., (2012). Frydenberg (2004) and Drobetz et al., (20113) also accounts for fixed effect (FE) estimates. To model the target leverage ratio Drobetz et al., (2013) as Flannery and Rangan (2006), Arvanitis et al., (2012), Mjøs (2007), Lemmon et al., (2008) and Merikas et al., (2015) applies the dynamic generalized method of moments (GMM) for speed of adjustment in order to account for heteroscedasticity and serial-correlation in regression residuals. This paper will follow the methodical framework applied in Drobetz et al., (2013), and examine the determinants of capital structure through the pooled OLS and FE method. Additionally, the generalized method of movements will be applied to model the target leverage and investigate the speed of adjustment. Throughout the paper illustrations, tables and thesis structure are inspired by Drobetz et al., (2013).

6.1 Panel data

Panel data is data where each observational entity or unit is being observed at two or several time periods (Stock & Watson, 2011, p.348). This type of data generates more accurate interpretation of model parameters and increase the capacity of capturing complex relationships (Hsiao, 2005). In panel data it differentiates between a balanced panel and an unbalanced panel. A balanced panel has no missing observations, whereas an unbalanced panel indicates that the panel data constitutes of missing observations for at least one entity or one time period. (Stock & Watson, 2011, p.348). Our analysis is conducted on an unbalanced panel data indicating that the various regressions and tests applied is accounted for dealing with this form of panel data.

6.2 Stationarity

Stationarity refers to the event where the probability distribution is complementary over time. Hence, in a stationary series the future should be similar to the past (Stock & Watson, 2011, p.536). A time series is stationarity when the mean and variance is constant over time, contrary the time series is nonstationary in the case where it varies (Stata, 2020). The concept is highly used when working with time series, however it also applies to panel data. The Fisher-type unit-root test investigates the null hypothesis of all panels containing unit roots to the alternative hypothesis of at least one panel is stationary. The null hypothesis is rejected when the p-value is close to zero.

The Fisher-type with conducted augmented Dickey-Fuller unit-root tests on each panel data is performed to investigate whether the panel data follows a random walk/unit root. This panel data unit root test can be applied on unbalanced panel data. Furthermore, the test includes three different specifications; lagged differences, time trend or drift term (Stata, 2020). All variables are thus investigated to conclude on whether the panel data prove stationarity and provides robust estimates. All the explanatory variables prove stationarity when run with no time trend and zero lags.

The two variables for leverage measures, book leverage and market leverage, fails to reject the null hypothesis of containing a unit root or a random walk as seen in appendix 11 and 12. Panel-data cointegration tests are used when the time series are nonstationary. These tests further investigate whether the variables in fact have a constant long-term relationship. Nonstationary series have the tendency to wander, and thus cointegration tests whether they in fact wander together and create a long-run equilibrium relationship. The Kao, Padroni and Westerlund tests are applied in Stata by using the xtcointtest command. Every test investigates cointegration, but in different ways ensuring a robust conclusion. The null hypothesis is that there is no cointegration, whereas the alternative hypothesis is that all panels are cointegrated. The null hypothesis is rejected in the case where the p-value is close to zero (Stata, 2020). Appendix 13, 14 and 15 illuminates that market leverage and book leverage provide results of cointegration in all the tests.

6.3 Ordinary least square (OLS) regression model

The OLS estimator is highly used in practice and is considered an efficient method to estimate regressions. Further, based on the fact that the OLS estimator is known as a common language within regression analysis, it makes the study more comparable to earlier empirical studies. The use of the OLS estimator ensures an unbiased and consistent estimator under a set of assumptions; the error term does not correlate with any of the explanatory variables, large outliers are unlikely and the observations are independent and identically distributed (Stock & Watson, 2011, p. 127).

$$Y_i = \beta_0 + \beta_1 X_i + \mu_i, i = 1, .., n$$

Equation 1. Standard pooled OLS regression

Y_i denotes the measure of the dependent variable, hereby leverage, of firm *i* at a specific time, X_i represents a vector of the explanatory variables to determine capital structure, β_1 is a vector of regression coefficients, μ_i represents the error term and β_0 the intercept. To analyze the panel data a standard pooled OLS regression is applied in accordance with Drobetz et al., (2013).

6.4 Prerequisites for OLS

In order for OLS to produce valid results, certain prerequisites must be met. The most common problems related to OLS are linearity, normality, multicollinearity, homoscedasticity and autocorrelation. At the same time, extreme observations and the number of independent variables can cause problems. In the following, these assumptions will be reviewed.

6.4.1 Outliers and amount of independent variables

Outliers are defined as data points that notably deviates from the usual range of the dataset. OLS are in particular sensitive to large outliers, and can potentially estimate misleading results if observations with values far outside the other values in the dataset is included (Stock & Watson, 2011, p.125). To mitigate the effect of extreme values and reduce the influence of potential outliers in the statistical data, the variables can be winsorized at the upper and lower ten percentile. This handling of extreme values is in line with data processing carried out in previous studies by Mjøs (2007), Frank and Goyal (2009) and Drobetz et al., (2013). However, the most extreme observations, including the sample minimum and maximum, are concluded to not be accounted as outliers. This

is supported by the fact that these observations do not significantly deviate from the usual range of the dataset. Moreover, the most extreme values account for actual variable values observed, and are considered to not cause any statistical problem. In context of the small sample, the actual nature of the data sample is used in the model selection. Removing the outliers could potentially introduce bias as it works as a correction point for the other values in the sample that clumps more tightly. Conversely, they will have considerable impact when occurring.

The OLS regression tends to suffer from weak estimation results when the number of independent variables are large. For this reason, only variables with proven empirical effect on the dependent variable are included to increase the probability for robust regression estimates. As mentioned earlier, the selection of variables are based on earlier empirical studies within the same field, and the number of variables chosen is concluded to be adequate.

6.4.2 Normality

Normality implies that the residuals have to be normally distributed with a mean $\mu = 0$ and variance $\sigma^2 = 1$, an is denoted ($e \sim N(0, \sigma^2)$ (Stock & Watson, 2011, p.36). When testing for normality, one can see whether kurtosis or skew is present. The degree of skewness depends on whether the distribution is symmetrical around the mean. Kurtosis on the other hand, gauge thickness on the distribution tail. It is however rarely presence of non-normality in sufficiently large data samples. In order to test whether the data sample is normally distributed and to quantify the normality a sktest in Stata is applied (Stata, 2020). The test is tabulated in appendix 9, and confirms normal distribution in the error terms.

6.4.3 Homoscedasticity

A prerequisite for a valid multiple regression is whether the error term, μ, exhibits constant variance and do not depend on the value of the explanatory variables, X_i. Mathematically, this is given by $Var(\mu | x_1, \ldots, x_n) = \sigma^2$ (Stock & Watson, 2011, p.156-157). Homoscedasticity is tested given a Breusch-Pagan test. If heteroscedasticity is present, it is likely that some data points are more likely to be affected by white noise than others. If the error term shows sign of varying variance, OLS will not be an efficient estimator. Appendix 6 and 7 illuminates the result of the Breusch-Pagan test

indicating that the data suffer from homoscedasticity. The null hypothesis of constant variance is not rejected, and there is significant evidence that the variance around the regression line is the same across all values of the explanatory variables.

6.4.4 Multicollinearity

Multicollinearity arise if two or more independent variables perfectly correlate (Stock & Watson, 2011, p.199). As the independent variables are a perfect linear combination of each other, it is difficult to understand the causal relationship between the independent variables and the dependent variable. Additionally, high correlations will create noise, which consequently result in unreliable results. Multicollinearity is investigated through the variance inflation factors test (VIF-test). The VIF-test show no signs of multicollinearity as VIF<5 (see appendix 8). These results are strengthened through an examination of the correlation matrix displayed in chapter 8.5.

6.4.5 Autocorrelation

Autocorrelation occur when the error term, e, correlate across time. When autocorrelation is present, it can cause erroneous standard errors as well as increase the likelihood of wrongly rejecting null hypotheses. The premise is fulfilled if $Corr(e_i, e_j|x) = 0$ for all $i \neq j$ (Stock & Watson, 2011, p.522-523). This means that the correlation between the residuals in two different time periods should be equal to zero. To test if the panel data contains autocorrelation, a Wooldridge test can be performed (Drukker, 2003). The results, tabulated in appendix 4 and 5, reveal positive autocorrelation in the analysis. The null hypothesis of no first-order autocorrelation is rejected. Thus, clustered default errors for both firm and year specific variables are used to remove autocorrelation. This method also corrects for heteroskedasticity (Petersen, 2009).

6.5 Fixed effect regression model

The fixed effect regression model is regularly used in panel data to control for omitted variables in the case where the omitted variables do not change over time but vary across entities (Stock & Watson, 2011, p. 354). Following equation 2 illustrates the fixed effects regression model.

$$Y_{it} = \beta_{1,it} + \cdots + \beta_k X_{k,it} + \alpha_i + \mu_{it}$$

Equation 2. The fixed effects regression model

According to Stock & Watson (2011) the intercept α_i can be interpreted as a state-specific intercept, while $\beta_{1,it}$ is consistent for each state. Hence, the intercept represents the entity fixed effects and vary across states. Further, $\alpha_{1\ ,\dots,}\alpha_n$ are treated as unidentified intercepts estimated for each state.

Furthermore, in accordance with the fixed effects regression model, regression with time fixed effects account for variables that develops over time but are constant across states. Thus, the time fixed effects control for omitted variables that changes over time (Stock & Watson, 2011, p.358-359). Hence, the time fixed effects regression model is exemplified in equation 3. The intercept λ_t can be interpreted as the "effect" on Y for the given time period t. Thus, $\lambda_1, \dots, \lambda_T$ represents the time fixed effects.

$$Y_{it} = \beta_1 X_{it} + \lambda_t + \mu_{it}$$

Equation 3. Time fixed effects regression model

A combination of entity and time fixed effects is used to detect omitted variables which both varies over time and across entities (Stock & Warson, 2011, p.360). Equation 4 elucidates this relationship. Hence, α_i represents the entity fixed effect and λ_t represents the time fixed effect. Additionally, the fixed effects regression models account for unobserved heterogeneity in the data sample.

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \lambda_t + \mu_{it}$$

Equation 4. Combined entity and time fixed effects regression model

6.6 Fixed effect or random effect estimator

In order to determine whether fixed or random effects is applied to the analysis a Hausman test is performed. The null hypothesis in this test is that the preferred model is the fixed effect estimator, while the alternative hypotheses is that the random effect estimator should be applied. Hence, it tests whether the error term μ_i are correlated with the regressors or not. The p-value is significant if $p<0.05$ implying that fixed effects should be used. As seen in appendix 10 the test shows that fixed effects should be used in the analysis, thus the null hypothesis is retained. (Torres-Reyna, 2007).

6.7 Logistic regression model

The logit regression is a nonlinear regression model and it is particularly beneficial for binary dependent variables. Thus, the model predicts values between 0 and 1. Following, equation 5 elucidates the logit model with the binary dependent variable Y, equal to the equity or debt dummy variable in this analysis, and with multiple regressors (Stock & Watson, 2011, p.392).

$$\Pr(Y = 1|\, X_1, X_2, \ldots, X_k) = F(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k$$

Equation 5. Logit regression model

6.8 Speed of adjustment econometric techniques

Earlier empirical studies investigating the speed of adjustment is highly dependent on dynamic panel models. Furthermore, the leverage relies on the lagged leverage. Equation 6 thus illustrates the most non-naturalistic conventional form of the speed of adjustment econometric technique.

$$L_{i,t} - L_{i,t-1} = \lambda\left(L^*_{i,t} - L_{i,t-1}\right) + \varepsilon_{i,t}$$

Equation 6. Speed of adjustment econometric technique

The equation shows that the change in leverage, $L_{i,t} - L_{i,t-1}$, is dependent on λ, the speed of adjustment. In addition to this, the difference between the target level of leverage noted by $L^*_{i,t}$ and the lagged level of leverage $L_{i,t-1}$ also influence the change in leverage. If a shock is present the estimate of $\lambda = 1$ indicates an immediate readjustment towards the target leverage, contrary $\lambda = 0$ indicates no adjustment. The target leverage is further linearly dependent on a set of firm-level variables, shown by $X_{i,t}$ in equation 7. These firm-level variables aim to detect the costs and benefits related to leverage in the dissimilar capital structure theories. As such the target leverage are denoted and measured as $\beta X_{i,t}$.

$$L_{i,t} = (1 - \lambda)L_{i,t-1} + \lambda\beta X_{i,t} + \varepsilon_{i,t}$$

Equation 7. Speed of adjustment with firm characteristic variables

Following, equation 7 elucidates the speed of adjustment technique including firm characteristic variables. $X_{i,t}$ is a vector with firm-specific leverage characteristics, while β is a coefficient vector.

The standard OLS estimation is as shown by Nickell (1981) subject to omitting fixed effects, and thus the estimation is biased upwards. Hence, the error term $\varepsilon_{i,t}$ is divided into a fixed firm effect, u_i, and Gaussian white noise, $\delta_{i,t}$, in order to account for biased estimation (Drobetz et al., 2013). Respectively, equation 8 exemplifies the speed of adjustment econometric specification accounting for biased estimates.

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t} + u_i + \delta_{i,t}$$

Equation 8. Speed of adjustment with fixed effect and Gaussian white noise

The introduction of a dummy variable for the fixed effects is, according to Baltagi (2005), accounting for the unobserved heterogeneity. However, it does not remove bias. The lagged leverage, $L_{i,t-1}$, is correlated with the error term $\delta_{i,t}$, in addition to the residuals associated with the firm fixed effects, u_i. This is a result of the leverage being a function of the fixed effects. The variables can be instrumented in order to correct for the bias. The "difference GMM-estimator" with valid instruments, developed by Arellano and Bond (AB) (1991), are employed to eliminate the time-invariant effect.

$$\Delta L_{i,t} = (1-\lambda)\Delta L_{i,t-1} + \lambda\beta\Delta X_{i,t} + \Delta\delta_{i,t}$$

Equation 9. Arellano and Bond (1991) " difference GMM-estimator" with valid instruments.

The first-differenced lagged dependent variable, $\Delta L_{i,t-1}$, can be instrumented by the use of all lagged independent variables (Drobetz et al., 2013). The estimator escapes bias as the second-order serial correlation in the residuals is nonexistent. In the case where the lagged variables have limited explanatory power over changes in leverage, problems may arise as the information given by the instruments are small. According to both Huang and Ritter (2009) and Blundell and Bond (1998) this problem is particularly evident when the coefficient on the lagged dependent variable is close to whole, which may be expected for the persistent leverage time series. An extension to the AB estimator was thus introduced by Blundell and Bond (BB) (1998), this is known as the "system GMM-estimator". This system involves both the level equation 10 and the difference equation 11.

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t} + u_i + \delta_{i,t}$$

Equation 10. Blundell and Bond (1998) "system GMM-estimator" level equation.

$$\Delta L_{i,t} = (1-\lambda)\Delta L_{i,t-1} + \lambda\beta\Delta X_{i,t} + \Delta\delta_{i,t}$$

Equation 11. Blundell and Bond (1998) "system GMM-estimator" first differences equation.

According to Drobetz. et al., (2013) all the lagged independent variables $L_{i,t-2}, \dots, L_{i,0}$ are considered valid instruments in equation 10. Contrary, in equation 11 only the lagged first differences are appropriate instruments. However, the BB-estimator is still subject to be biased in the event of the lagged dependent variable being close to whole or in the event of second-error correlation in the residuals (Huang and Ritter, 2009; Flannery and Hankins, 2012).

Drobetz et. al., (2013) also mention other potential biases that may arise when estimating speed of adjustment. First of all, the fact that leverage is a fractional variable between zero and one is not emphasized in neither of the estimates. This bias will be further elaborated below. Chang and Dasgupta (2009) postulate that this is due to mean reversion. Hence, financing decisions that are virtuously random can show a positive estimate for adjustment speed.

Empirical research by Elsas and Florysiak (2010) suggest a doubly-censored Tobit estimator to resolve the mean reversion problem, hence the estimator makes sure that the leverage ratio is between zero and one. It relies on a latent variable approach in order to account for the fractional nature of the left-hand variable. According to Baltagi (2005) and Loudermilk (2007) the DPF-estimator accounts for this, hence it is based on a doubly-censored dependent variable.

$$L_{i,t} = \begin{cases} 0 & L_{i,t}^{+} \leq 0 \\ L_{i,t} & 0 < L_{i,t} < 1 \\ 1 & L_{i,t}^{+} \geq 1 \end{cases}$$

Equation 12. The dependent variable in DPF-estimator

In equation 12, $L_{i,t}^{+}$, is denoted as the detected leverage ratio, which secures that values below zero is set equal to zero, and values higher than one is set equal to one. The fact that leverage is a fractional variable is thus taken into consideration. The Tobit estimator mainly correct data errors due to leverage ratios above or below these thresholds are rare.

$$L_{i,t} = (1-\lambda)L_{i,t-1} + \lambda\beta X_{i,t} + u_i + \varepsilon_{i,t}$$

Where

$$u_i = \alpha_0 + \alpha_1 L_{i,0} + E(x_i)\alpha_2 + \alpha_i$$

Equation 13. Specification of the fixed effect term

Furthermore, unobserved heterogeneity and corner solutions is captured by including the fixed effect term, as illuminated in equation 13. The unobserved firm fixed effect, u_i, depends on $E(x_i)$ and the Tobit estimator in the initial period $L_{i,0}$. Maximum likelihood is used to perform the Tobit estimation. Furthermore, Elsas and Florysiak (2010) document that their DPF-estimator is not subject to biases, even in the case where the fixed effect is exposed to lack of specification of the underlying distribution. Additionally, the DPF-estimator exhibited the lowest bias in their US sample compared with other dynamic panel estimators.

7.0 Econometric analysis

The objective of this chapter is to investigate which factors that might help explain the choice of leverage ratio in Norwegian shipping companies, and to which degree the Norwegian industry differs from the global shipping industry. Based on a sample of 16 publicly listed Norwegian shipping companies, this analysis test whether these companies have a target leverage ratio, and analyze the dynamics in their adjustments of capital structure. In accordance with Drobetz et al., (2013) the analysis is conducted through the use of an OLS regression model, in addition to a logistic regression model. This is done in order to investigate the determinants of leverage measures from different aspects and angles.

7.1 Standard leverage regressions

Table 6 displays the results from the OLS and the various fixed effect specification regressions on a full set of capital structure determinants. The OLS results in Column 1 is the standard pooled OLS regression. Tangibility show a significant positive relation to leverage, supporting the assumption that high degree of fixed assets postulate security for loans (mortgage backed bank loans), and hence strengthen debt capacity. The market-to-book ratio is positively related to book leverage. This is in line with the conjecture that firms with higher market-to-book ratios face lower cost of

financial distress, and debt funding is therefore preferred from a trade-off perspective. The market-to-book coefficient show significant explanatory power for Norwegian shipping companies with respect to book leverage. However, the relationship is opposite of what was detected by investigating the correlation matrix. The case is categorized as a situation of suppressor effect by Falk and Miller (1992), and suggest that the original relationship between the independent and the dependent variable have been suppressed. In this case, it is reasonable to assume that the difference in signs simply reflects random variation around zero due to the fact that the original relation between the variables is noticeably close to zero (Falk and Miller, 1992, p. 75-76).

