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Capital Structure Decisions of Shipbuilding Companies

A study of determinants and adjustment speeds in the period 1997-2013

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NORWEGIAN SCHOOL OF ECONOMICS

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Abstract

This thesis aims to investigate which factors are the major determinants of capital structure decisions for globally listed shipbuilding companies, and how quickly they adjust their capital structures when deviating from their target leverage ratios. Earlier academic articles have highlighted a number of firm specific factors that determine capital structures in other industries. This thesis gives special attention to the similarities between the merchant shipping industry researched by Drobetz et al. (2013) and the shipbuilding industry. We will use and apply determinants tested on the shipping industry to our sample of shipbuilders, but also add a set of new industry specific variables. To a large extent, unobserved company specific effects drive shipbuilders' capital structure decisions. Using a range of multiple regression models we find size, asset risk, and the market to book ratio to be the most influential observable determinants of capital structure. Our results imply that shipbuilding companies do not follow one explicit capital structure theory, but a combination of the trade-off theory and the pecking order theory. The former theory dominates the firm level determinants, whereas the latter dominates with regards to the influence from the macroeconomic environment. Shipbuilders can be said to have relatively lower adjustment than deviation costs compared to other industries, as shipbuilders tend to adjust their capital structures significantly faster. The rate of adjustment is heavily dependent on macroeconomic cycles because the shipbuilders actively change their leverage ratios much slower in times of recession. This indicates that the adjustment costs increase during worsened economic conditions.

Preface

This thesis concludes our five years of studies at the Norwegian School of Economics (NHH). During our studies we have developed a particular interest towards corporate finance. In our opinion, substantial insight to what drives capital structure decisions provides the best possible foundation for making educated business decisions related to funding. Since we had the opportunity of freely selecting a topic, we decided to further investigate capital structure decisions.

Shipping, as the subject for our thesis, was chosen based on heritage and surroundings. Norway holds long and proud traditions as a shipping nation. Especially our current hometown Bergen is regarded a key player in international shipping and maritime industries. The academic faculty at NHH is also recognized as particularly strong with regards to shipping economics. Previous studies have been directed towards the merchant shipping markets, but the capital structure decisions on the market's supply side seem neglected. We, therefore, decided that the shipbuilding market would allow us to investigate a vastly unexplored academic field.

Writing our master thesis has been the most challenging, but yet most rewarding task at NHH. We would especially like to thank our thesis supervisor, Roar Os Ådland, for always being available and contributing valuable academic insights throughout the process. Drobetz et al. (2013) were a great inspiration to us, and we would like to thank Rebekka Haller and Wolfgang Drobetz at the University of Hamburg for providing us with the rating probability regression results enabling us to better benchmark our findings with their study.

Bergen, June 2nd 2014

Rikke Skyttersæter Iversen	Joakim Noraas

1. Introduction

In this section we provide a brief introduction to the shipbuilding market and its financing. We elaborate some aspects that make the capital structure decisions of shipbuilders interesting. Finally, we present how this thesis contributes compared to previous studies.

The shipbuilding market facilitates world trade by providing its most essential tool – ships. The industry builds, maintains, repairs and converts complex ships and marine hardware for various seaborne commercial activities. Dry bulk carriers, cargo vessels, tankers, multipurpose vessels, and container ships are examples of the most common ship types in production (Stopford, 2009). In terms of geography, shipyards[1] have a range of international owners, but are located within regional clusters. Illustratively, most shipbuilding activity is set in China, South Korea and Japan (BRS, 2014).

Figure 1-2: Illustration of world shipbuilding hubs (Clarksons, 2014a)

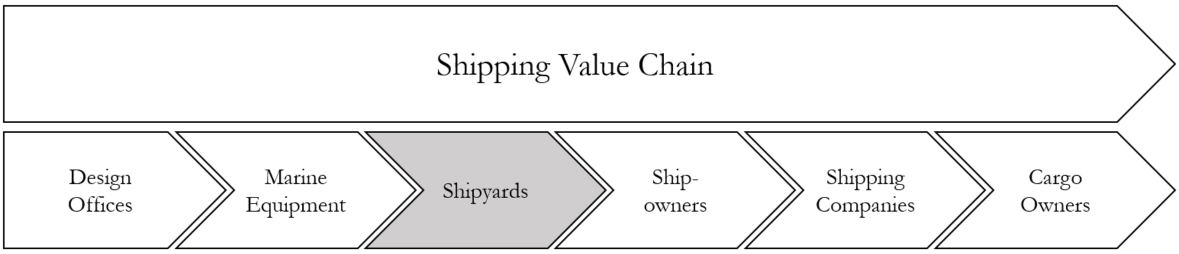

Figure 1-1: Shipping industry value chain (ECORYS, 2012, p. 25)

[1] Throughout this thesis, shipbuilder and shipyard are used interchangeably, but they always refer to a company involved in shipbuilding activities.

1.1 Shipyard Financing

According to the European Commission (2003), the average shipyard is primarily financed by equity. Thus, debt constitutes a smaller share of the total financing. Based on thoughts from the European Commission (2001) a shipyard's liabilities seem to consist of two main components; stationary debt financing related to the physical shipyard and mortgages connected to the individual shipbuilding project's construction financing.

In general shipbuilding requires high upfront capital costs and long tenors (European Commission, 2013), which can be assumed to create challenges for obtaining financing. However, to our knowledge little academic attention has been directed towards investigating how shipbuilders choose their leverage ratios. In the following we highlight some aspects that make shipyards' capital structure decisions interesting to research. We assess payment risks and security requirements, governmental interference, price dynamics, and shipyard heterogeneity, but acknowledge that these do not exhaustively represent all factors that influence shipyard financing.

1.1.1 Payment Risks and Security Requirements

The first aspects influencing shipyard financing are rooted in payment schedules and security requirements. New vessels are funded through project financing, which can be divided into a pre- and post-delivery phase (Stopford, 2009).

Shipyards depend on progress payments to fulfil the cash flow requirements associated with vessel construction (Fisher, 2008). Shipowners try to ensure that progress payments are only made for completed work. However, with payments based on physical progress shipbuilders have reduced incentives to finish non-direct producing work in a timely manner. Consequently, it is usual for the shipyards to receive payments based on a wide set of milestones (Fisher, 2008). The payments represent a risk transfer from the shipyard to the shipowner, as the shipyard's risk decreases when receiving the remuneration. Payments can be front-ended, evenly distributed or back-ended (European Commission, 2001). Prior to 2009, the convention was five even payments of 20% each, whereas some yards accepted payments as low as 1%-10% (Credit Suisse, 2013). The financing method itself is a competitive factor for the shipyards (European Commission, 2003) and it is fair to assume that back-ended payment schedules occur more frequently during depressions. Clarksons (2014a) reports that in early 2014 ABG Shipyard accepted 100% back-ended payments to attract new business following their financial problems and debt restructurings. Risks should be higher for the shipbuilders with back- than front-ended payments, because the uncertainty of receiving the payments is higher. According to the European Commission (2001), back-end loading of payments leads to larger interest expenses for the shipyard. As risk is of great importance to investment decisions (Berk & DeMarzo, 2013), the difference in payment schedules complicates shipyard financing.

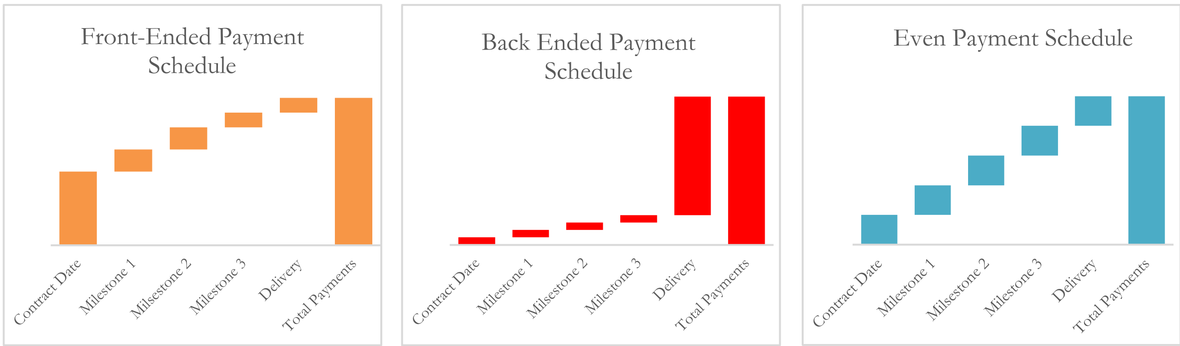

Figure 1-3: Illustration of payment schedules based on (European Commission, 2001)

According to Alizadeh and Nomikos (2009) a shipyard faces credit risks because it agrees to engage in business with an investor who might not intend or be able to fulfil her commitment toward the yard. Connected to this shipbuilders face risks like providing credit provisions, receiving untimely payments, and the customer's failure to accept the vessel when finished. Additionally, if a buyer perceives that a shipyard experiences financial distress they might stop paying instalments. This would increase the probability of default for the shipyard (the Economist, 2013).