Table 6. Standard leverage regressions

	[1]	[2]	[3]	[4]
Dependent variable: Book leverage				
Tangibility	0,357*	0,341***	0,297***	0,293***
	(0,175)	(0,086)	(0,060)	(0,074)
Market-to-book	0,158**	0,024	0,289***	0,145***
	(0,063)	(0,076)	(0,049)	(0,049)
Profitability	-0,208*	-0,038	-0,244	-0,063
	(0,107)	(0,963)	(0,157)	(0,993)
Firm size	0,081***	0,096***	0,072***	0,083***
	(0,025)	(0,017)	(0,009)	(0,019)
Operating leverage	0,270**	0,227	0,258***	0,178
	(0,126)	(0,162)	(0,040)	(0,156)
Dividend payer	-0,037	-0,061	-0,030	-0,057
	(0,034)	(0,036)	(0,025)	(0,036)
Asset risk	-0,007	0,031*	0,015	0,049**
	(0,014)	(0,016)	(0,014)	(0,021)
Firm fixed effects	no	yes	no	yes
Year fixed effects	no	no	yes	yes
Observations	244	244	244	244
Adj R2	0,333	0,655	0,386	0,697

Dependent variable: Market leverage				
Tangibility	0,351*	0,401***	0,276***	0,332***
	(0,352)	(0,088)	(0,079)	(0,088)
Market-to-book	-0,178**	-0,317***	-0,035	-0,177***
	(0,084)	(0,073)	(0,053)	(0,056)
Profitability	-0,243*	-0,062	-0,255	-0,064
	(0,134)	(0,104)	(0,203)	(0,106)
Firm size	0,091**	0,107***	0,080***	0,091***
	(0,032)	(0,017)	(0,011)	(0,021)
Operating leverage	0,284*	0,17	0,277***	0,131
	(0,138)	(0,1555)	(0,048)	(0,133)
Dividend payer	-0,040	-0,078	-0,031	-0,070**
	(0,042)	(0,034)	(0,023)	(0,031)
Asset risk	-0,018	0,022	0,004	0,042*
	(0,015)	(0,017)	(0,013)	(0,020)
Firm fixed effects	no	yes	no	yes
Year fixed effects	no	no	yes	yes
Observations	244	244	244	244
Adj R2	0,401	0,726	0,451	0,772

The table elucidates the results from the standard capital structure regression for 16 listed Norwegian shipping companies from 2000-2019. Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign;''. Firm fixed effects and year fixed effects indicates whether entity fixed effects, time fixed effects or both are included in the regression.*
** Statistical significance at 10 percent level*
*** Statistical significance at 5 percent level*
**** Statistical significance at 1 percent level*

On the other side, the market-to-book ratio coefficient is significantly negative for the market leverage regression. Consistent with the trade-off theory, the Norwegian companies with larger growth opportunities will experience higher cost of financial distress. Simultaneously, the agency costs of debt will increase as a result of problems associated with possible underinvestment. As such, one can assume that the use of debt financing is reduced in order to maintain corporate performance and reduce the probability of default. However, the inverse relationship might not be a result of financing behavior in the shipping industry, but rather a reflection of banks restrictions to lend against growth potential. The increased market-to-book ratio is a function of future earnings, which is often considered to serve as weak collateral compared to the value of tangible assets. As such, higher market-to-book ratios impact on leverage ratios might arise by banks behaving as a restraining part. Baker and Wurgler (2002) document the market timing theory, and argue that firms

in general are indifferent to whether they finance with equity or debt, but rather choose the form of financing that is favored by the financial market. Thus, companies tend to issue equity when the stock market is perceived as encouraging, typically during economic upturns, and when market-to-book ratios are generally high. They further emphasize that efforts to time the market have a persistent effect on the leverage ratio as company's do not subsequently readjust to their target.

The inverse relation pattern might be explained by the fact that a firms choice of financing depends on the stock market conditions, and following that the observed leverage ratios reflect the cumulative outcome of past attempts to time the equity markets (Drobetz et al., 2013). The market-to-book ratio is a positive function of market value of assets, which are largely affected by the cyclicality of the business cycle, and following stock market conditions. The book value of assets are, however, unaffected by changes in the economic environment, set aside ripple effects that lead to purchase or sale of vessels. Consequently, the cyclicality of the shipping industry, imposing significant time-lags in connection with the demand-supply balance, might explain the causality direction.

The coefficient on profitability is significantly negative in both the book and market leverage regression, indicating that increased profitability is followed by lower leverage ratios (equivalent to the findings in chapter 4.6). This observation supports the majority of prior empirical research, and the result is in line with the pecking order theory, indicating that companies choose internal financing to external financing and debt capital to equity capital. Furthermore, this can be explained by the high correlation between profitability and asset values in the shipping industry, consequently making leverage and profitability dependent on opposing factors. The weak profitability during bad macroeconomic states accompanied by more difficult access to debt financing, and visa versa, might imply a positive relation between profitability and leverage. However, the amount of debt financing employed in connection with new capital investments is reversed by the appreciation in asset values, and thus a decline in the leverage ratio is followed. Merikas et al., (2013) document a negative relationship between leverage and profitability during all stages of the shipping cycle except the peak. They argue that a higher degree of equity financing will enhance profitability in all stages of the shipping cycle except the peak, implying that shipowners tend to use debt financing

when expecting a downturn in the market. Additionally, profitability is documented to have a larger significant impact on leverage for the globally listed shipping companies (Drobetz et al., 2013).

As illuminated in table 6 dividend payouts exert a negative impact on leverage, which is indicated by the negative coefficient obtained on the dividend payer dummy variable. In other words, companies that exhibit large amounts of debt do not pay dividends to its shareholders. However, the variable is not statistically significant for Norwegian shipping companies. Asset risk shows a positive relationship to leverage, supporting the assertion of the pecking order theory, indicating that Norwegian shipping companies with more volatile assets suffer from higher costs of asymmetric information, and therefore exhibit higher levels of leverage. Wang (1993) find that information asymmetry among investors can increase volatility. This situation can be applied in the shipping industry when investors are differently informed about the future market prospects. The market values are reflected through stock prices which vary with investors information about potential future earnings. As such, asset volatility is a good thing for those who possess adequate information and manage to take advantage of the cyclical fluctuations in vessel values.

The estimated coefficients on firm size and operating leverage do not exhibit the same signs as in prior empirical research (Drobetz et al., 2013; Rajan and Zingales, 1995; Frank and Goyal, 2009). According to prior research on the global shipping industry, firms tend to mitigate financial leverage by possessing lower levels of operating leverage. However, the estimated coefficient on operating leverage indicate a positive correlation to financial leverage, implying that Norwegian shipping companies tend to carry high levels of both operating and financial leverage. The firm size coefficient exhibits the most significant explanatory power. This variable indicate that larger firms tend to carry higher leverage ratios as suggested by Frank and Goyal (2008), which find evidence that larger companies prefer a larger amount of debt in order to cover their financing requirements. This is in line with the rationale of the trade-off theory, implying that larger companies often are more diversified, and following less prone to bankruptcy. Furthermore, from a trade-off perspective, larger companies are less prone to cost of financial distress, thus establishing incentive to assume higher leverage. In the case of bankruptcy, large companies face significant liquidations of vessels through the secondary market. As such, one could argue that the cost of financial distress

increase with size. The potential situation with a large fire-sale of vessels are connected with risk for the creditors as large sales of vessels will translate to significant losses and put downward pressure on the secondhand prices. Consequently, might motivate the creditors to rather increase leverage further. For this reason, the pecking order theory should be considered. The pecking order theory suggest a negative relationship due to reduced asymmetric information in larger companies. It is worth mentioning that larger companies might benefit from lower borrowing costs and banks willingness to slack their lending terms as a result of higher bargaining power. Thus, large companies take advantage of greater access to debt capital, and the relation might be argued to arise as a result of banks willingness to lend.

Column 2 and 3 in table 6 present the firm and the time fixed effect panel regression. Column 4 display the panel regression specified for both firm and company fixed effects. These column's show relatively consistent results with the OLS, with the exception of some minor measurement errors. Equal to in prior research, the adjusted r squared value indicates that the market leverage regression model explains more of the variability in the data sample compared to the book leverage regression. As in Drobetz et al,. (2013) the explanatory power of the OLS substantially improves as firm fixed effects are added to the panel regression in Colom 2. This observation suggests that an unobserved time-invariant component significantly drive the capital structure, and consequently the variables will be irrelevant as time-invariant firm effects are accounted for in the regression. Thus, this indicates that the leverage ratio varies around a certain level of equilibrium, and if the ratio deviates from this equilibrium level, a readjustment process will occur. Consistent with prior studies the models explanatory power further increase as also year fixed effects are added to the regression (see Column 3 and 4). For this reason, the regression in Column 4 is concluded to be the best fitted specification of the model and will be the basis in further analysis.

7.2 Explanatory power

Earlier empirical research, as Drobetz et al., (2013) document that the explanatory power for leverage measures increases when firm fixed effects are included in the regression. This is explained by the omission of the unobserved time invariant component when applying the standard pooled OLS regression. Hereby, underlining that the company's capital structure in fact is driven by this.

Composing standard OLS regressions are thus considered irrelevant because it fails to incorporate the time invariant component. In line with Lemmon et al., (2008) investigation of corporate capital structure, there is detected a larger adjusted R square for market leverage than for book leverage when including firm fixed effects. Column 2 in table 6 emphasize the increased explanatory power. Additionally, the standard leverage regression for Norwegian shipping companies also show a larger adjusted R square for market leverage than for book leverage in compliance with earlier empirical research. Additionally, column 4 in table 6 elucidates that the adjusted R square experience an increase when year fixed effect is added to the regression.

The detected larger explanatory power towards market leverage as dependent variable, when including firm fixed effects, is thus interesting to investigate. In order to detect if there is evident a target adjusted R square for this model a comparison of different OLS regressions versus FE regressions is practiced. Market leverage is used as the dependent variable and a set of firm specific variables is applied as explanatory variables. Further, the findings will be based on a set of empirical researches investigating similar relationships; Rajan and Zingales (1995), Lemmon et al., (2008), Frank and Goyal (2009), Gropp and Heider (2010), Harrison et al., (2011), Drobetz. et al., (2013) and our research for Norwegian shipping companies as illuminated in table 7. By computing the average adjusted R square for the following researches, it is obtained an adjusted R square of 0.36 when performing OLS regression compared to 0.75 when applying fixed effect regression. Based on the sample of seven different studies these findings can be expected to be applicated to use as a target in further analysis. Comparing the adjusted R square as opposite to the regular R square provides a more realistic assessment of the explanatory power of the regression. Reasoning in the fact that the adjusted R square is used as a target for explaining the fit of the model and does not necessarily increase when a new regressor is added (Stock & Watson, 2011). Hence, the use of this measure is often applied in similar research. Nevertheless, it is expected that the OLS regressions on average explain approximately 36.0 % towards the dependent variable market leverage, compared to 75.0 % in fixed effects regressions. Set in context of the determined explanatory power in the standard leverage regressions of our sample, it is only detected minor deviations in the explanatory power.

Table 7. Average adjusted R square

	Adjusted R2 OLS	Adjusted R2 FE
[1] Our research	0,40	0,77
[2] Rajan and Zingales (1995)	0,19	
[3] Lemmon et al. (2008)	0,38	0,45
[4] Frank and Goyal (2009)	0,29	
[5] Gropp and Heider (2010)		0,88
[6] Harrison et al. (2011)		0,82
[7] Drobetz et al. (2013)	0,53	0,81
Average	**0,36**	**0,75**

The table illuminates the adjusted R square for the standard ordinary least square regression and the fixed effects regression model for seven different empirical research. This is executed in order to be able to compare the adjusted R square for the two different types of regression, in order to investigate the effect by the time invariant component. The average adjusted R square for the OLS regression and the fixed effect regression is thus market with bold in the table. The table is based on the average R square for our research of Norwegian shipping companies, Rajan and Zingales (1995), Frank and Goyal (2009) and Lemmon et al., (2008) for US data, Drobetz et al., (2015) for globally listed shipping companies, Harrison et al. for the capital-intensive REIT industry and Gropp and Heider for the banking industry.

7.3 Determinants of changes in leverage

The analysis has until this point employed aggregate leverage measures, elucidating the historical changes in debt and equity levels. In order to further investigate the factors affecting leverage measures, the determinants of marginal capital structure decisions are examined with respect to annual changes in leverage and security issuance decisions. This analysis is performed through the use of a logistic regression, to capture the aspect of the firm-specific variables with respect to debt and equity issuances (Drobetz, et al., 2013).

Dummy variables indicating the change in equity and debt is thus created to use as dependent variables. In similarity with the analysis in Drobetz et al., (2013) a 10% threshold is used when determining the dummy variables. Hence, the equity dummy variable is set to 1 if there is detected

an increase in the companies' shares outstanding above the threshold during a fiscal year, contrary 0. Additionally, the debt dummy variable is set to 1 if the companies increase the level of debt above the threshold in a given year, contrary 0. Furthermore, the dummy variables are regressed against the firm specific variables in year-to-year differences. Lastly, an additional variable to the firm specific variables is included in order to be able to test for market timing behavior (Drobetz et al., 2013). This variable is called price run-up, and accounts for the company's stock market return during the past 12 months. A price run-up might be caused by gradual resolution of information asymmetry and following the variable can be associated with temporarily low information asymmetry. Column 1 and 2 in table 8 report the results.

Table 8. Determinants of changes in leverage

	[1] Debt issuer	[2] Equity issuer	[3] Book leverage	[4] Market leverage
△ Tangibility	5,171	-2,402*	0,003**	0.038***
	(6,799)	(1,274)	(0,001)	(0,012)
△ Market-to-book	4,273	5,599***	-0,108	-0,229**
	(4,162)	(2,013)	(0,088)	(0,094)
△ Profitability	-0,025	-0,241	0,003***	-0,000
	(0,082)	(0,262)	(0,001)	(0,001)
△ Size	119,446***	24,908**	-1,110**	-1,536***
	(25,484)	(12,106)	(0,477)	(0,458)
△ Operating leverage	0,458***	-0,240	-0,022*	-0,028***
	(0,168)	(0,272)	(0,012)	(0,009)
△ Asset risk	-0,102	-0,494	0,041*	0,037
	(1,606)	(0,459)	(0,02)	(0,026)
Dividend payer	0,633	-1,782***	-0,066	-0,114*
	(0,617)	(0,430)	(0,050)	(0,056)
Price run-up	-1,708	-1,606**	-0,006	-0,003
	(1,162)	(0,745)	(0,009)	(0,011)
Observations	210	214	212	212
Adjusted R2	0,463	0,288	0,172	0,1827

The table reports which regression coefficients that affects the decision of issuances and leverage ratios. In column 1 regressors affecting the issuance of additional debt through a logistic regression is displayed. Similarly, in column 2 regressors affecting the issuance of additional equity is displayed. The dependent variables are dummy variables that indicates whether the firm has issued additional debt or equity in a given year. In column 3 and 4 annual changes in book leverage and market leverage are used as dependent variables, thus the columns report the regression results. The sample is 16 listed Norwegian shipping companies during 2000-2019. Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign; ''.*
** Statistical significance at 10 percent level*
*** Statistical significance at 5 percent level*
**** Statistical significance at 1 percent level*

The estimated coefficients on the determinants of changes in debt displayed in Column 1 do not show similar coefficient patterns as those in Drobetz et al., (2013). The likelihood of a debt issuance seems to be a positive function of firm size and operating leverage. In contrary, profitability is negatively related to the probability of an increase in debt. The coefficient on market-to-book ratio in the debt issuance regression are, against expectations, lost in measurement error. This could be explained by the fact that the shipping companies have during the sample period been unable to time the market due to information asymmetry and following low market-to-book ratios. However, the negative coefficient on the price run-up variable indirectly underpin the conjecture of the market timing theory, implying that durable positive stock returns enhance equity issues, and thus mitigate the probability of debt issuance. The equity issuance model in Column 2 exhibits an adjusted r squared value marginally lower than the debt issuance model. In this model tangibility display an inverse relationship to the probability of an increase in equity. Also, profitability is inversely related with changes in equity. The price run-up is determined to have a statistical inverse relationship to an issuance of equity. Hence, the companies are less likely to issue equity when the stock return is high, thus partly contradicting the mitigation of debt issuances during high stock returns. However, this contravene with economic intuition, where high stock returns normally are followed by issuance of equity (Alti & Sulaeman, 2012). At first glance, the inverse relationship can be interpreted as a failure to time the market. However, the negative relationship may be explained by the finding of Alti & Sulaeman (2012) where equity issuances in the event of high stock returns only are evident when accompanied by substantial demand from institutional shareholders. Hereby, emphasizes that the regression may fail to incorporate the accurate relationship between equity issuance and price run-up due to omission of a variable that takes the institutional shareholders demand into account. The firm size coefficient is significantly large for changes in both debt and equity. This is explained by the fact that large investments in new vessels require substantial financing from both capital sources. However, the estimated coefficient on firm size suggest that larger Norwegian shipping companies primarily cover their capital requirements by issuing debt.

7.4 The peculiarity of the Norwegian shipping industry

Drobetz et al. (2013) discussed the peculiar nature of the global shipping industry. Hence, in this chapter the object is to investigate to which degree the Norwegian shipping industry exhibits peculiar characteristics. The leverage ratio in the Norwegian shipping companies are on average higher compared to the global shipping industry. This observation might imply that the Norwegian shipping companies generally have greater access to debt capital or that the investors at the Oslo Stock Exchange are less risk averse. The latter may be explained by the willingness of professional investors to take larger risks in their attempt to time the business cycle to receive spin-off returns, as a result of Norway's position within the industry. The Oslo Stock Exchange is internationally recognized as a leading marketplace within the shipping industry (Oslo Børs, 2020). Additionally, the Norwegian shipping industry has a proud history and represent unique expertise and innovation power (Norwegian Shipowners´Association, 2020). As such, an affiliation to the Norwegian shipping industry is present.

The signs of the estimated coefficients in the standard leverage regressions displayed in table 9 do not strongly differ from those in earlier studies of non-Norwegian shipping companies. It is not expected that the Norwegian shipping industry exhibits completely different drivers of corporate leverage compared to other industries. It is, nevertheless, interesting to analyze to which degree the various capital structure factors impact on leverage ratios deviate given the differences in leverage ratios. Based on the findings in this analysis, some indications that the Norwegian registered shipping companies deviate from the rest of the industry in some areas are found. The results are compared to those in Drobetz et al. (2013) for globally listed shipping companies, in Frydenberg (2004) for Norwegian manufacturing firms, Rajan and Zingales (1995) and Frank and Goyal (2009) for non-financial companies, and Arvanitis et al., (2012) for European shipping companies. The comparable regression models are displayed in table 9. Column 1 summarize our results from the market leverage regression with firm and time fixed effects in table 6 column 4.

Table 9. Comparing the impact of capital structure determinants

	[1] Table 6 Column 4	[2] Drobetz et al. (2013)	[3] Rajan and Zingales (19	[4] Aravnitis et al. (2012)	[5] Frydenberg (2004)	[6] Frank and Goyal (2009)
Tangibility	0,332***	0.283***	0.330***	0.396***	0,005	0.105***
	(0,088)	(0.059)	(0.03)	(3.30)	(0.008)	(0.006)
Market-to-book	-0,177***	-0.107***	-0.08***	0,0002	0.1621**	-0.023***
	(0,056)	(0.018)	(0.01)	(0.75)	(0.025)	(0.001)
Profitability	-0,064	-0.272**	-0.06***	-0.195		-0.114***
	(0,106)	(0.125)	(0.07)	(-0.96)		(0.003)
Firm size	0,091***	0,006	0.03***	-0.011	0.0409**	0.023***
	(0,021)	(0.025)	(0.000)	(-0.68)	(0.002)	(0.001)
Operating leverage	0,131	-0,049				
	(0,133)	(0.033)				
Dividend payer	-0,070**	-0,017			-0.0205**	-0.102***
	(0,031)	(0.015)			(0.005)	(0.003)
Asset risk	0,042*	-0.375***			-0.180	
	(0,020)	(0.12)			(0.015)	
Observations	244	1007	2207	192	135000	180552
Adj R2	0,772	0,806	0,190	0,185	0,193	0,292

The table relates the regression results of this study to prior empirical research on various data samples. The dependent variable is market leverage, and the model is specified for firm and year fixed effects. Column 1 display the results for Norwegian shipping companies from Table 10 (Column 4). The results used as comparison are Drobetz et al., (2013) for globally listed shipping companies, Aravanitis et al., (2012) for European shipping companies, Rajan and Zingales (1995) and Frank and Goyal (2009) for US data, and last Frydenberg (2004) for Norwegian manufacturing firms. Xxx do not apply fixed effects specifications to their analysis. X use book leverage as the dependent regression variable. Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign; ''.*
** Statistical significance at 10 percent level*
*** Statistical significance at 5 percent level*
**** Statistical significance at 1 percent level*

The capital structure dynamics of the Norwegian shipping companies exhibit several noteworthy peculiarities. The first major observation is that tangibility is the most influential determinant of capital structure in the Norwegian shipping industry. The estimated coefficient in the standard leverage regression indicates that a one unit increase in the ratio of PPE to total assets will increase the leverage ratio by 33.2%. This is a higher value than those revealed in prior empirical studies by Frydenberg (2004) and Frank and Goyal (2009) (see table 9) investigating non-shipping companies. The observation supports the assumption that tangible assets tend to be favorable from a creditors perspective as they are easier to repossess in the case of default. However, tangible assets are often liquidated at values below original cost (Pulvino, 1998; Benmelech and Bergman, 2011). Campello and Giambona (2012) argue that tangible assets impact on capital structure is restricted to the extent that they are able to be sold in the secondhand market. As such, only easily redeployed tangible assets support higher leverage, and therefore "market tangibility" should be considered as the ultimate driver behind leverage.

Despite the fact that vessel values respond to the demand-supply balance in the secondhand market, commercial vessels degree of redeployability is closely linked to the high asset price risk. Asset price risk arise as a company's assets are subject to fluctuations in value (Alexandridis, et al., 2018). The estimated coefficient on asset risk have limited statistically significant effect in the reported specification, possibly indicating that financial mangers do not use operational or financial hedges as a tool in their corporate risk policies. However, Drobetz et al., (2013) find evidence that the shipping industry exhibits high asset risk compared to other industries. The fluctuations in asset value affect a company's creditworthiness as it is directly linked to the ability to service their debt obligations. In periods of recession the redeployment of commercial vessels are limited, and the high volatility in vessel prices impact collateral values negatively. Consequently, high asset price risk tends to carry lower proportions of leverage. However, asset price risk does not necessarily merely distress the individual shipping company. Benmelech and Bergman (2011) document that high volatility in tangible assets can magnify shocks that affect the overall economy using a data sample of US airlines issuance of secured debt tranches. The findings for the airline industry disclose that the bankruptcy of one firm reduce collateral values for other industry participants, in particular during industry downturns. These results can also be applied to the shipping industry. The bankruptcy of a shipping company will probably increase secondary vessel supply, placing downward pressure on the value of similar vessels. Additionally, vessel demand is offset by financial distress, also pressuring vessel values downwards. In general, these effects increase the cost and limit the availability of external debt financing.

A third observation is that high financial risk in the Norwegian shipping companies are accompanied by high levels of operating leverage. This observation is in line with the platitude suggested by Kavussanos and Visvikis (2006). They document that the shipping industry tend to exhibits high levels of operating leverage in addition to high levels of financial leverage. On the other side, Meulbroek (2002) points out that a company can manage corporate risk by changing its operations or by adjusting the capital structure. The more the company secures its exposure to operational risk, the less equity is needed to support the company's operations, and thus the risk of bankruptcy is reduced (Drobetz et al., 2013). This form of risk management can potentially increase debt capacity, and thus advocate the use of debt.

The total risk faced by a shipping company is often caused by the operational business or changes in the economic environment (i.e. freight rates and secondhand values directly affect the vessel values and corporate performance). The risk can be adjusted through operational decisions, such as long-term contracts and leasing of ships. Furthermore, the remaining exposure to risk must be covered by sufficient equity. This is where the interaction between operations, risk management and capital structure come into play. Shipping companies with higher risk should to a greater extent run risk management, and vice versa. In addition to risk management decisions on the asset side of the company's balance sheet, capital structure constitutes an additional aspect of risk management (Stulz, 1996).

Another interesting observation is the fact that profitability does obtain limited statistically significant impact on leverage ratios for the Norwegian shipping companies. In comparison to Drobetz et al., (2013) the results indicate that foreign listed companies possess lower levels of debt as profitability increase, and thus prefer internal financing to a greater extent than Norwegian shipping companies. At the same time, table 9 show that operating leverage affects the globally listed shipping companies negatively, suggesting that they conduct a more conservative fiscal policy, with a lower proportion of debt as they are subject to higher fixed costs. The asset risk coefficient signal limited statistical significant effect on the Norwegian shipping industry, indicating that Norwegian shipping companies are less vulnerable to fluctuations in market value, and that the probability of financial distress is potentially less compared to globally listed shipping companies. Frydenberg (2004) do neither find asset risk to exhibit significant impact on leverage for the Norwegian manufacturing firms. Fan et al., (2012) document that Norway is the country obtaining the second largest average long-term debt. Generally, equity holders have strong incentives to increase volatility at the expense of debtholders. Reasoning in the fact that debt and equity holders have different risk preferences. An increase in the financial positions volatility for equity holders are followed by a rise in the value of the position, thus making it more favorable for the equity holder. Contrary, the increased volatility will have an inverse effect for the debtholders (Bluhm et al., 2003, p.138). However, according to Jeon and Nishihara (2015) the risk of default rise as debt maturity shortens. Investments increasing both growth options and risk volatility, sharply decrease leverage ratios when the debt maturity is long enough. As such, the results are complemented and in the

view of these facts, one could argue that the generally long debt maturities in Norway can decrease the probability of default for Norwegian shipping companies.

7.5 Robustness tests

In this section, robustness tests for the baseline regression with respect to alternative definitions of leverage and different model specifications are provided in order to analyze model uncertainty. Both Frank and Goyal (2009) and Drobetz et al. (2013) suggest estimating lagged values of the explanatory variables in the standard leverage regression. This method involves explaining the dependent variable with observations of the explanatory variables from a year earlier. Appendix 16 displays the results with lagged explanatory variables for OLS and fixed effects specifications. The alternative specifications provide approximately unchanged results. The change in significance on certain variables are not of significant importance to the analysis.

Furthermore, the results dependence on the definition on leverage are analyzed by testing the leverage measures against alternative definitions of leverage suggested by Rajan and Zingales (1995). The alternative definitions of leverage applied is, first, the ratio of total liabilities to total value of assets, and second, the ratio of total debt to value of capital. The standard leverage regressions are applied in this analysis, and tabulated in appendix 17. The results postulate that none of the alternative leverage measures highly increases the explanatory power measured by the adjusted R square. Contrary, the second definition of leverage illuminates relatively low explanatory power. Nevertheless, the first alternative definition of leverage elucidates that tangibility, firm size and market-to-book remain variables with greatest effect in explaining leverage. Indicating, that the leverage measure applied in this analysis is largely robust when compared with the alternative leverage measures.

7.6 The impact of macroeconomic factors

Macroeconomic factors are applied to the analysis to further investigate factors affecting the level of leverage. The purpose of this is to investigate if the macroeconomic conditions can explain the company's capital raising and draw them against choosing different levels of leverage during different economic conditions. In chapter 11.1, capital structure was observed to be driven by an

unobserved time-invariant component. Following, the purpose of this chapter is thus to investigate if underlying time-variant factors such as macroeconomic conditions could be the driver behind this time component. The importance of the macroeconomic variables applies highly to shipping companies given the nature of the industry. As mentioned earlier, the industry is highly dependent on supply and demand, and further considered a volatile industry. Thus, the industry is said to be influenced by several macroeconomic factors. The macroeconomic determinants are included in the standard leverage regression with firm fixed effects specifications, and the results are displayed in table 10. In order to keep the number of explanatory variables at an acceptable level and avoid impaired results, it is concluded appropriate to include the macroeconomic variables in groups.

In Column 2 a dummy variable accounting for the cyclicality in the Norwegian industry is applied. The variable equals 1 if above six months in the given year are classified as depressed months, determined by GDP growth below trend growth inducing a negative production gap, in the contrary 0. The following four years have thus been categorized as recession 2002, 2003, 2008 and 2009 (SSB, 2008); (Holter, 2020). Similarly, in Column 3 a dummy variable for the recession in the shipping industry is applied to the analysis. The variable equals 1 if the shipping industry hits a recession indicated by periods in the shipping industry that is classified as depressed, contrary 0. Following 2001, 2002, 2008, 2009 and 2016 are categorized as recession years as illustrated in figure 3 based on the change in the level in freight rates. These dummy variables are included to account for cyclicality of leverage and investigate whether the financing choice and leverage ratios are affected by the business cycle. Furthermore, according to Drobetz et al., (2013) information asymmetry between investors and companies during the business cycle are based on the demand for capital. Hence, asymmetric information affects the choice of financing, as in the pecking order theory. Poor macroeconomic conditions induce higher costs associated with asymmetric information, and the company is more likely to issue debt as compared to equity. Thus, the asymmetric information is negatively related to the business cycle. Additionally, macroeconomic conditions are affecting the supply of capital, hence this should be taken into consideration in terms of leverage measures.

Table 10. Macroeconomic determinants of leverage

	[1]	[2]	[3]	[4]	[5]
Dependent variable: Book leverage					
Tangibility	0,341***	0,362***	0,345***	0,353***	0,349***
	(0,086)	(0,089)	(0,088)	(0,095)	(0,085)
Market-to-book	0,024	0,035	0,35	0,067	0,052
	(0,076)	(0,075)	(0,075)	(0,072)	(0,076)
Profitability	-0,038	-0,047	-0,047	-0,070	-0,069
	(0,963)	(0,102)	(0,102)	(0,102)	(0,112)
Firm size	0,096***	0,098***	0,098***	0,101***	0,097***
	(0,017)	(0,016)	(0,017)	(0,022)	(0,018)
Operating leverage	0,227	0,209	0,227	0,183	0,192
	(0,162)	(0,166)	(0,65)	(0,165)	(0,168)
Dividend payer	-0,061	-0,068*	-0,061	-0,074*	-0,067*
	(0,036)	(0,037)	(0,036)	(0,395)	(0,037)
Asset risk	0,031*	0.034*	0,032*	0,033*	0,035*
	(0,016)	(0,016)	(0,016)	(0,017)	(0,017)
Recession (NO)		0,043*			
		(0,019)			
Recession (shipping)			0,026**		
			(0,009)		
Inflation				-1 149	
				(1,377)	
Term spread				-0,034*	
				(0,017)	
GDP growth				-1 956	
				(1,153)	
Oil price				0,004	
				(0,023)	
Stock market returns				-0,062**	
				(0,029)	
Freight rates					0,055
					(0,031)
FX NOK					0,042
					(0,112)
Secondhand ship prices					-0,117*
					(0,055)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	244	244	244	243	242
Adj R2	0,655	0,661	0,657	0,669	0,665

Dependent variable: Market leverage					
Tangibility	0,401***	0,414***	0,401***	0,415***	0,403***
	(0,088)	(0,089)	(0,089)	(0,089)	(0,084)
Market-to-book	-0,317***	-0,309***	-0,306***	-0,281***	-0,281***
	(0,073)	(0,072)	(0,071)	(0,072)	(0,073)
Profitability	-0,062	-0,067	-0,069	-0,944	-0,097
	(0,104)	(0,108)	(0,111)	(0,104)	(0,121)
Firm size	0,107***	0,108***	0,109***	0,107***	0,106***
	(0,017)	(0,017)	(0,017)	(0,019)	(0,018)
Operating leverage	0,17	0,159	0,170	0,139	0,136
	(0,1555)	(0,157)	(0,159)	(0,159)	(0,151)
Dividend payer	-0,078	-0,083*	-0,079**	-0,084**	-0,086**
	(0,034)	(0,036)	(0,034)	(0,036)	(0,035)
Asset risk	0,022	0,024	0,023	0,026	0,027
	(0,017)	(0,017)	(0,017)	(0,018)	(0,017)
Recession (NO)		0,025			
		(0,018)			
Recession (shipping)			0,024**		
			(0,009)		
Inflation				-0,070	
				(1,244)	
Term spread				-0,019	
				(0,019)	
GDP growth				-1 073	
				(1,115)	
Oil price				0,012	
				(0,022)	
Stock market returns				-0,065**	
				(0,026)	
Freight rates					0,041
					(0,026)
FX NOK					0,246
					(0,173)
Secondhand ship prices					-0,117**
					(0,047)
Firm fixed effects	yes	yes	yes	yes	yes
Observations	244	244	244	243	244
Adj R2	0,726	0,727	0,727	0,731	0,761

The table report the results from standard capital structure regression including macroeconomic factors. The sample consists of 16 publicly listed Norwegian shipping companies during 2000-2019. All firm-level variables are constructed on data retrieved from the Bloomberg Terminal. See appendix 2 for definition and data sources on the various macroeconomic variables. Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign; ''. All regressions include firm fixed effects.*
** Statistical significance at 10 percent level*
*** Statistical significance at 5 percent level*
**** Statistical significance at 1 percent level*

Column 2 and 3 in table 10 elucidate that the dummy variable for cyclicality in the Norwegian industry and the dummy variable for cyclicality in the shipping industry is positively correlated with book leverage, and significant on a 10.0% and 5.0% level respectively. Hence, as measured by the dummy variable for the Norwegian industry the impact for the Norwegian recession dummy is large

and increases the dependent variable by 4.3 percentage points. The impact caused by the shipping recession dummy is quite smaller, increasing the dependent variable by 2.6 percentage points when included. However, only the shipping recession dummy is significant at 5.0% in explaining market leverage and increases the dependent variable by 2.4 percentage points. This indicates that Norwegian shipping companies' book leverage is counter-cyclical with respect to the Norwegian and the global shipping industry. Contrary, the Norwegian shipping companies' market leverage is only counter-cyclical with respect to the global shipping industry. The counter-cyclicality nature of the leverage measures is consistent with the findings in Hackbart et al., (2006) and Drobetz et al., (2013) for market leverage. Furthermore, an empirical study based on a sample of international industrial companies also document leverage ratios to behave counter-cyclically (Halling et al., 2012). In addition, they argue that the findings are in line with the trade-off theory inducing that the target leverage is lower after a stock price run-up or in the event of high equity market levels. In the event of low equity valuations and interest rates, the level of issued debt would increase. Furthermore, Halling et al., (2012) argues that the findings are in line with the market timing theory elucidating that firms' sources of financing can be explained by whether the debt or equity market is most favorable. The counter-cyclical leverage ratios can also be explained by the pecking order theory, implying that firms tend to use internal funds rather than debt financing during a boom. Additionally, column 2 in table 10 also illustrates that firm size is significant in having explanatory power towards book leverage. Inducing firm size to have a positive relationship with the dependent variable. Hence, when firm size increases the leverage measures will follow. This may be explained by the intuition of shipping companies using debt to finance new vessels, thus firm size expands. In the following regression the leverage measures are counter-cyclical as explained above. However, when investigating the same regression by excluding firm size the variable for cyclicality lose its significance (appendix 19). Elucidating the fact that when debt is not issued to finance new vessels the leverage measures are not counter cyclical. This may be explained by the intuition that if debt is not used to finance new vessels, the counter-cyclical nature of the leverage measures is neutralized due company size fluctuating with the business cycle (i.e. a constructed as a positive function of asset values). Ordering new ships during an economic recession is considered cheaper. Additionally, the delivery is expected to take place prior to a peak and the companies are thus expected to cover the demand when the business cycle changes. Hence, explaining the original

counter-cyclical nature of the leverage measures. Thus, when the effect of firm size is omitted the leverage measures lose this characteristic.

In accordance with Drobetz. et al., (2013) and Ferson and Harvey (1994) a set of variables related to the macroeconomic environment in Norway are included. As the target of the analysis is Norwegian publicly listed shipping companies this is considered as important variables to investigate with respect to leverage measures. The stock return represents the annual stock market return of the Norwegian market index (OSEBX). GDP growth is the aggregated growth rate in Norway, inflation is the sustained increase in the general price level of goods and services and FXNOK is annual change in the trade-weighted Norwegian krone exchange rate (TWI). The FXNOK is included to account for an appreciation or contrary depreciation of the Norwegian krone. Because the Norwegian shipping companies often trade in US dollars, this will reflect whether it will be expensive or not to invest in shipping at a given of point in time. Hence, affecting the shipping company's choice of financing. Last, a one period lagged term spread between the 10-year effective interest series and the 3-year effective interest series of Norwegian government bonds is included.

Respectively, Column 4 in table 10 elucidates the results when including the macroeconomic variables to the standard leverage regressions. It is thus detected that the variable term spread has significant explanatory power at 10% towards the dependent variable book leverage. According to Dahlquist and Harvey (2001) a low term spread can be considered as an indication of recessions. The inverse relationship between book leverage and the term spread is thus consistent with the counter-cyclicality nature of the leverage measure, as discussed above. Furthermore, the variable for stock market returns has significant explanatory power towards the dependent variables in Norwegian shipping companies. The following inverse relationship thus indicate that when stock market returns is high the Norwegian shipping companies tends to have lower leverage ratios. Indeed, the explanatory variable decrease book leverage and market leverage about 6.2 and 6.5 percentage points respectively. This is explained by the fact that issuing equity is more favorable compared to debt, as a result of high returns. Consequently, in favor of the market timing theory. Furthermore, because high returns indicate that the Norwegian shipping companies are valued

higher and that the equity is used to finance new assets this indicates that the total amount of assets will increase. Hence the ratio of debt to assets would decrease.