Shipyard financing is further complicated by the security requirements from banks and shipowners. The European Commission (2003) state that it is common that the value of a shipbuilder's annual production exceeds the value of the company itself. A ship in progress is not regarded as a capitalized asset, but rather as work in progress using IAS 11[2] (European Commission, 2009). Consequently, using the complete value of a ship under construction as collateral value for a shipyard's loans is difficult. Simultaneously the shipyard must account for the total liabilities of a shipbuilding project. In addition to this, ship investors often demand

[2] IAS is an abbreviation for International Accounting Standards, comprising accounting standards prior to 2001. Newer standards are published through the International Financial Reporting Standards (IFRS), however, the IAS are still valid unless new standards concerning the same subjects are issued (Hamberg, 2012)

refund guarantees from the shipyards for their down payments during the vessel construction (Fraser, 2009), which increases the needed amount of debt financing for a project.

1.1.2 Governmental Interference

A second aspect increasing the complexity of shipyard financing is governmental interference. As shipyards generate foreign currency income and employ a significant number of workers, the maritime industry is an integral part of economic development. Thus, governments have a tendency to assist their shipbuilding industries and thereby distort the free market forces (Glen, 2006). Strategic investments resulting in excess production capacity can create an imbalance between supply and demand in the shipbuilding market (European Commission, 2003). If shipyards accept orders despite making losses to utilize production facilities and unsustainable capacity is kept in existence by government support, it is fair to assume that the market prices will decrease. As prices deteriorate, further losses will be endured requiring new government interventions to save shipyards from bankruptcy. Thus, governmental interference can create an unstable and risky operating environment that has the potential of distorting corporate financial decisions.

Historically the shipbuilding industry has received many different governmental support measures (e.g. debt forgiveness, interest relief by government-controlled banks, loan guarantees) (European Commission, 2003). State ownership in shipyards can be said to create a comparative financial advantage over privately owned shipbuilders, since governments most often are considered both liquid and solvent by the shipping banks (OECD, 2008). Government supported credit lines also distorts market dynamics, as shipowners are induced to order new ships even though the economic conditions may be depressed (European Commission, 2013).

1.1.3 Price Dynamics

Issues related to price dynamics represent a third aspect influencing shipyard financing. According to Alizadeh and Nomikos (2009) the shipbuilding market is almost perfectly competitive as shipowners gather quotes from multiple shipyards before placing an order and there are no barriers restricting them from competing internationally. Newbuild prices are settled in an equilibrium process between yard-supply and investor-demand, but also depend on general market conditions (e.g. the price of steel, freight rates, the orderbook of the shipyard and industry orderbook, the contract terms). There is a substantial lag between ordering and delivery lasting everything from a couple of months to multiple years (Alizadeh & Nomikos, 2009). The developments in the period 1997-2013 offer a tangible example of the delivery lag as peak deliveries was reached in 2011 two years after the peak in orderbook. Over the course of the delivery lag, the economic viability of a shipbuilding project may change substantially due to ship price fluctuations (Alizadeh & Nomikos, 2012). Because of unfavourable market conditions, customers may force forward postponements of delivery (Bakkelund, 2013). Consequently, these factors will influence the availability and cost of financing for shipyards.

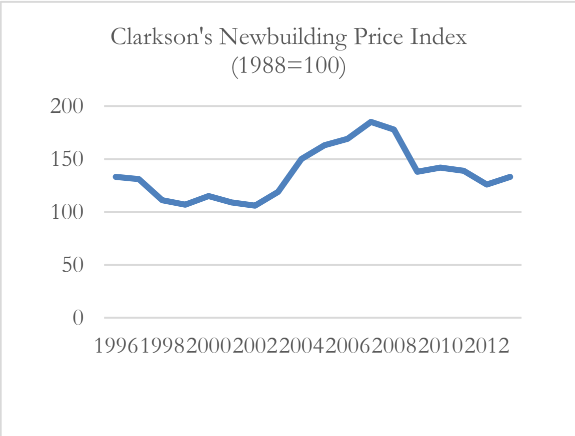

Figure 1-5: Clarksons Newbuilding Price Index (Clarksons, 2014d)