Lastly, a set of variables particularly relevant in the shipping industry is included. The freight rate variable is the annual change in the Clarksea index, which is a weighted average index of earnings for the main vessel types. Secondhand values represent the annual change in the Clarkson secondhand price index, and oil price is the annual change in the brent crude oil price. Column 5 in table 10 illuminates the results after including the variables related to the shipping industry. High oil prices are often correlated with a booming industry. Thus, this would indicate that companies lower their leverage ratios when the oil price is high, and that the crude oil has an inverse relationship with leverage. However, this variable does not obtain any explanatory power over leverage measures for Norwegian shipping companies. Accordingly, secondhand values is the only variable accounting for the shipping industry that is proven to significantly explain the leverage measures. Hence, secondhand values are determined to have an inverse relationship to leverage in Norwegian shipping companies. Comparatively, Drobetz et al., (2013) predicts an inverse significant relationship between leverage measures and secondhand values. Further, they underline that this result seems strange based on the fact that vessels serves as collateral in mortgage backed bank loans, and therefore contribute to higher leverage capacity. This can be withdrawn to the study of Norwegian shipping companies, where the intuition would have been that secondhand values should have had a positive relation to leverage measures, due to mortgage backed bank loans increasing the value of debt as documented by Drobetz et al., (2013).

However, by observing the results obtained in column 4 and column 5 it is detected that oil price, freight rates, GDP-growth, inflation and FXNOK do not have significant explanatory power over leverage measures for Norwegian shipping companies. These results contradict to those found by Drobetz. et al., (2013), where several of the macroeconomic variables show significance, indicating that the variables are lost due to estimation error. However, in line with Drobetz. et al., (2013) findings of the total impact by including these variables, the additional explanatory power by introducing the macroeconomic variables is very low measured by the slightly increase in the adjusted R square.

7.7 Standard corporate performance regressions

In this section, we investigate the effect of leverage on corporate performance. The measures return on assets (ROA) and return on equity (ROE) are included as dependent variables. ROA and ROE are extracted directly from the Bloomberg Database, and is calculated as net profit to total assets and net profit to common shareholders equity. The set of the firm specific variables conducted in the standard capital structure regression are used as independent variables. Furthermore, the corporate performance measures are investigated through an OLS regression and a FE regression model with both firm fixed and year fixed effects. Book leverage is applied as the dependent variable in this analysis to capture the effect of leverage. Equivalent with earlier findings the explanatory power increases when fixed effects is added to the regression.

Table 11. Standard corporate performance regressions.

Dependent variable	ROA		ROE	
Book leverage	-0,149***	-0,084*	-0,342***	-0,398**
	(0,029)	(0,045)	(0,111)	(0,174)
Tangibility	-0,057	-0,167***	-0,062	-0,161
	(0,039)	(0,061)	(0,073)	(0,137)
Market-to-book	-0,027	-0,067	0,116***	0,183**
	(0,033)	(0,042)	(0,041)	(0,077)
Profitability	1,396***	1,449***	2,199***	2,168***
	(0,287)	(0,241)	(0,266)	(0,259)
Firmsize	-0,011*	-0,011	0,007	0,118**
	(0,005)	(0,013)	(0,012)	(0,047)
Operating leverage	-0,096***	-0,105**	-0,114*	-0,387**
	(0,028)	(0,046)	(0,066)	(0,163)
Assetrisk	0,002	0,001	0,004	0,045*
	(0,009)	(0,110)	(0,015)	(0,026)
Dividend payer	-0,034*	-0,020	0,022	0,011
	(0,019)	(0,125)	(0,027)	(0,032)
Firm fixed effects	no	yes	no	yes
Year fixed effects	no	yes	no	yes
Observations	244	244	244	244
Adj R2	0,779	0,809	0,575	0,620

The table elucidates the results from an OLS regression and a FE regression with both firm fixed and year fixed effects, on both performance measures. The sample consists of 16 publicly listed Norwegian shipping companies during 2000-2019. All data are

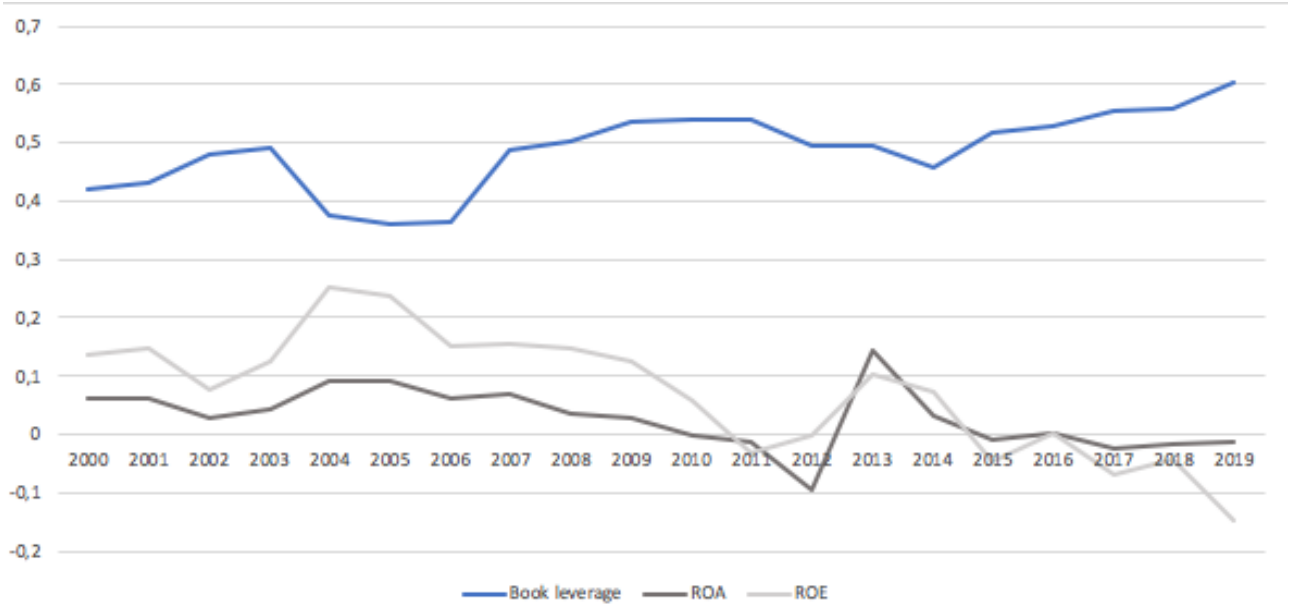
obtained from the Bloomberg Terminal. Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign; ''.*
** Statistical significance at 10 percent level*
*** Statistical significance at 5 percent level*
**** Statistical significance at 1 percent level*

As expected, leverage show a strong negative relationship to corporate performance across both definitions in the fixed effect regression (see also figure 6). The observation indicates that companies with lower leverage ratios perform better than those with higher leverage ratios. In other words, increased leverage is accompanied by higher costs of financial distress, and as such, lower ROE and ROA. This is consistent with the conjecture that significant indirect costs of financial distress associated with higher leverage are considered more expensive than too little debt financing (Gonzáles, 2013; Opler and Titman, 1994). Moreover, Myers (1977) underlines the underinvestment problem, where higher leverage might increase agency costs of debt, and thus lead to weaker corporate performance. We find no evidence for the use of leverage in order to mitigate the free cash flow problem. This can be reasoned with the fact that publicly listed companies often use performance shares rather than debt capital as a tool to reduce agency problems. Furthermore, Gonzáles (2013) postulate that the costs of financial distress are greater than the disciplinary role of debt in developed economies. He also underlines that countries with strong shareholders rights and a solid legal system exhibit a negative relationship between leverage and corporate performance, in particular during economic downturns. Therefore, the benefits of debt capital are less relevant when other control mechanisms are effective (Gonzáles, 2013). On the other side, the findings might imply that the typical Norwegian shipping company fail to adjust their leverage ratio according to the development in the business cycle, but rather exploits the increased lending options during market expansions. As a result, companies that employ a more conservative financing policy throughout the business cycle, generally perform better than their peers even in non-distress situations (Gonzáles, 2013).

Not surprisingly, issuing debt will have a larger impact on ROE than ROA. ROE is denominated by equity, and a rise in leverage is accompanied by a relative decrease in equity, consequently boosting ROE. Simultaneously, a rise in debt is considered to be reflected through total assets, thus also decreasing ROA.

Higher amounts of tangible assets are expected to have an inverse effect on corporate performance, as indicated by the negative coefficient. This relationship is explained by Margaritis and Psillaki (2009), which suggest that tangible assets reduce growth opportunities, and thus, also agency costs. Not surprisingly, profitability is positively related to corporate performance, indicating that increased profitability has a positive effect on firm efficiency. Firm size exhibits a significantly negative relationship to ROA. In general, size should be considered to impact corporate performance positively in developed economies as a result of economies of scale and entry barriers (Lee, 2009). However, this observation is consistent with the findings for tangibility. Firm size is a positive function of total assets, thus indicating that larger more established companies face less costs associated with agency problems. Asset risk exhibits small significant impact on corporate performance. The coefficient suggest that more volatile assets affect corporate performance negatively. Last, dividend paying companies tend to have a positive effect on ROE. This can be explained by the fact that dividend policy can contribute to reduced asymmetric information.

Figure 6. Corporate performance measures over the sample period.



The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal. ROA is measured as the ratio of net profit to total assets. ROE is measured as the ratio of net income to total equity. Book leverage is measured as the ratio of total debt (short- and long-term debt) to book value of assets.

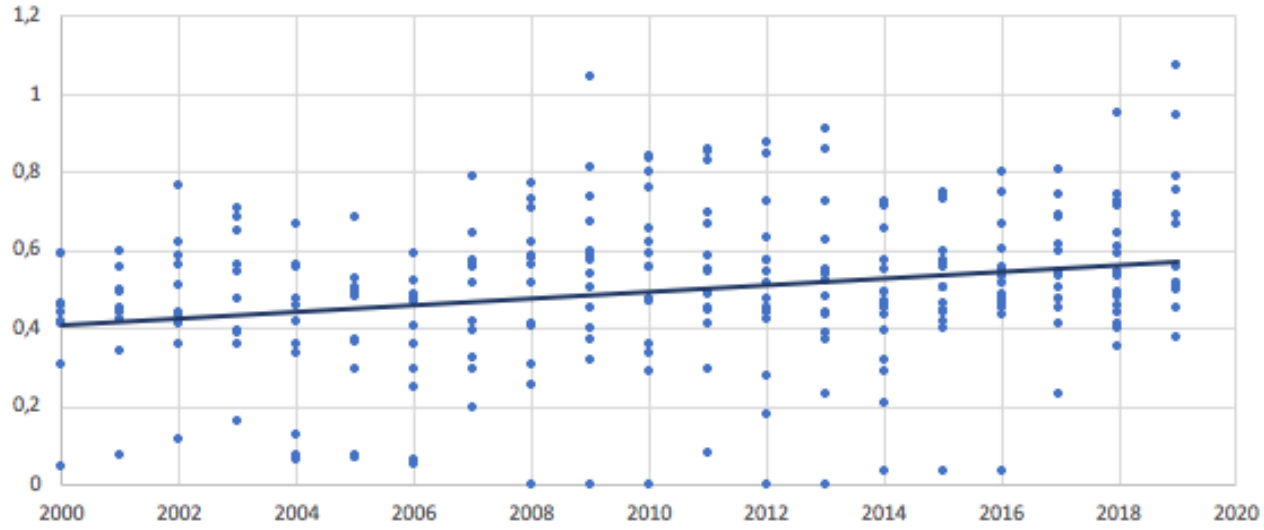
Figure 6 displays the development of book leverage and the corporate performance measures across the sample period. The leverage is significantly negatively correlated to corporate

performance. This observation is consistent with the pecking order theory, suggesting that financing with internal funds is sufficient for companies with strong corporate performance. Simultaneously, less profitable periods of the shipping industry are accompanied by higher levels of leverage as internal funds do not cover investments in new capacity. This conjecture is further elaborated in chapter 7.9.

7.8 Do Norwegian shipping companies follow a target leverage ratio?

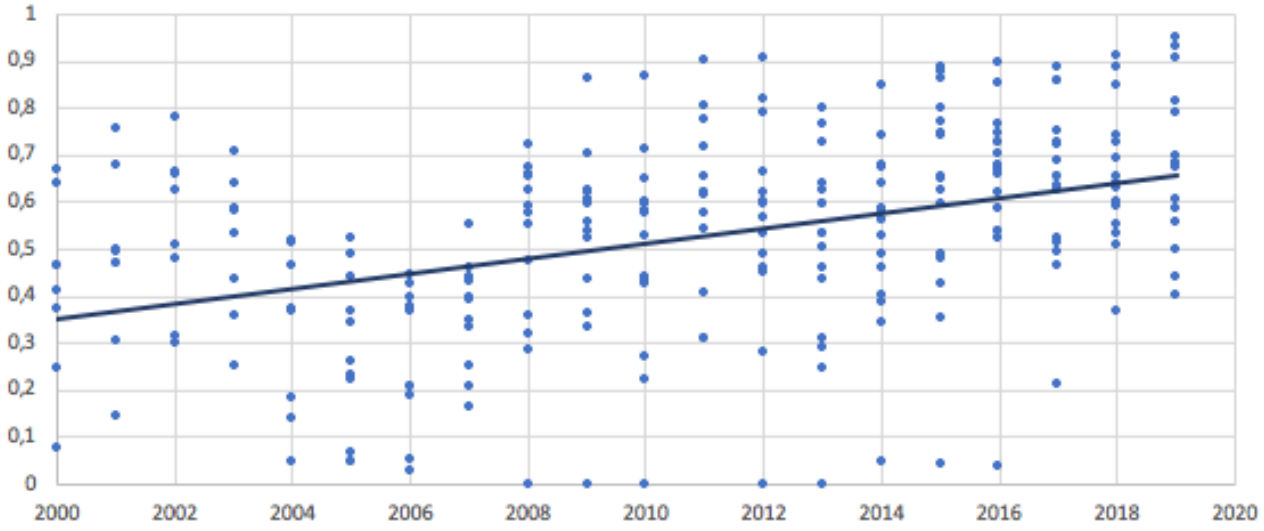
The empirical findings in this analysis indicate that leverage ratios in the Norwegian shipping industry are reliably determined by a set of firm specific and macroeconomic variables. As outlined in chapter 11.1, the considerably strengthened explanatory power of the OLS regression with firm fixed effect model specification implies that an unobserved time-invariant component remarkably drive the leverage ratio. Accordingly, the figure 7 suggests that the Norwegian shipping companies are driven by an upward time-trend, and thus appear to follow a time-varying target leverage ratio. Target leverage ratio is the level of debt the companies wish to exhibit expressed as a percentage of total assets, and represents the best value of financial leverage. From the Fisher-test with conducted augmented Dickey-Fuller unit-roots in chapter 6.2, it is concluded that the leverage ratio is not stationary when removing the underlying trend. Hence, the regression model is investigated through a cointegration test on the non-stationary variables for market leverage and book leverage. As determined in chapter 10.2 all tests conclude that the regression model is confirmed to exhibit an equilibrium relationship that determines a long-term behavior in the time series.

Figure 7. Scatterplot Book leverage.



The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal. Book leverage is measured as the ratio of total debt (short- and long-term debt) to book value of assets.

Figure 8. Scatterplot Market leverage



The data sample consist of 16 listed Norwegian shipping companies obtained over the period 2000 to 2019. All data are obtained from the Bloomberg Terminal. Market leverage is measured as the ratio of total debt (short- and long-term debt) to market value of assets.

Targeting an efficient level of leverage is key in order to preserve both operational and financial flexibility at attractive cost of capital, most recently addressed by Terje Iversen (2019), CFO at Odfjell SE, stating that *"achieving an optimal capital structure to ensure strong cash flows in any market is*

a priority after achieved operational competitiveness in recent years". He further emphasizes the importance of an optimal capital structure in connection with the industry's cyclical fluctuations, noting that *"we are exposed to cyclical downturns with returns in line with the industry, but the downturn has disconnected our leverage from historical levels"* continuing *"alongside a substantial increase in our cost of capital"* (Iversen, 2019). In light of the underlying market fundamentals and the current pressure on secondhand values the company target to reduce leverage going forward in order to *"retain leverage capacity for cyclical downturns and investment opportunities"* (Iversen, 2019). The long-term target leverage is further highlighted to directly translate to the ability to deliver sustainable cash-flow generation across all stages of the business cycle.