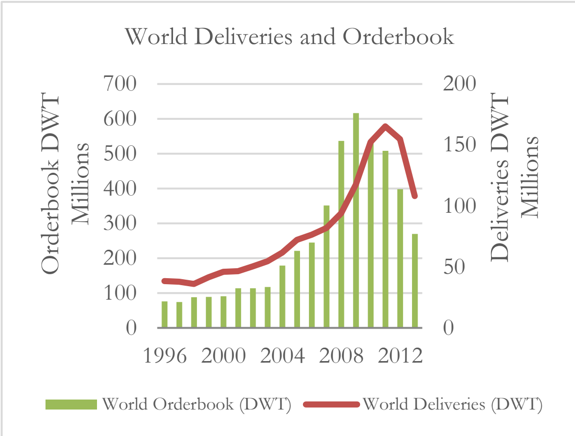

Figure 1-4: World orderbook and deliveries (Clarksons, 2014c)

1.1.4 Operational Heterogeneity of Shipbuilders

A fourth interesting aspect complicating the financing decisions is that shipyards are heterogeneous along many different dimensions. Ultimately these differences affect the amount of financing available to shipyards through influencing their competitiveness. According to Jiang and Pettersen (2012) a shipbuilder's competitiveness depends on its size (e.g. market share) and cost position.

Labor costs can differ substantially between countries and impact shipyard's competitiveness. For example, the main competitive advantage of Chinese shipbuilders has been low labor costs (Jiang & Pettersen, 2012). Another source of competitiveness is quality. According to Hyundai Heavy Industries (2014), technological quality is of major strategic importance to shipbuilders. Quality can also be associated with reliability and as pointed out by Fearnleys (2014), a timely delivery of a vessel from the shipyard is very important to the customer. This is because foregone revenue opportunities due to delays are very costly. Overall, low-cost-based shipyards tend to win more contracts for constructing larger tankers and bulk carriers, whereas those able to deliver superior technological solutions are better positioned with LNGs and SPVs (Fearnleys, 2014).

Factors connected to size could affect a shipbuilder's capital structure as larger shipyards can be assumed to utilize economies of scale easier and offer a wider product range. Additionally, increased size could be associated with a larger number of contracts from multiple customers. Combined these factors should contribute to diversify and lower the shipyard's operational risk. Larger shipbuilders can also be more visible than smaller peers to investors. This increased recognition effect can be assumed to influence the volume of financing available to the individual shipyard. Based on the composition of the shipbuilding market, size evidently influences competitiveness. This understanding can be drawn from the fact that the top ten shipyards possess a fairly dominant share of the overall world orderbook.

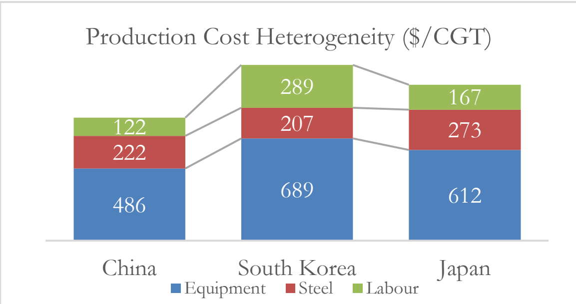

Figure 1-7: Cost distribution as of 2009 for China, South Korea, and Japan (Jiang & Pettersen, 2012)

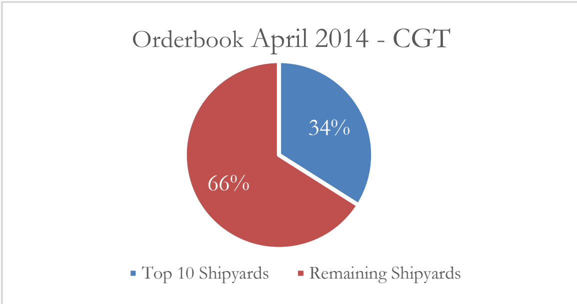

Figure 1-6: Global orderbook composition by yard (Clarksons, 2014a)

1.2 Contribution of Our Study

Our study contributes in three ways compared to previous studies. First, we contribute by examining the previously under-researched shipbuilding industry. Despite the four aspects making shipyard financing interesting, there is to our knowledge no available research on their capital structure decisions. Our second contribution comes from including macroeconomic factors in our model. In the study of capital structure decisions, including macroeconomic parameters has received scarce academic attention. Compared to previous papers, we have included both formerly researched determinants and brand new shipbuilding specific indicators. Third, we contribute by examining the dynamics of capital structure decisions by evaluating how rapidly shipbuilders adjust toward their target leverage ratios. Although a dynamic evaluation of capital structure seems common among academic papers, former master theses published by NHH have mostly emphasized capital structure in a static environment.