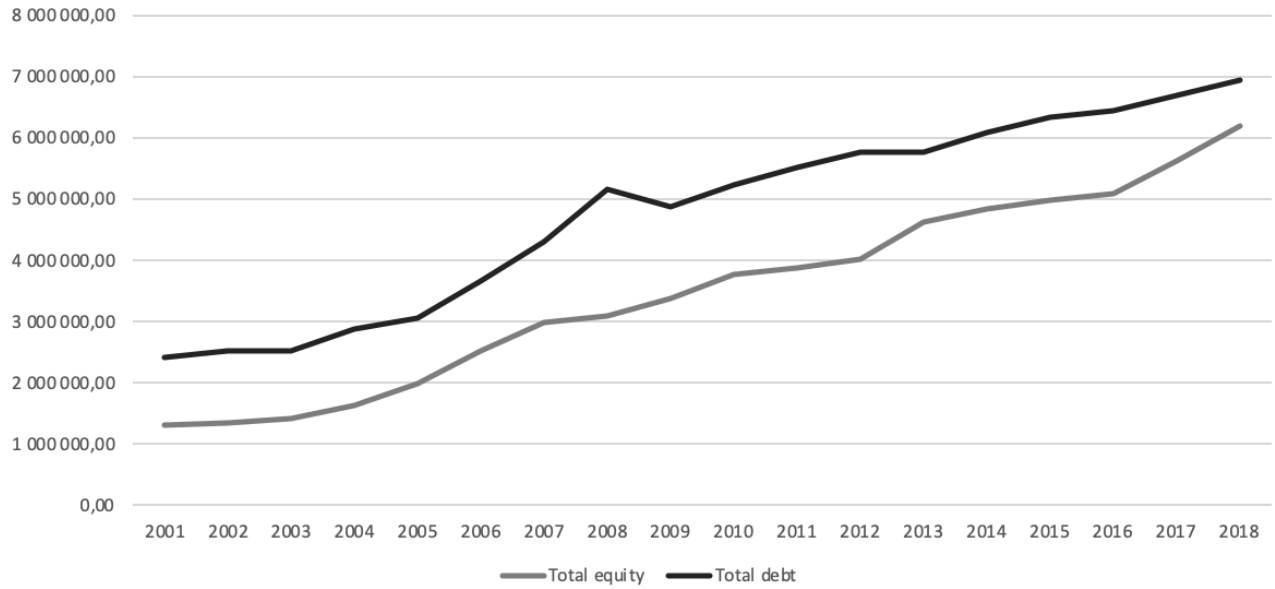
According to the trade-off theory the companies weight the costs against the benefits of having leverage, and hence it exists a target leverage ratio. The trade-off theory further predicts that deviation from the target leverage ratio negatively impact company value. Following, companies that exhibit leverage ratios that closely follow the target leverage tend to be more likely to maximize shareholder value (Modigiliani and Miller, 1958; Myers 1977). In the contrary, companies that largely deviate from the target are subject to higher financing costs and bankruptcy risk. This mechanism is supported by Graham and Harvey (2001) study where a strict target debt ratio or a target range for debt-equity ratios was claimed by 81% of the companies investigated. However, even though there has been extensive research investigating leverage movements, the focus on the reflection of the deviation from a stable target is evident (Cook, et al., 2016). Findings by Dudley (2012) support the existence of the trade-off theory and underline that companies adjust their leverage ratios during the investment period. In line with the research on deviation from a stable target Dudley (2012) finds that as firms growth options are being transformed into assets in place, the target leverage expands during the financing period. Respectively, the research by DeAngelo and Roll (2015) investigate the stability of corporate capital structures. Their main finding is that firms leverage ratios in a time series change over time. Indicating that the leverage ratio is important at each point in time, but the way in which the leverage ratio matters adjusts. *"In this case, the challenge for researchers is to identify the factors that generate substantial time series volatility in target ratios."* (DeAngelo and Roll, 2015, p. 27). Furthermore, it is detected that leverage cross-sections differ in periods of more than a few years with divergent growing each year. In the case

where there is almost zero similarity in cross-sectional snapshots across time, the leverage is stabilizing or reverting. Additionally, the findings of stable regimes over longer periods seems to be far less common. A stable regime is often identified in periods of low leverage. Withdrawing this to the study for the Norwegian shipping companies, it is expected that the leverage ratio on average is higher compared with other industries, as a result of the findings of the shipping industry being highly leveraged. Contrary, research conducted by Chen and Zhao (2007) investigate the presence of a mechanical mean reversion of leverage ratios. This concept contradicts the presence of a target leverage ratio and states that the companies would eventually revert to the mean, independent on a target leverage ratio. The findings of this research are ambiguous, but do not manage to completely determine that the presence of a target leverage ratio is not evident. Hence, several of the evidences still support the existence of a target leverage ratio.

Given the fact that our research is conducted on a panel data ranging over 19 years it is in accordance with the findings by DeAngelo and Roll (2015) about stable regimes expected movements in the target leverage during the sample period. Titman and Wessels (1998) document several factors indicating that both small and large firms have tendencies to be highly leveraged. The fact that large firms are less prone to bankruptcy as a result of being more diversified, suggest that large firms are highly levered compared with smaller firms. However, findings suggest that firm size is associated with the cost of equity securities and the issuance of debt. Following, small firms tends to pay more to issue long-term debt and new equity compared with larger firms. Indicating that small firms are considered to use short-term borrowing as bank loans to decrease the costs of issuing debt. Thus, argues in the favor of small firms being more leveraged than larger firms. Appendix 20 illustrates that the smallest companies in our sample exhibit the largest mean leverage ratios of 54.5% for book leverage and 57.4% for market leverage. Additionally, our sample of medium and large companies exhibit mean leverage ratios at 49.1% and 45.3% for book leverage and 50.0% and 49.7% for market leverage respectively. Not surprisingly, the average leverage ratio rises by almost 20 percent during the sample period, indicating an upward trend as elucidated in figure 7. In line with DeAngelo and Roll (2015) the level of market leverage varies more than book leverage throughout the investigated period. The rise in the average leverage ratio during the sample period can be explained by open capital markets, falling interest rates and monetary policy.

In general, companies today have greater access to debt, and there is a larger circulation of capital in the world economy. Hjelseth and Solheim (2020) argue that, typically, access to debt capital will grow as the economy grows, thus foster further growth. It is the richest countries that typically have the highest debt levels. At the same time, we know that high debt involves risk. Historically, there is a close relationship between periods of particularly high debt growth and financial crises. The International Monetary Fund (IMF) argues that more debt is a good thing - to a point. If the debt becomes too high, it can increase the vulnerability to negative financial impacts (Hjelseth and Solheim, 2020). Norway is a rich country with a well-developed financial system and well-functioning debt markets. According to surveys conducted by Norges bank (2020), Norwegian non-financial companies stands out with having substantial higher total debt levels compared to the average across the Nordic region and the countries in the Euro area. Figure 9 enlighten that the increase in leverage in the overall Norwegian market is in accordance with the characteristics mentioned above. Additionally, Hjemdal (2020) emphasizes the availability of shipping companies to benefit from the Asian market. Several leasing institutions and funds have emerged in recent years that offer shipowners an increased debt ratio, but often at a slightly higher price. Particularly through the increased use of leasing institutions in China during the last years, partly offsetting the use of traditional bank lending to gain capital. Another interesting observation is that China EXIM Bank has taken over as the largest lender in shipping. Geographically, Asia is probably the most important and most active capital source for shipping today. The fact that Asia is now considered a great provider to the shipping market may be explained by the essence that they were not present during the financial crisis in 2008, hence not exposed to the considerable losses experienced by the providers evident in the following period (Hjemdal, 2020).

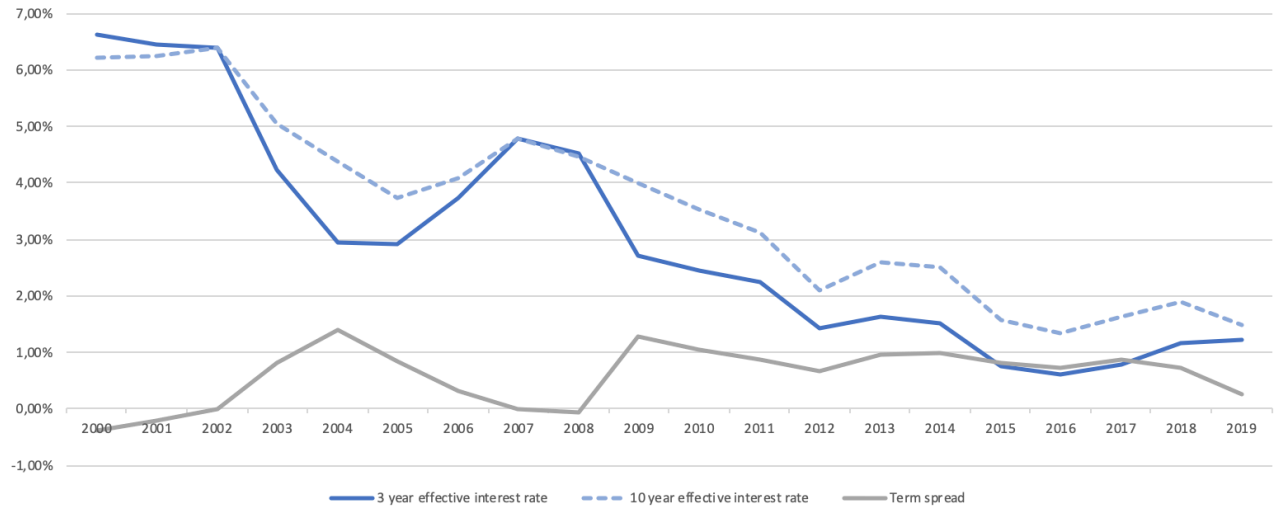
Figure 9. Development in debt and equity



The figure elucidates the development in debt and equity for Norwegian non-financial corporations in all industries from 2001-2019. The data are obtained from ssb.no (statistisk sentralbyrå).

Open capital markets increase the company's possibilities for raising capital, and to which extent the capital can be raised. Further, open capital markets affect financial stability and ensures economic growth (Committee on the Global Financial System, 2019). The fact that the capital is now moving freely across national borders between economies throughout the world can explain the rise in the average leverage ratios. Debt financing may be easier to obtain today than in 2000 as a result of new financing sources and a larger financing base. Even though open capital markets have been evident in a long time, they have been increasing the last years. Exemplified by the introduction of an alternative marketplace in 2005, at Oslo Børs, making the bond market more accessible. Where trading bonds and short-term debt instruments and listing are possible actions (Oslo Børs, 2013). This is further emphasized by Bente Landsnes, President and CEO of Oslo Børs; *"We are experiencing a lot of interest from foreign companies. Many companies, both Norwegian and international, are knocking on our door with plans for a listing in Oslo."* (Oslo Børs, 2013). Even though this statement highlights the increased interest from foreign companies to be listed, it also incorporates the fact that open capital markets are more evident. Additionally, the use of capital markets have remarkably increased throughout the sample period (Hjemdal, 2020).

Figure 10. Interest rates during the sample period



The figure exhibits the short-term interest rate, long-term interest rate and the term spread during 2000-2019. All data are obtained from Norges bank. Term spread is calculated as the difference between the 10- year effective interest rate and the 3-year effective short-term interest rate.

By investigating the variable conducted for term spread (figure 10), it is determined that the majority of years during the sample period is categorized by a positive term spread. Indicating that the long-term interest rate is higher than the short-term interest rate, resulting in a normal yield curve. A normal yield curve is determined by long-term yield being higher than short-term yield, indicating that you are expecting higher earnings for the amount lend (CFI, 2020). Hence, the banks are more willingly to issue long-term debt to shipping companies, because the potential return is higher. However, the priority of issuing long-term debt is dependent on the banks' optimization problem. The banks are more willingly to issue long-term debt in the event of potentially higher return, and if they are confident on being repaid. Furthermore, the overview of the 3-year and 10-year interest rate illuminated in figure 10 for Norwegian government bonds indicate that the Norwegian economy is exposed to falling interest rates throughout the investigated period. Reducing from approximately 6.0% in 2000 to approximately 1.3% in 2019. Hence, partly explaining the rise in leverage ratio during the sample period, as a result of shipping companies being able to utilize debt in a higher degree as a result of the falling interest rate. However, chapter 11.6 The impact of macroeconomic factors, slightly contradicts the impact by term spread on the investigated leverage measures. As mentioned, the variable only has significantly explanatory power at 10% towards book leverage (see table 10 column 4). Contrary, the detected inverse relationship between term spread and the dependent variable indicate that in periods of recession the leverage measures

should increase, as a result of the counter-cyclical nature of leverage measures. Thus, this implies that falling interest rates increases the target leverage ratio. The final factor in explaining the increasing trend in leverage ratios is monetary policy. Quantitative easing is a monetary policy used by central banks to stimulate the economy, when the tool of reduced interest rates is already been used. In this way increasing the presence of investments and spending in the economy (Norges Bank, 2020). Although this tool is available in the monetary policy in Norway, the economic conditions has not required the use of quantitative easing yet. However, the policy rate is highly used as monetary policy in Norway to prevent huge downturns in the economy by stabilizing the inflation and keeping it low. The use of the policy rate is further affecting the interest rates (Norges Bank, 2020). Monetary policy is thus beneficial for the Norwegian shipping companies because it stimulates the availability for potential financing sources in the economy.

However, there is expected to be evident a target leverage ratio that Norwegian shipping companies tends to move towards over time. As determined by DeAngelo and Roll (2015) the leverage ratios vary over time, but there still exists a target leverage ratio at each point in time. Further, as mentioned in the event of almost zero similarity in cross-sectional snapshots across time, the leverage is stabilizing or reverting. Hence, the trend observed in the leverage measures is not expected to remain in infinity. The detected increase in the average leverage ratio of 20 percent imply a 1 percentage point increase each year. This would have indicated that if the trend is followed further the average leverage ratio would eventually end up at 100 percentage points, or even higher. It is unrealistic that the average leverage ratio of the Norwegian shipping companies thus follows this development, indicating that the companies are fully leveraged. YEO (2016) investigated top 130 shipping companies leverage measures with respect to solvency and liquidity ratio. The main findings from the research is that leverage is closely related to the liquidity of the shipping companies. Furthermore, evidence implies that lower cash holdings is often followed by higher leverage. Moreover, the degree of leverage is determined by the company's ability to cover the interest payments. If the company's easily can cover these, it is considered to be an efficient amount of leverage (Simply Wall St, 2019). Additionally, Hjemdal (2020) states that it is impossible for the Norwegian shipping companies to be completely financed by debt, as a result of equity being necessary to obtain financing. Thus, emphasizes the impossibility of following the observed trend in

indefinitely. Contrary, the fact that there is small similarity in the cross-sectional snapshots across the last 19 years indicate that the leverage ratio will eventually revert or be stabilized. Additionally, the confirmed long-term equilibrium relationship of the leverage measures indicate that the companies follow a target leverage ratio, even though it differs throughout the sample period. The presence of falling interest rates would eventually reach its limit. Nevertheless, open capital markets and monetary policy would not drive the target leverage in infinity as they are already largely present in the global market today. Hence, the increase in the leverage ratio would reach a point where the leverage ratio cannot increase further and the observed trend will experience a break.

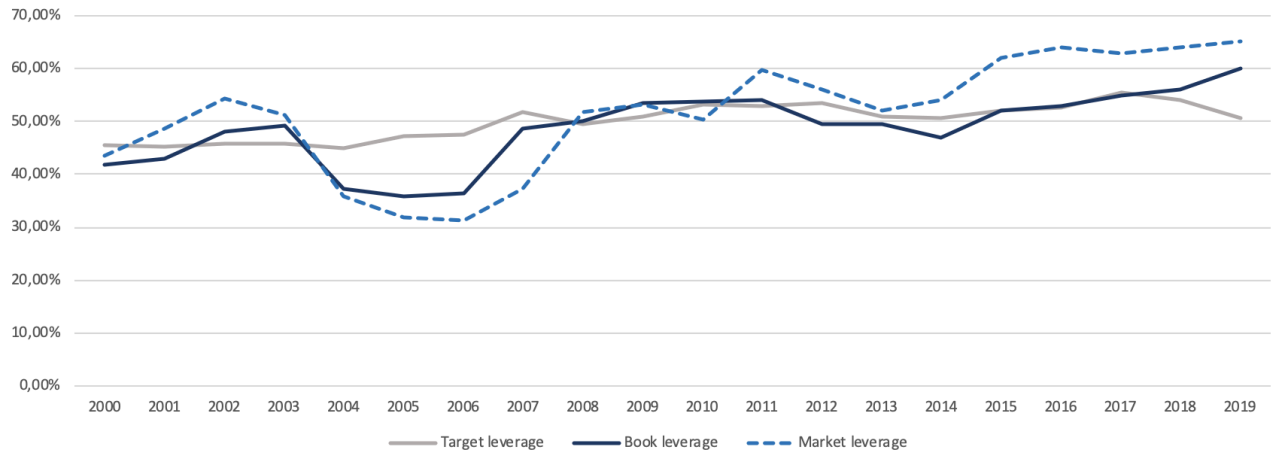
A new long-term leverage ratio would thus be categorized by a leverage ratio still ranging at high levels of leverage, as detected by the observed trend. The high levels of leverage can also be reasoned with the fact that publicly listed companies have easier access to Asian capital due to fleet size, additionally lower entry to the bond market. Finally, the changes in the universe of capital sources during our sample period increase the companies access to debt (Hjemdal, 2020). Findings by Lemmon et al., (2008) exhibit that target leverage ratios show evidence of convergence over time. Firms with high leverage is therefore expected to move towards more moderate levels of leverage. Contrarily, apart from the convergence, firms leverage ratios tends to be surprisingly stable over time. Hence, firms with high leverage thus tends to be characterized by this over a long period, up until two decades. By investigating our sample, the companies exhibiting high levels of leverage in 2000 also exhibit this in 2019 (appendix 3). Relative to the current economic environment, the average Norwegian shipping company is thus categorized by being highly leveraged. This can be explained by the facts mentioned above currently describing the financial market and the availability of financing sources. The presence of a shock or an eventual downfall in the global economy or the Norwegian industry would thus affect the shipping companies leverage ratios over time, as the presence of the financial crisis in 2008. The fact that the detected trend is ranging over a period of 19 years make it applicable to incorporate different business cycles over time, and hence the trend is considered robust to use as a benchmark for further leverage ratios. The average ratio of debt to total asset is thus expected to somewhat continue to follow the observed trend in the future. However, it is expected that the leverage ratio will revert towards the end of 2019, and thus start over again at a lower level of leverage in periods following our sample

period. Hence, the leverage ratio is not expected to range at higher levels than the current observed ratio.

7.9 Target leverage and speed of adjustment analysis

The speed of adjustment analysis aims to account for the rate at which the market reacts to economic changes. Hence, in order to estimate the companies speed of adjustment back to the target capital ratio the dynamic of capital structure choices is analyzed. In recent empirical studies this type of dynamic analysis has gained prominence. Huang and Ritter (2009) addressed it as *"the most important issue in capital structure research"*. All estimators presented in chapter 3.1 are applied in order to obtain a comprehensive analysis. These estimators are; ordinary least squares (OLS), fixed effects (FE), Arellano and Bond (AB), Blundell and Bond (BB) and the dynamic panel fractional (DPF) as in Drobetz et al., (2013). The standard capital structure determinants and the one period lagged leverage ratio are used to model the target leverage ratio following the partial adjustment model proposed by Flannery and Rangan (2006) and Drobetz et al., (2013). Figure 11 displays the target book leverage ratio during the sample period based on the DPF estimator.

Figure 11. Target leverage over the sample period



The figure elucidates the target leverage, book leverage and market leverage during 2000-2019 for 16 publicly listed shipping companies. Target leverage is modeled through the use of the results from regression 5 in table 12 with the DPF estimator for book leverage.

The target leverage ratio is relatively stable over the sample period, reporting only a minor increase of approximately 5 percentage points. From a trade-off perspective, the leverage ratio of over-levered companies is expected to fall during the adjustment process back to the target ratio, and

vice versa (Flannery and Rangan, 2006). The classical view on leverage decisions suggest that the target leverage ratio balance the risk of bankruptcy with the benefits of tax from debt capital. The average leverage ratio strongly deviates from the target between 2004 and 2006. This period was embossed by an extremely beneficial economic environment, consequently significantly reducing the risk of insolvency. Solid levels of retained earnings contributed to a relative devaluation of debt, thus setting the average Norwegian shipping company in an under-levered position with respect to the target. From a pecking order perspective, the deviation in leverage can be explained by increased corporate performance, as disclosed in chapter 7.7, consequently making the companies independent on debt financing in order to cover capital investments.

However, for the main part of observation years, the leverage ratio moves relatively close to the target leverage, indicating lower deviation. This can be explained by less volatile macroeconomic conditions, making the companies level of leverage more stable. Myers (1977) argue that both over- and underleveraged companies might suffer from financial risk, impending growth potential and compromised debt capacity (Alexandridis, et al., 2020). On one side, overleveraged companies are subject to direct financial cost in connection with insolvency. On the other hand, under-levered companies might suffer from missed growth options as a result of underinvestment and extremely conservative debt policies, setting them in a disadvantageous competitive position (Binsbergen, et al., 2010). Also worth noting, overleveraged companies might suffer from missed growth potential as a result of financial restrictions (Kayhan and Titman, 2007). Moreover, Binsbergen, et al., (2010) find evidence that the cost of being over-levered is more pronounced. The average Norwegian shipping company are for negligible small periods of time marginally deviating above the target, suggesting limited overleverage across the sample period. Figure 11 elucidates that cost of financial distress is considered to forego the potential benefits of debt in Norwegian shipping companies.

From a trade-off perspective, deviation from target is in general considered to negatively affect firm value as the companies fail to benefit from the optimal trade-off between risk and leverage. However, from chapter 7.7, we know that the period between 2004 and 2006 exhibit the highest corporate performance across the sample period. Simultaneously, this period is in figure 11 characterized with large deviations below the target. One could argue that the corporate

performance potentially could be increased further during this period through the use of more debt financing. Both corporate performance and leverage highly correlate with the macroeconomic environment, and as such, the actual relationship might be suppressed. Martin Hjemdal (2020) argue that deviation from target not necessary negatively impact the companies as higher leverage implies higher risk and often weaker market conditions. In addition to this, as discussed earlier, the largest deviation is caused by the global shipping boom and shipowners' inability to immediately refinance due to significant time-lags in connection with upsurge in demand. As addressed by González (2013) high leverage might have a limiting effect on companies during economic downturns. Companies with already weak performance, and thus often high leverage, will be forced to utilize debt capital in order to keep the business running. Likewise, by investigating figure 6 and figure 11 weak corporate performance is observed to correlate with deviations above the target, and visa versa. Prior literature confirms this relationship, and document that beyond a certain threshold, higher leverage hampers the companies' capability to raise capital (Alexandridis, et al., 2020). According to Agyei-Boapeah, et al., (2018), deviation from the target leverage ratio implies managerial inefficiency as managers have the responsibility over financing decisions. Otherwise stated, efficient managers that aim to maximize long-term firm value are expected to follow the target leverage ratio by minimizing cost of financing (Alexandridis, et al., 2020).

As in Drobetz et al., (2013), an interaction term between the Norwegian recession dummy variable and the one period lagged leverage measure is constructed and included in the regression model. This is done to particularly investigate the speed of adjustment during periods of recession, and account for the variations in the speed of adjustment during different stages of the shipping cycle. Table 12 summarize the results of the estimated partial adjustment models. The speed of adjustment is estimated by subtracting the coefficient on the lagged leverage ratio from one. The adjustment speed estimate can be converted into half-lives of the impact of a shock on the capital structure, illustrating the time required to reduce to half of its initial value of leverage. These half-lives are calculated as log (0.5)/log (1 - λ). The λ represents the adjustment speed estimate.

Table 12. Dynamic partial adjustment regression.

	[1] OLS	[2] FE	3 [AB]	[4] BB	[5] DPF
Dependent variable: Book leverage					
Book leverage t-1	0,740***	0,543***	0,393***	0,467***	0,656***
	(0,075)	(0,070)	(0,510)	(0,049)	(0,054)
Book leverage t-1 * Recession (NO)	0,068**	0,081***	0,083***	0,104***	0,078**
	(0,027)	(0,023)	(0,029)	(0,027)	(0,031)
SOA(%)	26,0	45,7	60,7	53,3	34,4
SOA-recession(%)	19,2	37,6	52,4	42,9	26,6
Tangibility	0,151***	0,213**	0,160**	0,216***	0,178***
	(0,056)	(0,087)	(0,063)	(0,065)	(0,051)
Market-to-book	0,077*	0,049	0,021	0,04	0,082***
	(0,042)	(0,034)	(0,028)	(0,028)	(0,026)
Profitability	-0,021***	-0,128	-0,199***	-0.271***	-0,282
	(0,079)	(0,093)	(0,077)	(0,083)	(0,106)
Firm size	0,027***	0,058***	0,085***	0,066***	0,046***
	(0,008)	(0,147)	(0,015)	(0,142)	(0,011)
Operating leverage	0,058*	0,103	0,178***	0,069	0,093*
	(0,033)	(0,102)	(0,065)	(0,061)	(0,051)
Dividend payer	-0,027*	-0,048**	-0,054***	-0,065***	-0,030*
	(0,015)	(0,020)	(0,016)	(0,016)	(0,016)
Asset risk	-0,012	0,010	-0,006	-0,000	-0,001
	(0,011)	(0,010)	(0,021)	(0,022)	(0,022)
Observations	236	236	218	236	236

Dependent variable: Market leverage					
Market leverage t-1	0,715***	0,458***	0,408***	0,410***	0,513***
	(0,056)	(0,043)	(0,038)	(0,036)	(0,047)
Market leverage t-1 * Recession (NO)	0,076**	0,069**	0,069***	0,084***	0,066**
	(0,035)	(0,028)	(0,027)	(0,021)	(0,032)
SOA(%)	28,5	54,2	59,2	59,0	48,7
SOA-recession(%)	20,9	47,3	52,3	50,6	42,1
Tangibility	0,160***	0,218**	0,217***	0,254***	0,169***
	(0,052)	(0,096)	(0,056)	(0,054)	(0,048)
Market-to-book	-0,090***	-0,204***	-0,265***	-0,273***	-0,175***
	(0,034)	(0,046)	(0,026)	(0,025)	(0,029)
Profitability	-0,159*	-0,071	-0,080	-0,100	-0,147
	(0,081)	(0,070)	(0,069)	(0,071)	(0,092)
Firm size	0,031***	0,066***	0,073***	0,063***	0,061***
	(0,008)	(0,016)	(0,012)	(0,011)	(0,011)
Operating leverage	0,088***	0,147	0,217***	0,205***	0,185***
	(0,033)	(0,103)	(0,059)	(0,055)	(0,043)
Dividend payer	-0,007	-0,042*	-0,037**	-0,050***	-0,021
	(0,073)	(0,212)	(0,014)	(0,014)	(0,170)
Asset risk	0,018	0,019*	0,017	0,025	0,013
	(0,013)	(0,001)	(0,019)	(0,019)	(0,022)
Observations	230	230	212	230	230

The table summarize the speed of adjustment for the dynamic partial adjustment regressions. The sample consists of 16 publicly listed Norwegian shipping companies during the period 2000-2019. All data are obtained from the Bloomberg Terminal. Column 1display the standard ordinary least squares method (OLS). In column 2 the results obtained by estimating the model using firm fixed effects (FE) are reported. The results in Column 3 is estimated using the Arellando Bond (1991) difference generalized method of moments (AB). For Column 4, the Bundell and Bond (1998) system generalized method of moments (BB) is applied. Column 5 show the estimated results using Elsas and Florysiak (2010) dynamic panel fractional estimator (DPF). Row number 2 and 3 display the percentage values for the speed of adjustment (SOA) and speed of adjustment during recessions (SOA-recession). Standard errors are shown in parentheses, and the significance of each variable towards the dependent variable are shown by use of the following sign; ''. Definitions of variables is shown in appendix 2.*

** Statistical significance at 10 percent level*

*** Statistical significance at 5 percent level*

**** Statistical significance at 1 percent level*

As Drobetz et al., (2013) this analysis focus to provide a general picture of the speed of adjustment. The coefficient on speed of adjustment show great variety across the different estimators, ranging between 26.0% for the OLS estimator to 60.7% for the AB estimator in the book leverage regression. The estimates have a mean of 44.02%, and the corresponding half-live account for 1.2 years. In the market leverage regression however, the coefficient on speed of adjustment range from 28.5% for the OLS estimator to 59.2% for the AB estimator. The mean of the speed of adjustments estimates is 49.92%, which corresponds to half-lives of 1.0 years. In comparison, Huang and Ritter (2009) document that adjustment speed estimates range between 11% to 23% for US companies. As such, the results imply that shipping companies implement leverage adjustments subsequent to target

deviations distinctly faster compared to other industries. In addition to this, Drobetz et al., (2013) report a mean speed of adjustment of 40% for their sample including globally listed shipping companies. This is lower than the mean for the Norwegian shipping industry. Öztekin and Flannery (2011) find that the speed of adjustment on average is distinctly higher in Norway compared to other large shipping nations, such as Greece and Japan, due to significant differences in the countries legal and financial institutions. The adjustment speed varies plausibly with international differences in ease of access, information asymmetry, financial constraints and adjustment costs. If these findings can be generalized to the shipping industry, they can help explain the distinction in the estimated adjustment speed between the Norwegian and global shipping industry.

However, the Norwegian shipping companies have a comparatively lower speed of adjustment back to a target capital ratio during recessions compared to globally listed shipping companies. This is indicated by the difference between the coefficient on speed of adjustment and the coefficient on the interaction term. The average adjustment speed estimate in the book leverage regression is 35.74% during economic recessions. In the market leverage regression, the average adjustment speed estimate is 42.64% during periods of recession. In comparison, Drobetz et al., (2013) document a speed of adjustment mean of 37.76% for the book leverage regression and 49.6% for the market leverage regression during recessions. Additionally, in accordance with Elsas and Florysiak (2010) findings for the DPF-estimator providing the lowest bias in their US sample compared with other dynamic panel estimators, the DPF-estimator also provides lowest bias for Norwegian shipping companies.

The speed of adjustment is contingent on two factors. First, the cost associated with deviation from the target, and second, the adjustment costs back to the target leverage ratio (Drobetz et al., 2013). Thus, the cost of deviating from the target and the cost of adjustment are weighted against each other from a financial managers perspective. In the presence of high costs of adjustment, it might be cheaper for companies to not fully readjust despite the fact that their leverage ratio deviates from the target. Shipping companies are expected to face relatively high cost of adjustment and be gradual to revert their leverage ratio back to the target in the time after a shock to their leverage. This is justified by the fact that the shipping industry in general are financially constrained (see

chapter 4.5). In contrary, shipping companies tend to carry high levels of leverage, often above the target ratio, which consequently results in adverse cost of financial distress. For this reason, it is a requisite for the shipping industry to adjust to the target rapidly. The analysis does not explicitly investigate the effect of asymmetry. The results do, however, indicate that bankruptcy costs from high leveraging are more damaging for firm value in shipping companies compared to the cost associated with financing with too little debt (i.e. free cash flow problems). This is in line with the findings of Faulkender et al., (2012), which document that companies tend to deleverage fast subsequent to a market upswing, and that they on the other side subsequent to an economic downturn do not releverage with the same speed. Faulkender et al., (2012) also find evidence that constrained companies revert their leverage ratio in a more gradual speed when they are underleveraged, but adjust more rapidly when they are overleveraged. One can also rational the observation with the cyclical nature of the shipping industry characterized with long-lasting downturns in the market and high asset risk. During periods of recession, the high leverage ratios with correspondingly high levels of fixed assets execute challenges for the industry as collateral values decline and the cost of financial distress increase (see chapter 7.4). Because of this, shipping companies are pressured by their bank to quickly adjust their level of leverage back to the target ratio. The case is also illustrated in figure 11, where the leverage ratios are observed to greater deviate from the target during periods of economic expansion.

Last, the adjustment speed is expected to exhibit dependence on the business cycle, owing to the fact that adjustment to target leverage are more rapidly to implement in periods of economic expansions. The speed of adjustments state dependence is examined through the incorporated cross-product term of the one-period lagged leverage ratio and the Norwegian recession dummy variable. Coherent with earlier empirical research (Drobetz et al., 2013; Halling et al., 2012; Hackbarth et al., 2006; Cook and Tang, 2010) the speed of adjustment estimates in this analysis are observed to be considerably lower during downturns than during upturns in the market. The average adjustment speed estimate in the book leverage regression is 8.28% percentage points lower during downturns, which is indicated by the interaction term. In the market leverage regression, the average adjustment speed estimate is 7.28% percentage points lower during periods of recession. The interaction term is statistically significant for all estimators in both the book and

the market leverage regression. These results confirm the certainty that shipping is a truly cyclical industry, subject to strong business cycle dependencies. For example, default risk and the cost of debt financing is expected to rise during market depressions. During periods of recession, the liquidity in financial markets are in general low and bank tightens their lending terms, consequently limiting the capital supply. Firms are subject to increased adjustments costs and accordingly large adjustments are not considered as optimal. According to Jeon and Nishihara (2015) the capital structure is determined based on the initial state, and therefore the leverage ratio significantly deviates from the target leverage if the industry is set for a recession. The investment triggers in a recession are generally more dependent on the recovery rate cyclicality than during a market expansion. As the company receive less value given default in bad macroeconomic states, the timing of default is delayed. These arguments strengthen the conclusion that adjustment speed in Norwegian shipping companies is more rapid in robust macroeconomic states than in weak states.

Drobetz et al., (2013) document a change of 2.3% for the book leverage regression and 9.3% for the market leverage regression in the speed of adjustment during economic recession. Our result also suggest that the speed of adjustment is distinctly slower during economic recessions, with a change of 8.28% and 7.28% for the book and market leverage regressions. The results indicate that the Norwegian shipping companies to a larger extent suffer from default risk and cost of raising debt during downturns, which thus suggest larger cost of adjustment. The tighten loan activities from Norwegian banks in recent years (Hjemdal, 2020) might help explain why it is less beneficial for Norwegian shipping companies to make frequent and large adjustment in bad macroeconomic states. Drobetz and Wanzenried (2006) argue that a high speed of adjustment is amplified by a high term spread and an encouraging economic prospect.

7.10 Expected development of the target leverage ratio

For the main part of our sample period, in particular in recent years, the Norwegian shipping industry exhibits high levels of leverage. The findings question the optimality of the historical high level of gearing. On the one hand, it should be expected a decrease in the amount of debt financing, and an increase in the equity requirements in the Norwegian shipping industry. This is explained by

the facts that redeployment of commercial vessels are limited in periods of recession, and that large Norwegian banks have reduced their lending capacity towards the shipping industry.

The outlook for increased earnings from 2020 onwards was definitely present at the beginning of the year. At the same time, these encouraging prospects were badly needed for the industry which have overall been embossed by deficits since 2014 (Helseth, et al., 2020). The poor results have affected the equity to shipping companies sharply, increasing the average leverage ratio by almost 10% since 2013 (see figure 1). However, the recent Covid-19 pandemic has had major impact on the global shipping markets. World trade has remarkably decreased and is expected to do so for a long time, thus significantly decreasing the demand which the shipowners deliver. The global shipping industry is responsible for the transportation of roughly 90 percent of world trade (UNCTAD, 2017). The slump in demand have so far had a ripple effect on most shipping segments, increasing the overall uncertainty, and causing unprecedented price volatility of the underlying commodities and other shipping goods. This again has a knock-on effect on the number of cargo quotes, thus impacting fleet utilization. The deteriorating global environment is expected to be accompanied by tightened fiscal- and foreign exchange constraints over the course of the year.

Like most other industries, the shipping industry will be affected by the global slowdown in economic growth and trading activity. To predict the duration of the economic recession is difficult for several reasons. It is difficult to predict how the coronavirus and government emergency measures will develop. There was no underlying financial problem that led to the crisis, which suggest that the economy will recover relatively quickly after the pandemic. Depending on the duration of the crisis, underlying problems might develop in the industry which have historically exhibited high levels of leverage. This may affect economic growth for several years to come. The overall picture is therefore uncertain in the coming years (Helseth, et al., 2020).

The coronavirus outbreak has triggered major stock market declines worldwide, and the Oslo Stock Exchange is no exception. The coronavirus has, not surprisingly, also spelt doom for the shipping stocks, which have heavily declined. Figure 12 displays the development in the average daily stock price (see appendix 21 for the daily stock price on the individual companies). Following, the

companies' market value of equity has substantially decreased. According to Mike Patton (2020), stock values are expected to decrease further, reasoned with the tendency that stocks hit bottom in the second half of the recession. The market value of assets is a function of potential future earnings and the assets current value in the open marketplace. As such, the market value of assets is expected to substantially decrease, and for this reason the leverage ratios are expected to rise significantly. As a result of weak markets, several shipping companies are now considering several active measures in order to secure liquidity 1) recycling excess tonnage 2) redeliver excessive chartered in tonnage by early termination of contracts and 3) commencing warm and/or cold stacking of vessels. The Norwegian shipping companies estimate that they will recycle about twice as many vessels as first expected at the beginning of the year. (Norwegian Shipowners' Association, 2020). However, the secondhand price is intricately linked to the redeployability of tangible assets. Given the state of the industry, the redeployment of vessels might be limited. As emphasized earlier in chapter 7.4, tangible assets are the most significant determinant of the leverage ratio. A decrease in tangible assets should in general carry a decrease in leverage.

Figure 12. Average daily stock prices.

The figure displays the development in the average daily stock prices between 01.01.2020 until 30.04.2020. for 16 publicly listed Norwegian shipping companies. All data are obtained from Yahoo finance.

The economy slows sharply due to measures taken to curb the infection, which means significantly weaker earnings for the shipping industry. Overall, the Norwegian shipping companies expect a turnover decline of nearly 35 percent as a result of the coronavirus outbreak (Norwegian Shipowners' Association, 2020). This decline will be by far the largest in the last 15 years. Subsequently, from a pecking order perspective, external capital requirements will rise, and as such, also leverage ratios will increase. Contrary, based on the increased use of the Asian market to gain capital (as explained in chapter 7.8), the leverage ratio may be expected to decrease as a result of the Asian banks being more selective to issue debt in accordance with European banks.

Several shipping analysts have emphasized the importance of sustained trade. The shipping industry is currently embossed by surplus capacity, decreased freight rates and remarkably decreasing secondhand values. The Norwegian shipping companies report very tight capital supply, and all segments expect further deterioration of the capital supply (Norwegian Shipowners' Association). In particular, the offshore segment expects a significant decline in supply of capital in the coming months (Norwegian Shipowners' Association, 2020). According to Martin Hjemdal at Fearnley Securities, the uncertain market sentiment has made it almost impossible for all shipping companies to refinance at traditional banks and through equity capital, making many look for alternative sources of financing. He emphasizes that hedge funds currently are an active capital source that can offer high leverage ratios (Hjemdal, 2020). However, the use of alternative financing often includes a higher price tag, consequently increasing leverage ratios (Norton Rose Fulbright, 2017). There is expected an increase in debt default, and companies with limited cash holdings and high maturity debt will face challenges in connection with refunding. Shipowners are dependent on powerful government emergency measures in order to keep the propellers running. In Italia, financial liquidity support has already been granted to the shipping industry (Osler, 2020). These stimulation measures are highly necessary to keep both the economy and the shipping industry on road during the coronavirus lockdown. However, significantly raising the amount of leverage in shipping companies even more. In order to respond to the financial consequences of the coronavirus, Norges Bank cut its policy rate to 0.25 per cent on the 20 of March - the lowest level in 200 years (Kampevoll, 2020). The rationale behind this decision is to help businesses and individuals who will struggle to pay their debt obligations as a result of the decline in earnings.