2. Capital Structure Theory

Capital structure theory helps us understand which factors affect the relationship between a company's capital structure and its value. This dynamic occurs as the combination of debt and equity influences the firms' value through altering the cost of capital and financial risk (Harris & Raviv, 1991). In capital structure optimization the goal is to choose the leverage that maximizes company value (Myers, 2001). Alternatively, the decision can be seen as minimizing the weighted average cost of capital.

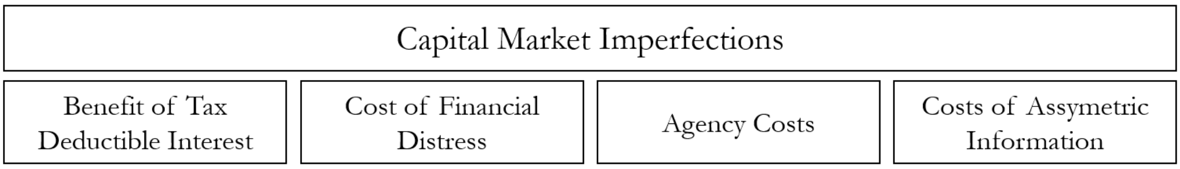

Figure 2-1: Examples of capital markets imperfections (Berk & DeMarzo, 2013)

Modigliani and Miller (M&M) (1958) were among the first contributors to capital structure theory. They showed that capital structure is irrelevant in a market of perfect competition. However, their initial findings can be characterized as rather unrealistic, as the effects of taxes, risk, cost of bankruptcy, agency costs, and asymmetric information are not taken into account. By introducing market imperfections to the M&M model the attractiveness of debt and equity changes, making the choice of capital structure highly relevant. A comprehensive theory explaining all patterns of leverage ratios does not exist (Parsons & Titman, 2009; Graham & Leary, 2011). Nevertheless, the trade-off theory, the pecking order theory, and the market timing theory emerge as more sophisticated versions of the M&M (1958) model taking into account more realistic market assumptions.

2.1 The Trade-Off Theory

The trade-off theory states that the capital structure of a company is determined by the trade-off between the costs and benefits of using debt financing (Litzenberg & Kraus, 1973). The original idea builds on M&M's (1958) findings by assuming the existence of an optimal leverage ratio, but differs in introducing corporate income tax to the irrelevance proposition. The main theory dynamic is that the marginal benefit of further increases in debt declines as the level of total debt increases. Simultaneously, the marginal cost of the additional debt increases. A company looking to optimize its overall value will take on additional debt until the marginal benefit equals the marginal costs. The reached equilibrium is known as the optimal leverage ratio.