Oil prices have fallen sharply in the wake of the Covid-19 outbreak. The coronavirus has decreased the demand for oil as people travel less and buy fewer goods. At the same time, oil production increased after Russia and Saudi Arabia ended in a price war. OPEC countries later agreed to reduce oil production by 10 million barrels a day (Kampevoll, 2020). Prices have remained low as the cuts hardly makes up for the reduced oil demand. These events have caused a decrease in investments from oil companies, which is an important source of demand in the Norwegian shipping industry (Helseth, et al., 2020). Helseth, et al., (2020) predicts a value creation in the Norwegian shipping industry that is significantly less optimistic than at the beginning of the year. The negative development is mainly reasoned with reduced earnings from key segments within the Norwegian shipping industry. The offshore shipping companies are currently in a challenging position. They suffer from drastically deteriorating market prospects in combination with a critical financial situation. The offshore shipping segment account for above 30% of the Norwegian industry total measured in fleet value (Norwegian Shipowners' Association, 2020). According to Helseth, et al., (2020) the capital situation can, nevertheless, generally be considered satisfactory among the Norwegian shipping companies. Declines in world trade will reduce shipping earnings in 2020, but global trade will recover at some point. The question is when rather than if. However, the current demand changes can have major impact on shipping companies as overall tonnage is finely balanced against expected trading activity, and rates will therefore fall in line with demand, resulting in double slumps in earnings during the economic downturn. Tanker shipping companies is the big exception, they have experienced strong rate growth as a result of parts of the market capacity is used as oil storage (Helseth, et al., 2020).

The crisis has tremendously hit the Norwegian economy, and Norway is for the first time since the 2008 financial crisis in risk of sinking into a recession (Holter, 2020). The Norwegian exchange rate has during the recent weeks sharply declined, and then from already historically weak levels (Kampevoll, 2020). The significant fall in Norwegian kroners leads to increased costs in connection with trading of goods abroad. As accounted for earlier, the leading currency in the shipping industry is US dollars, and thus a depreciation in the Norwegian krone against US dollars implies higher cash flows from operations for the Norwegian shipping companies. This is because earnings are

generated in US dollars, and large amounts of the costs are in NOK. At the same time, Norwegian shipping companies will experience a relative increase in secondhand prices, which show an inverse relation to the leverage ratio. This is explained by the asset play investment strategy. The depreciation in Norwegian kroners make shipowners able to sell vessels at high valuation levels, and thus add the difference between book and market value of the assets to the equity position, which consequently partially offset the caused increase in leverage ratios.

The tremendous fall in oil prices as a result of the coronavirus, have had a positive impact on the fuel cost for shipping companies, indicating a significant decrease on the companies' cost side. Consequently, strengthening the operating cash flow further. The increased cash flow from operations for Norwegian shipping companies is positive in relation to the leverage ratio, and will partially help offset the overall decreased earnings.

The repercussions from the coronavirus outbreak might place the development in leverage ratios outside the historical variation in our model. Furthermore, as described above, the current economic environment is embossed by uncertainty. The shipping market cycle is characterized as irregular and 'episodic', meaning that they do not follow in an orderly progression. Consequently, making it a challenging process for shipowners to predict the development of the next cycle. There is no firm pattern decisive for the timing or length of each stage, and accurate forecasting is therefore essentials in order for shipowners to make money on their investment. Martin Stopford (2003) use the highly speculative nature of poker to describe the behavior of shipowners in a shipping market cycle. In comparison to poker; strategy, luck and psychology are decisive factors deciding the potential return to investors, and as such, also the development of leverage in the industry. To predict the future of the shipping industry is a quite dicey process given the current extraordinary situation. However, at the present time, the end of April 2020, the severity of the coronavirus is expected to decrease. To resume the global shipping industry to its original state is a restructuring process that is expected to take some time, although the restrictions on quarantine levels are already loosening up as the coronavirus situation is stabilizing. Simultaneously, several shipping segments have already experienced a recovery from the sharp decline in freight rates (see figure 13). In March, analysts predicted promising prospect for a numerous number of shipping

stocks despite the coronavirus outbreak. Given the possibility of a recovery in shipping stocks and the Covid-19 pandemic, the overall shipping industry might not experience significant changes in leverage ratios, and thus not substantially deviate from the observed historical trend.

Conclusion

This thesis analyzes the leverage decisions in Norwegian shipping companies. Consistent with the widely-known assertion that the shipping industry exhibits high financial leverage, the Norwegian shipping companies are documented to be highly leveraged compared to other industries. Despite the notion that shipping is a truly global industry with limited local influences, the findings indicate that the Norwegian shipping industry carries more debt compared to the global shipping industry. The cross-sectional variation in leverage ratios can be explained by the firm-level variables. The peculiar nature of the shipping industry is used to explain the difference in causality directions and impact magnitude from prior research. First, tangibility exerts the most pronounced impact on leverage. In contrast to the global shipping industry, both asset risk and operating leverage exhibit a positive relationship to leverage. The conjuncture that the shipping industry carries high levels of both operating and financial leverage is thus confirmed.

Leverage is documented to behave counter-cyclically above the business cycle and exhibits an inverse relationship to corporate performance. Furthermore, we employ a set of dynamic panel estimators, and show that also the adjustment speed back to target leverage after deviation is higher in the Norwegian shipping industry. The large deviation costs may be reasoned in high costs associated with financial distress in shipping companies. Additionally, the speed of adjustment is documented to be higher during periods of economic expansion than downturns due to larger adjustment costs.

The results suggest that the underlying dynamics behind leverage decisions in the Norwegian shipping companies cannot unambiguously be explained by one theory, but rather a combination of them. We find evidence that the Norwegian shipping companies follow a target leverage ratio. However, given the volatility in asset values large deviations can be seen in connection with strong cyclical fluctuations. Given the cyclical nature of the shipping industry, our results indicate that

leverage decisions are key in connection with financial management. The industry is currently embossed by uncertainty, shedding light on the optimality of the industry's historically high levels of leverage.

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Appendix

Appendix 1. Company list

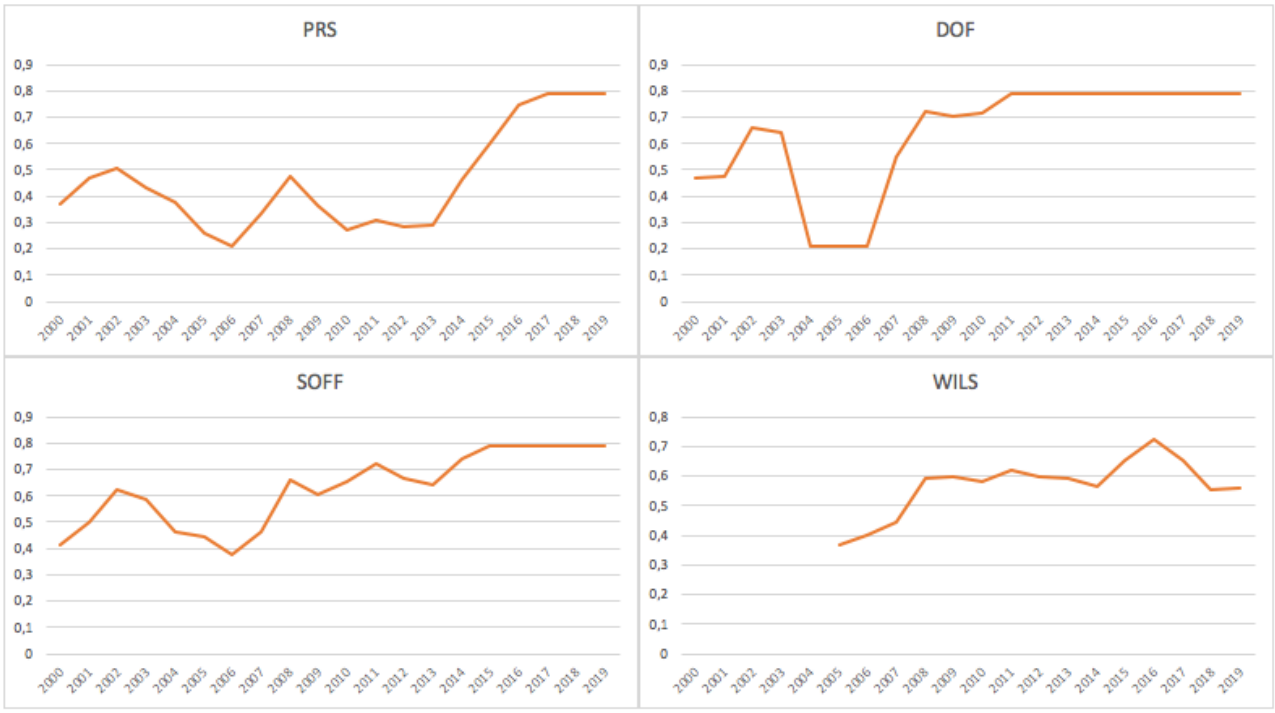
Company name	Ticker
American Shipping Co ASA	AMSC NO
Bonheur ASA	BON NO
BW LPG Ltd	BWLPG NO
BW Offshore Ltd	BWO NO
DOF ASA	DOF NO
FLEX LNG ASA	FLNG NO
Frontline Ltd	FRO NO
GC Rieber Shipping ASA	RISH NO
Golden Ocean Group Ltd	GOGL NO
Ocean Yield ASA	OCY NO
Odfjell SE	ODF NO
Prosafe SE	PRO NO
Solstad Offshore ASA	SOFF NO
Stolt-Nielsen Ltd	SNI NO
Wallenius Wilhelmsen ASA	WALWIL NO
Wilson ASA	WILS NO

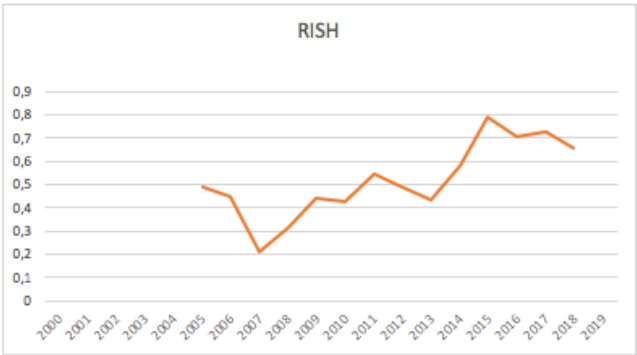
Appendix 2. Definition of variables

	Definition	Source
Firm-level variables		
Profitability	Ratio of operating income before depreciation to total book value of assets	Bloomberg
Firm size	The natural logarithm of total assets	Bloomberg
Market-to-book ratio	Ratio of market value of assets to book value of assets	Bloomberg
Market leverage	Ratio of total debt to market value of assets	Bloomberg
Book leverage	Ratio of total debt to book value of assets	Bloomberg
Operating leverage	Ratio of operating expenses to total assets	Bloomberg
Dividend payer	Dummy variable equal to 1 if the firms pays dividends in a given year, 0 otherwise	Bloomberg
Asset risk	Unleveraged annualized standard deviation of a company`s daily stock price return	Yahoo Finance
Tangibility	Ratio of PP&E to total book assets	Bloomberg
Price run-up	Annualized stock return immediately preceding the leverage observation	Bloomberg
Macroeconomic variables		
GDP growth	Aggregated growth rate in Norway	SSB
FX NOK	Annual change in the trade-weighted norwegian krone exchange rate (TWI)	Norges bank
Inflation	Sustained increase in the general price level of services and goods	SSB
Recession (NO)	Dummy variable equal to 1 if above 6 months in the given year are classified as depressed months (GDP growth below trend growth e.g. negative production gap)	SSB
Recession shipping	Dummy variable equal to 1 during periods in the shipping industry classified as depressed	Bloomberg
Stock market returns	Annual stock market return of the Norwegian market index	Bloomberg
Freight rates	Annual change in the Clarksea index (A weighted average index of earnings for the main vessel types)	Clarksons

Oil price	Annual change in the brent crude oil price	Datastream
Secondhand values	Annual change in the Clarkson all ships secondhand price index	Clarksons
Term spread	One period lagged term spread between the 10-year effective interest series and the 3-year effective interest series of Norwegian government bonds	Norges bank
Alternative leverage measures		
Book leverage (2)	Ratio of total liabilities to total book value of assets	Bloomberg
Book leverage (3)	Ratio of total debt to book value of capital	Bloomberg
Market leverage (2)	Ratio of total liabilities to total market value of assets	Bloomberg
Market leverage (3)	Ratio of total deb to market value of capital	Bloomberg
Firm performance		
Return on assets (ROA)	Ratio of net income to total assets	Bloomberg
Return on equity (ROE)	Ratio of net income to total equity	Bloomberg

Appendix 3. Development market leverage ratios

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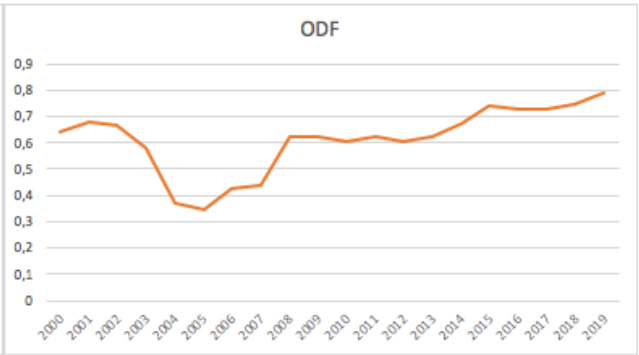
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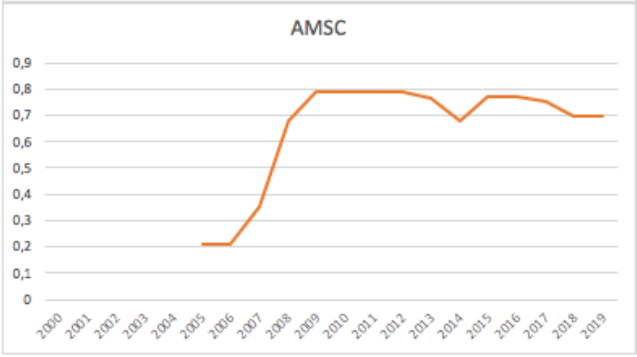
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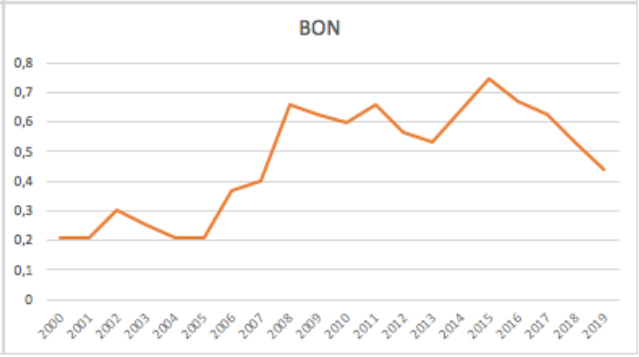
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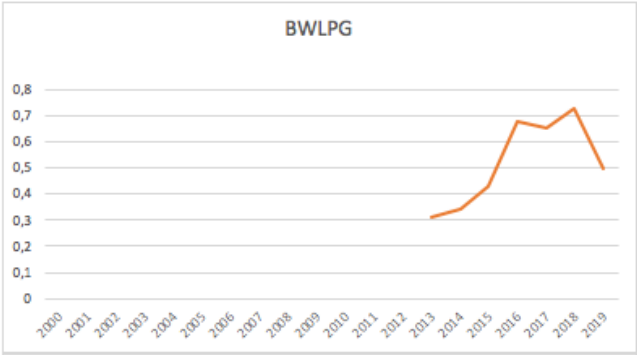
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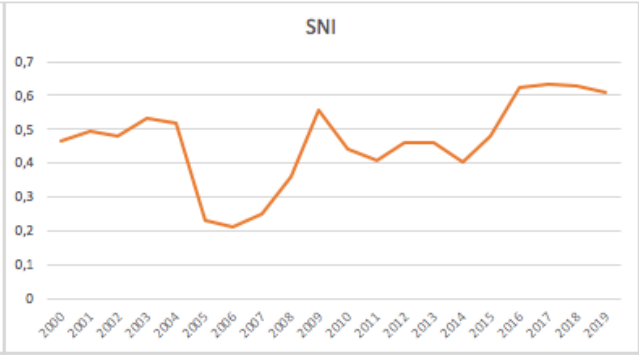
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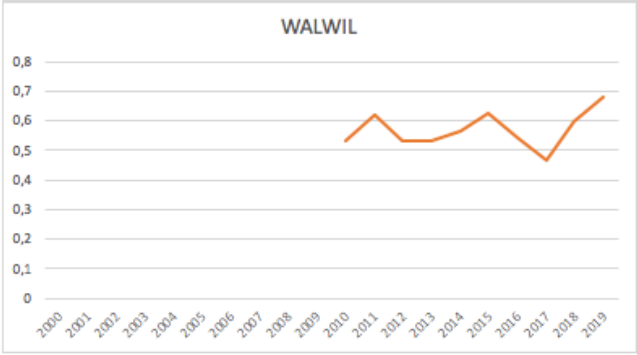
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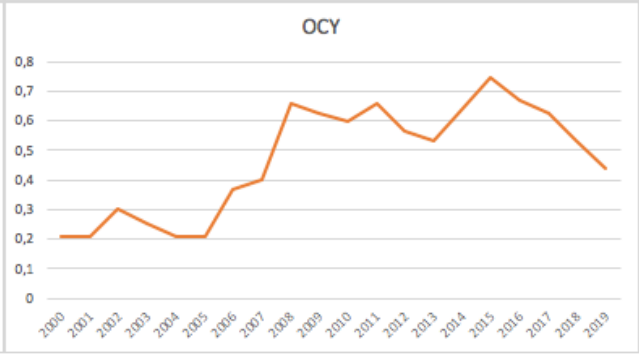
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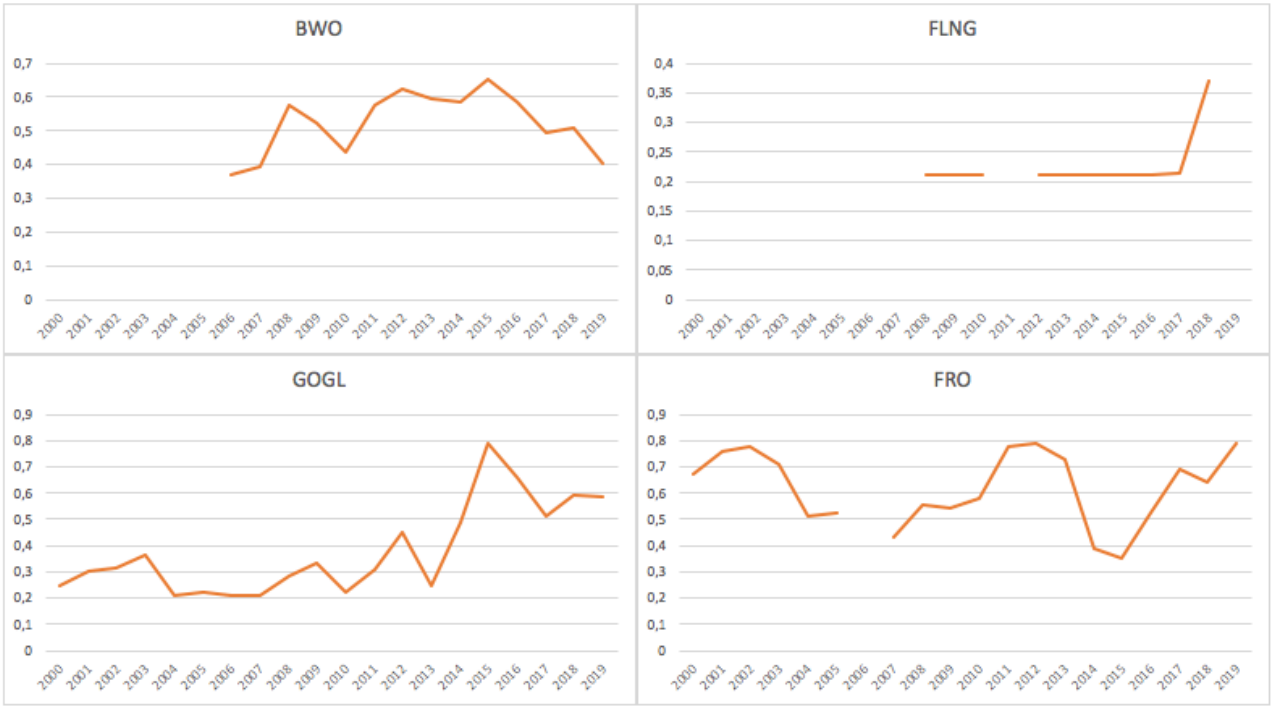