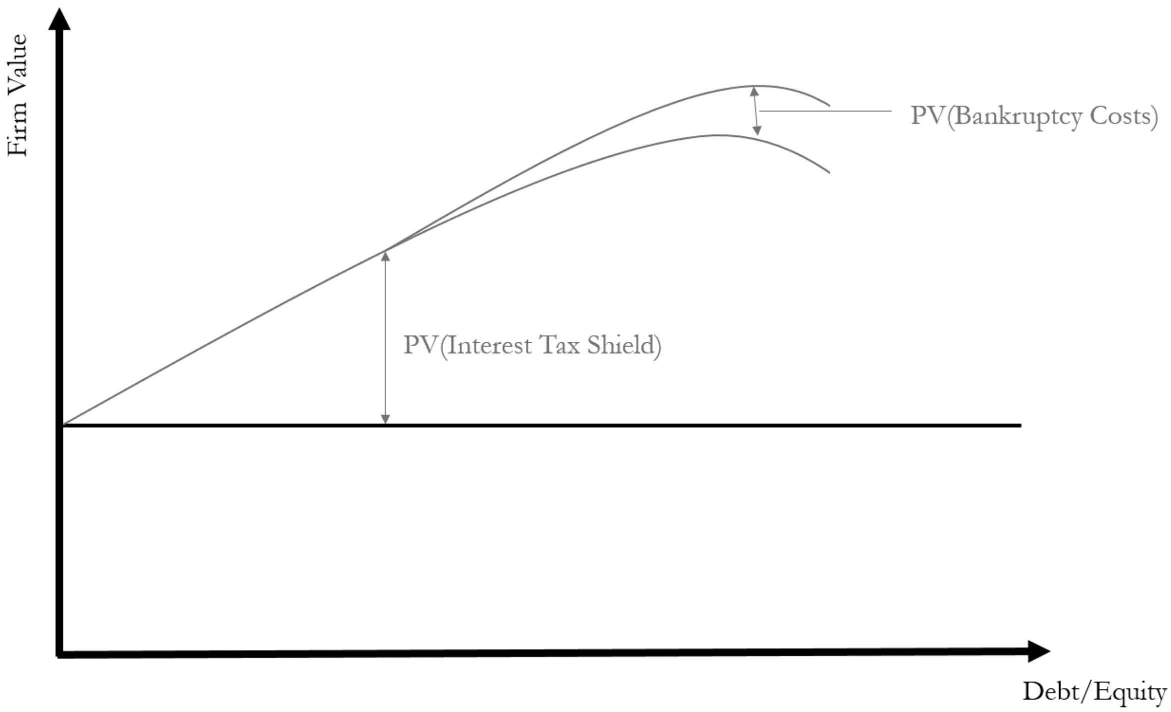

Figure 2-2: Illustration of trade-off theory's implications on firm value (Brealey et al., 2009, p. 453)

The trade-off theory offers several assessments of the costs and benefits of debt. Today, the tax-bankruptcy and the agency perspectives remain the most popular. On the one hand, the tax-bankruptcy perspective illustrates the tax benefits a firm can obtain from holding debt. These benefits must be balanced against the increased financial distress and possible bankruptcy costs associated with choosing debt as the source of financing (Litzenberg & Kraus, 1973). On the other hand, the agency perspective explains that debt finance is embedded with a manager-shareholder conflict. Both Stulz (1996) and Jensen (1986) argue that due to the seniority of debt claims, increasing debt has a disciplinary effect on management through reducing the agency costs associated with the usage of free cash flows. Increasing debt will thereby reduce underinvestment and asset substitution issues (Jensen & Meckling, 1976). However, while increasing leverage might reduce the agency costs of equity the company could stand the risk of worsening the bondholder-shareholder conflicts (Gossy, 2007).

Shyam-Sunder and Myers (1999), Fama and French (2002) as well as Welch (2011) have questioned the empirical relevance of the trade off theory. Critique has been directed at the fact that debt and equity carry very different characteristics, and comparing the trade-off between the two is an unrealistic simplification (Frank & Goyal, 2009). Others have argued that tax rates are much more complex than assumed by the model (Graham, 2003), or that bankruptcy costs are not transferrable in real life and the theory therefore lacks a dynamic treatment of the costs

(Haugen & Senbet, 1978). Despite criticism, the trade-off theory remains among the dominant theories taught in the study of corporate capital structure.

Table 2-1: Comparisons of agency models based on shareholder-management conflicts (Harris & Raviv, 1991, p. 303)

Model	Conflict	Benefit of Debt	Cost of Debt
Jensen & Meckling (1976)	Managerial perquisities	Increase managerial ownership	Asset substitution
Jensen (1986)	Overinvestment	Reduce free cash	Unspecified
Harris & Raviv (1990)	Failure to liquidate	Allows investors option to liquidate	Investigation costs
Stulz (1990)	Overinvestment	Reduce free cash	Underinvestments

The table summarizes different studies on agency models based on shareholder-management conflicts.

2.2 The Pecking Order Theory

The pecking order theory is an application of Akerlofs (1970) "Market for Lemons" and was introduced by Myers in 1984 catering to the shortcomings of the trade-off theory. Insiders and outsiders of a firm can be assumed to possess asymmetric information, which results in problems concerning adverse selection for raising capital (Myers & Majulf, 1984). A fair assumption is that managers possess more information than outside investors about their own company's prospects, risks and value creating asymmetric information between demand and supply when companies look for funding (Myers, 1984).

A firm can choose between retained earnings, debt, and equity to finance its operations and investments. As outlined by Berk and DeMarzo (2013) the pecking order theory states that existing asymmetric information favors the issue of debt over equity. When a company is overvalued, the management has incentives to issue equity in order to maintain the interests of its current investors. A rational outside investor would factor this in when considering buying the newly issued securities, which lowers the market value of the company. Thus, equity offers high adverse selection problems and is the least preferred method of financing. Debt has smaller adverse selection problems and is the second most efficient financing option. Retained earnings are the preferred source of financing, as they reveal the least information. The pecking order theory does not assume that a firm has an optimal leverage ratio (Frank & Goyal, 2009), but supports the counter-cyclical behavior of leverage ratios (Halling et al., 2012). When the macroeconomic environment is depressed, the mechanism suggests that firms tend to issue less equity (Choe et al., 1993).

Empirical studies have both celebrated and criticized the pecking order theory. Findings from Psillaki and Dakalakis (2009) support the existence of a pecking order in corporate capital structure. In their study leverage relates positively with the ratio of tangible assets to total assets and the company's size. Simultaneously, leverage is negatively correlated with profitability and risk, which corresponds to internal funds being preferred over external funds. Other studies imply that a real life pecking order might not be as elegant as the theory initially implies. Different external financing opportunities carry heterogeneous characteristics, which demands a more complex pecking order to be comparable and work on a universal basis (Chirinko & Singha, 2000; Leary & Roberts, 2010).

2.3 The Market Timing Theory

When market imperfections occur, the market timing theory assumes that corporations time their capital issues to stock market conditions. Managers will choose to issue equity capital only in periods where the capital market conditions are favorable to the firm (Frank & Goyal, 2009). Capital structure decisions are seen as the company taking advantage of favorable market conditions rather than a dynamic optimization strategy. If a firm is in need of financing, managers will select their financing based on which market conditions are the most adequate. Exceptionally poor conditions may lead the firm to postpone issuance, whereas a particularly good market could induce a firm to issue more capital than needed in order to meet future requirements. An example of the market timing theory in practice is the issuance of equity after a period of stock price run-up (Frank & Goyal, 2009). The importance of debt versus equity is thereby diminished and the theory does not support the understanding of a target capital ratio.

To some extent the theory is supported by empirical findings. According to Baker and Wurgler (2002) companies will finance themselves using equity during favorable stock market conditions (e.g. in a market with high stock prices compared to book values). Through their work, the authors document that the weighted average of a firm's previous market to book ratios exerts a negative effect on leverage.

3. Literature Review

In this section we briefly outline findings from earlier studies done on standard capital structure determinants, the impact of macroeconomic factors, and speed of adjustment estimates. Combined these studies provide the basis on which our study is built on.

3.1 Standard Capital Structure Determinants

Lemmon et al. (2008) investigated nonfinancial firms in the period 1965-2003 and found two notable characteristics about their leverage ratios. First, leverage ratios seem to converge over time. Highly levered firms tend to become less levered over time, and vice versa. Second, although leverage ratios are converging across companies, more indebted firms tend to remain relatively indebted over time. As a consequence, leverage ratios can be said to have both a transitory and a permanent component. The importance of these components varies across model specifications. Their findings indicate that most of the variance in a firm's leverage is explained by time invariant factors. Lemmon et al. (2008) found book leverage to have a positive relationship with tangibility and size. Dividend paying status, profitability, and market to book ratio were found to negatively relate with book leverage.

Harrison et al. (2011) studied capital structures of real estate investment trusts (REITs) in the period 1990-2008 using a standard OLS regression. Their findings indicated a positive relationship between leverage and the tangibility as well as the size of a company. Profitability and the market to book ratio exerted a negative effect on the book debt ratio. Since REITs are known to contain large illiquid assets prone to market cyclicality, the findings of this research are highly comparable to our study of shipbuilders.

Drobetz et al. (2013) studied the capital structure decisions of 115 merchant shipping companies in the period 1992-2010. They found that tangibility was positively related to book leverage, whereas profitability, annual volatility of stock returns, and operating leverage were negatively related to book leverage. In line with what is observed in other industries, shipping companies' leverage ratios are to a large extent driven by time-invariant factors.

Frank and Goyal (2009) studied factors affecting the capital structures of all listed American companies in the period from 1950 to 2003. As indicated by their findings, the median industry leverage, tangibility, logarithm of assets, and expected inflation all had a positive effect on the market leverage. Leverage ratios were affected negatively by profitability and the market to book ratio. An identical analysis performed with book values was mostly consistent with the findings of market leverage, except that firm size, market-to-book ratio, and inflation were concluded as unreliable leverage predictors. They also revealed that lower leverage was more prominent amongst firms with stable dividend paying strategies.

Gropp and Heider (2010) studied the relationship between debt and equity of large European and U.S. banks in the period from 1991 to 2004. Market to book, profitability and asset risk were shown to relate negatively with market leverage, while size experienced a positive relationship. Unobserved time-invariant effects were pointed out as the primary determinant of the sample companies' capital structure decisions. The result indicated similarities between banks' and non-financial firms' capital structure decisions.