Appendix 4. Woolridge test for autocorrelation, book leverage

Woolridge test for autocorrelation in panel data
H0: no first-order autocorrelation

F(1,15) = 68.099
Prob > F = 0.000

Appendix 5. Woolridge test for autocorrelation, market leverage

Woolridge test for autocorrelation in panel data
H0: no first-order autocorrelation

F(1,15) = 62.850
Prob > F = 0.000

Appendix 6. Breusch-pagan test for heteroskedasticity, book leverage

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
H0: Constant variance
Variabels: fitted values of Booklev

chi2(1) = 0.06
Prob > chi2 = 0.8087

Appendix 7. Breusch-pagan test for heteroskedasticity, market leverage

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
H0: Constant vatiance
Variabels: fitted values of Marketlev

chi2(1) = 2.38
Prob > chi2 = 0.1231

Appendix 8. VIF-test for multicollinearity

Variable	VIF	1/VIF
Tangibility	1,20	0,83333333
Market-to-book	1,19	0,84033613
Profitability	1,16	0,86206897
Firm size	1,12	0,89285714
Operating leverage	1,1	0,90909091
Dividend payer	1,04	0,96153846
Asset risk	1,03	0,97087379
Mean VIF	1,12	

Appendix 9. Skewness/kurtosis test for normality

Skewness/Kurtosis test for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	- joint - Prob>chi2
Book leverage	268	0,0341	0,0506	7,78	0,0205
Market leverage	251	0,0027	0,8747	8,35	0,0154
Tangibility	271	0,0000	0,0000	.	0,0000
Market-to-book	253	0,0000	0,0000	.	0,0000
Profitability	269	0,0000	0,0000	.	0,0000
Firm size	271	0,0000	0,0000	28.03	0,0000
Operating leverage	270	0,0000	0,0000	.	0,0000
Dividend payer	273	0,0000	0,0000	.	.
Asset risk	247	0,0000	0,0000	.	0,0000

Appendix 10. Hausman test

	Coefficients			
	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Tangibility	0,3408001	0,2957666	0,0450335	.
Market-to-book ratio	0,0237027	-0,0090062	0,0327089	.
Profitability	-0,380879	0,1801655	-0,5610445	.
Firmsize	0,0955463	0,0945558	0,0009905	0,0030825
Operating leverage	0,2265829	0,2908526	-0,0642697	0,0095023
Dividend payer	-0,06095	-0,0405093	-0,0204407	0,0008297
Asset risk	0,0018288	0,0027163	-0,0008875	.

b = consistent under Ho and Ha; obtained from xtreg
B= inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho : difference in coefficients not systematic

chi2(7)= (b-B)'[(V_b-V_B)^2(-1)] (b-B)
= 112.81
Prob>chi2= 0.0000
(V_b-V_B is not positive definite)

Appendix 11. Unitroot test, Book leverage

```
xtunitroot fisher Booklev, dfuller lags(0)
(25 missing values generated)

Fisher-type unit-root test for Booklev
Based on augmented Dickey-Fuller tests
```

Ho: All panel contain unit roots		Number of panels	= 16
Ha: At least one panel is stationary		Avg. Number of period	= 16.75
AR parameter:	Panel-specific	Asymptotics: T -> Infinity	
Panel means:	Included		
Time trend:	Not included		
Drift term:	Not included	ADF regressions: 0 lags	

		Statistics	p-value
Inverse chi-squared (32)	P	42.5871	0.1000
Inverse normal	Z	-0.3504	0.3630
Inverse logit t (84)	L*	-0.1050	0.4583
Modified inv. Chi-squared	Pm	1.3234	0.0929

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Appendix 12. Unitroot test, Market leverage

xtunitroot fisher Marketlev, dfuller lags(0)
(25 missing values generated)

Fisher-type unit-root test for Marketlev
Based on augmented Dickey-Fuller tests

Ho: All panel contain unit roots		Number of panels	= 16
Ha: At least one panel is stationary		Avg. Number of period	= 15.69
AR parameter:	Panel-specific	Asymptotics: T -> Infinity	
Panel means:	Included		
Time trend:	Not included		
Drift term:	Not included	ADF regressions: 0 lags	

		Statistics	p-value
Inverse chi-squared (32)	P	27.5356	0.6921
Inverse normal	Z	1.0417	0.8512
Inverse logit t (84)	L*	1.3162	0.9042
Modified inv. Chi-squared	Pm	-0.5580	0.7116

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

Appendix 13. Kao cointegration test

xtcointtest kao Booklev Year

Kao test for cointegration

Ho: No cointegration		Number of panels	= 16
Ha: All panels are cointegrated		Avg. Number of period	= 14.5
Cointegration vector:	Same		
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	1.25 (Newey-West)
AR parameter:	Same	Augmented lags:	1

	Statistics	p-value
Modified Dickey-Fuller t	-4.1292	0.0000
Dickey-Fuller t	-4.6634	0.0000
Augmented Dickey-Fuller t	-3.9962	0.0000
Unadjusted modified Dickey-Fuller t	-5.0834	0.0000
Unadjusted Dickey-Fuller t	-4.9817	0.0000

xtcointtest kao Booklev Tangibility Mbratio Profitability Firmsize Oplev Div

Kao test for cointegration

Ho: No cointegration		Number of panels	= 16
Ha: All panels are cointegrated		Avg. Number of period	= 13.313
Cointegration vector:	Same		
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	1.25 (Newey-West)
AR parameter:	Same	Augmented lags:	1

	Statistics	p-value
Modified Dickey-Fuller t	-4.6642	0.0000
Dickey-Fuller t	-5.2790	0.0000
Augmented Dickey-Fuller t	-2.2930	0.0109
Unadjusted modified Dickey-Fuller t	-5.8915	0.0000
Unadjusted Dickey-Fuller t	-5.6597	0.0000

Appendix 14. Pedroni cointegration test

xtcointtest pedroni Booklev Tangibility Mbratio Profitability Firmsize Oplev Div

Pedroni test for cointegration

Ho: No cointegration		Number of panels	= 16
Ha: All panels are cointegrated		Avg. Number of period	= 14.438
Cointegration vector:	Panel specific		
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	2.00 (Newey-West)
AR parameter:	Panel specific	Augmented lags:	1

	Statistics	p-value
Modified Phillips-Perron t	4.6743	0.0000
Phillips-Perron t	-1.6602	0.0484
Augmented Dickey-Fuller t	-8.8056	0.0000

Appendix 15. Westerlund cointegration test

xtcointtest westerlund Booklev Year

Westerlund test for cointegration

Ho: No cointegration		Number of panels	= 16
Ha: All panels are cointegrated		Avg. Number of period	= 16.75
Cointegration vector:	Panel specific		
Panel means:	Included		
Time trend:	Not included		
AR parameter:	Panel specific		

	Statistics	p-value
Variance ratio	-3.7681	0.0001

Appendix 16. Standard leverage regressions with lagged independent variables

	[1]	[2]	[3]	[4]
Dependent variable: Book leverage				
Tangibility	0,344*	0,235*	0,277***	0,179
	(0,165)	(0,115)	(0,058)	(0,129)
Market-to-book	0,150**	0,020	0,253***	0,106
	(0,065)	(0,402)	(0,047)	(0,065)
Profitability	-0,125	0,313	-0,134	0,385
	(0,111)	(0,066)	(0,133)	(0,093)
Firm size	0,084***	0,119***	0,074***	0,102***
	(0,026)	(0,012)	(0,008)	(0,017)
Operating leverage	0,198	0,085	0,185***	0,060
	(0,131)	(0,098)	(0,034)	(0,109)
Dividend payer	-0,035	-0,049	-0,027	-0,042
	(0,039)	(0,038)	(0,029)	(0,028)
Asset risk	-0,021	0,015	-0,007	0,015
	(0,013)	(0,015)	(0,008)	(0,014)
Firm fixed effects	no	yes	no	yes
Year fixed effects	no	no	yes	yes
Observations	227	227	227	227
Adj R2	0,306	0,659	0,369	0,685

Dependent variable: Market leverage				
Tangibility	0,347*	0,303**	0,266***	0,231*
	(0,172)	(0,121)	(0,072)	(0,120)
Market-to-book	-0,106	-0,216***	0,013	-0,092
	(0,089)	(0,049)	(0,042)	(0,081)
Profitability	-0,138	-0,022	-0,188	-0,022
	(0,128)	(0,710)	(0,211)	(0,088)
Firm size	0,096***	0,138***	0,084***	0,115***
	(0,032)	(0,015)	(0,009)	(0,021)
Operating leverage	0,234	0,098	0,234***	0,101
	(0,133)	(0,104)	(0,049)	(0,884)
Dividend payer	-0,037	-0,065	-0,018*	-0,048*
	(0,046)	(0,038)	(0,028)	(0,027)
Asset risk	-0,002	0,034	0,009	0,041***
	(0,015)	(0,019)	(0,010)	(0,013)
Firm fixed effects	no	yes	no	yes
Year fixed effects	no	no	yes	yes
Observations	227	227	227	227
Adj R2	0,334	0,646	0,424	0,738

Appendix 17. Standard leverage regressions with alternative leverage measures

	Book leverage (2)	Book leverage (3)	Market leverage (2)	Market leverage (3)
Dependent variable: Alternative leverage measures				
Tangibility	0,325***	57,447	0,316**	17,657
	(0,151)	(46,326)	(0,108)	(13,550)
Market-to-book	0,151***	11,742	-0,263***	-2,454
	(0,039)	(7,276)	(0,047)	(8,628)
Profitability	-0,117	-89.693	-0,130	-6,782
	(0,077)	(107,374)	(0,075)	(14,976)
Firm size	0,063**	-8,553	0,070***	2,186
	(0,028)	(10,083)	(0,024)	(2,475)
Operating leverage	0,183	10,420	0,158	-2,037
	(0,149)	(22,476)	(0,132)	(12,284)
Dividend payer	-0,044*	-3,404	-0,058***	-10,098*
	(0,023)	(5,277)	(0,020)	(5,205)
Asset risk	0,009	1,724	-0,003	2,463
	(0,016)	(1,699)	(0,018)	(2,406)
Firm fixed effects	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes
Observations	246	244	246	242
Adjusted R2	0,787	0,01	0,829	0,139

Appendix 18. Descriptive statistics for all variables

	Obs.	Mean	SD	Median	25th	75th	Min	Max
Book leverage	268	0,498	0,197	0,502	0,412	0,595	0,070	0,814
Market leverage	251	0,525	0,215	0,552	0,398	0,667	0,053	0,866
Tangibility	271	0,720	0,171	0,745	0,659	0,823	0,397	0,919
Market-to-book	253	1,010	0,581	0,929	0,814	1,085	0,637	0,560
Profitability	269	0,094	0,094	0,094	0,056	0,126	-0,010	0,204
Firm size	271	7,191	1,044	7,509	6,362	8,026	5,459	8,442
Operating leverage	270	0,212	0,215	0,164	0,059	0,286	0,004	0,513
Dividend payer	273	0,656	0,476	1,000	0,000	1,000	0,000	1,000
Asset risk	249	0,121	0,398	0,066	0,026	0,080	0,017	0,278
Price run-up	231	0,159	1,368	0,001	-0,329	0,357	-0,974	18,851
Recession	273	0,231	0,422	0,000	0,000	0,000	0,000	1,000
Recession NO	273	0,176	0,381	0,000	0,000	0,000	0,000	1,000
Inflation	273	0,021	0,009	0,021	0,016	0,025	0,003	0,038
Term spread	273	0,651	0,459	0,800	0,260	0,950	-0,390	1,410
GDP growth	273	0,101	0,011	0,140	0,010	0,024	-0,017	0,040
Oil price	73	0,101	0,336	0,133	-0,166	0,341	-0,514	0,709
Stock market returns	273	0,131	0,332	0,150	-0,110	0,260	-0,650	0,990
Freight rates	273	0,064	0,339	0,128	-0,205	0,242	-0,653	0,707
FX NOK	273	0,008	0,040	0,005	-0,017	0,029	-0,044	0,107
Secondhand ship price	273							
Return on assets	273	0,024	0,169	0,021	-0,007	0,061	-1,636	1,876
Return on equity	273	0,055	0,301	0,056	-0,009	0,149	-1,986	1,889

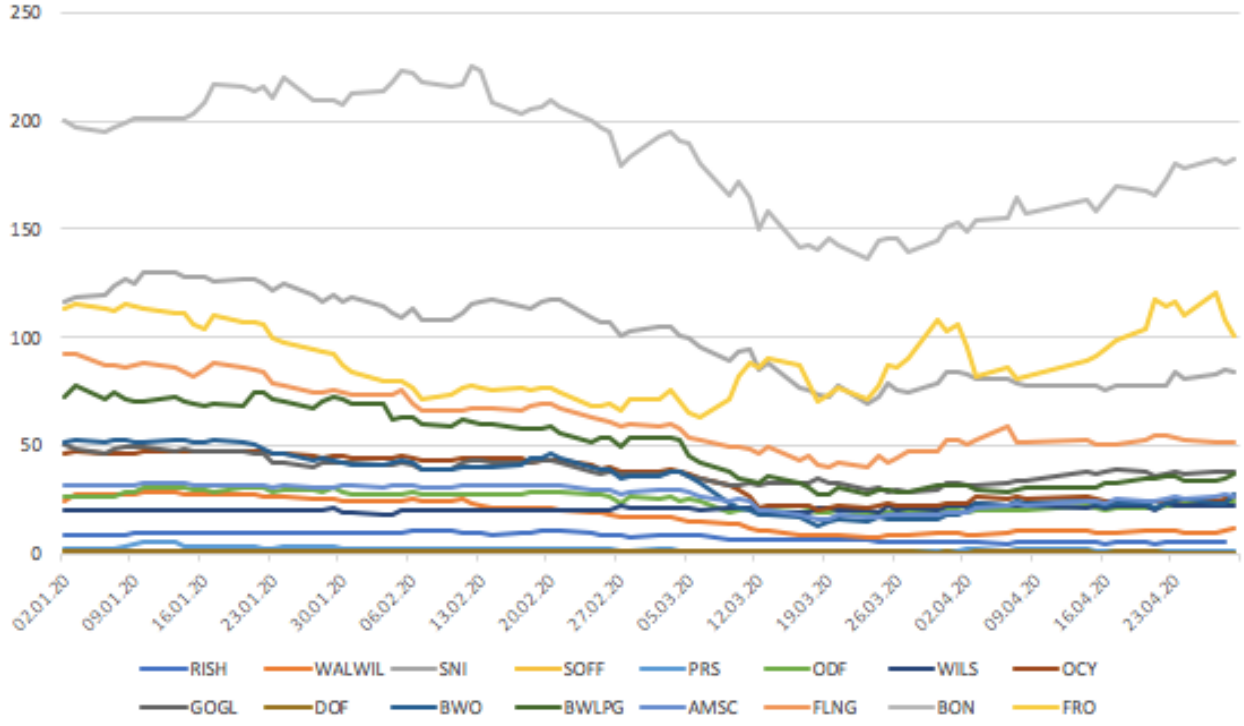
Appendix 19. Macroeconomic regressions excluding firm size

	[2]	[3]
Dependent variable: Book leverage		
Tangibility	0,540***	0,526***
	(0,102)	(0,102)
Market-to-book	0,003	0,000
	(0,089)	(0,089)
Profitability	-0,104	-0,103
	(0,100)	(0,102)
Operating leverage	0,245	0,256
	(0,146)	(0,145)
Dividend payer	-0,068*	-0,063
	(0,039)	(0,038)
Asset risk	0.023	0,021
	(0,021)	(0,021)
Recession (NO)	0,032	
	(0,019)	
Recession (shipping)		0,012
		(0,011)
Inflation		
Term spread		
GDP growth		
Oil price		
Stock market returns		
Freight rates		
FX NOK		
Secondhand ship prices		
Firm fixed effects	yes	yes
Observations	244	244
Adj R2	0,594	0,591

Appendix 20. Descriptive statistics for companies sorted in groups

	Mean	SD	Median	25th	75th	Min	Max
Small companies (Market cap of 0 to $1 Billion)							
Book leverage	0,545	0,167	0,544	0,461	0,65	0,257	0,799
Market leverage	0,574	0,214	0,586	0,438	0,721	0,210	0,898
Medium companies (Market cap of $1 billion to $5 billion)							
Book leverage	0,491	0,248	0,558	0,327	0,850	0,000	0,849
Market leverage	0,500	0,258	0,579	0,314	0,704	0,000	0,816
Large companies (Market cap from $5 billion)							
Book leverage	0,453	0,162	0,456	0,407	0,519	0,115	0,693
Market leverage	0,497	0,15	0,528	0,429	0,619	0,147	0,68

Appendix 21. Daily stock prices



Appendix 22. Interview over mail with Martin Hjemdal

Interviewee: Martin Hjemdal, Fearnley Securities (Project Finance)

Date: 20th March 2020

Main content: Financing sources in the shipping industry

- The use of different financings sources within the industry as Private equity, IPOs, bonds, bank loans etc.

- The development of financing sources in Norway

Appendix 23. Telephone interview with Martin Hjemdal

Interviewee: Martin Hjemdal, Fearnley Securities (Project Finance)

Date: 5th May 2020

Main content: Target leverage ratio and development in leverage measures

- Discussion of figure 11. Target leverage over the sample period
- The impact of Corona on Norwegian shipping companies leverage ratios
- The difference between financing with debt or equity
- Whether the Norwegian shipping market can be considered more leveraged than other markets