Table 3-1: Empirical findings of capital structure determinants

	Lemmon et al. (2008)	Frank and Goyal (2009)	Gropp & Heider (2010)	Harrison et al. (2011)	Drobetz et al (2013)
Tangibility	+***	+***	+	+***	+***
Market to book	-***	-***	-***	-***	+
Profitability	-***	-***	-***	-***	-*
Size	+***	+***	+***	+	+
Operating Leverage	NA	NA	NA	NA	-
Dividend Payer	-/+	-***	-	NA	-
Asset Risk	NA	NA	-***	NA	-***
Rating Probability	NA	NA	NA	NA	+
Firm Fixed Effects	Yes	No	Yes	No	Yes
Year Fixed Effects	Yes	No	Yes	Yes	Yes
Sample Industry:	Non-financial firms	Publicly traded American firms	Banks	REITs	Merchant Shipping

The table summarizes empirical findings on standard leverage determinants . "+" indicates a positive relationship with leverage, whereas a "-" indicates a negative relationship. NA means that the study did not include the variable in question. Column 1, 4, and 5 have book leverage as their dependent variable, whereas column 2 and 3 displays results using market leverage.

* Statistical significance at 10% level
** Statistical significance at 5% level
*** Statistical significance at 1% level

3.2 Impact of Macroeconomic Factors

Including macroeconomic factors in the study of capital structure decisions has received relatively scarce attention in academic literature (Halling et al., 2012). We will now briefly outline the main findings of three studies that have included macroeconomic factors.

Korajczyk and Levy (2003) show that unconstrained firms have counter-cyclical movements in their book and market leverage. Constrained firms experienced pro-cyclical leverage ratios. In a later related study, Halling et al. (2012) found further proof for counter-cyclicality in market leverage ratios among non-financial firms. However, pro-cyclicality was observed for book leverage.

In addition to the standard leverage regressions, Drobetz et al. (2013) included a set of macroeconomic and shipping specific macroeconomic indicators in their study of merchant shipping companies. Despite the additional variables the explanatory power did not increase significantly. Evidence from their study indicates that shipping companies have counter-cyclical leverage ratios. The understanding is supported by the significantly negative relationships between book leverage and inflation rate, lagged term spread, and annual oil price return. GDP growth showed an unexpected positive relationship with leverage. Return on freight rates and the Real Trade Weighted US Dollar Index also displayed positive relationships with book leverage, while secondhand ship prices were negatively related.

3.3 Speed of Adjustment

Drobetz et al. (2013) state that adjustment speeds rely on the trade-off between the cost of deviation from the optimal combination of debt and equity and the adjustment cost the company faces to achieve the target capital structure. Financially constrained firms are faced with a higher cost of adjustment and, therefore, adjust slower towards the target capital structure. However, due to high costs of financial distress firms can be expected to adjust faster despite even higher adjustment costs.

Previous research reveals significant variation in the results of adjustment speeds based on the chosen measurement method, country of incorporation, and industry. Using a long difference panel estimator, Huang and Ritter (2009) calculate yearly adjustment speeds of US corporations to vary between 11% and 23% per year. Kayhan and Titman (2007) report adjustment speeds of around 10% per year based on the OLS methodology. Flannery and Rangan (2006) find the speed of adjustment for US firms to be 30%. Öztekin and Flannery (2012) found that adjustment speeds in more developed markets (e.g. more efficient capital markets) could be as much as 50% faster. The latter result is in line with expectations, as capital is more costly in the presence of market imperfections.

Running OLS regressions, Lemmon et al. (2008) found adjustment speeds of 13%-17% for the nonfinancial firms listed in the Compustat database. In their study they also used fixed effects estimates that showed a significantly faster adjustment speed of 36%-39%. Blundell Bond estimators indicated the adjustment speeds were 22%-25%. An important insight from Lemmon et al. (2008) is that there is only limited additional information to be obtained by controlling for time varying effects, with increased adjustment speeds of just 2-3% per annum.

For the merchant shipping industry, Drobetz et al. (2013) report adjustment speeds that are much higher than for other industries. This could indicate substantial deviation costs due to large expected financial distress costs. Their estimates yielded adjustment speeds of 22% and 42% using an OLS and a fixed effects model respectively. However, when using the Arellano-Bond estimator their results indicated an adjustment speed of 59%. The corresponding adjustment speed generated from the less biased and more reliable Blundell-Bond estimator was 46.7%[3].

When it comes to macroeconomic conditions and adjustment speeds, Hackbarth et al. (2006), Cook and Tang (2010), and Halling et al. (2012) report adjustment speeds that are slower during recessions. According to Faulkender et al. (2012), firms are quicker to deleverage when experiencing positive shocks than to re-leverage after negative shocks. Drobetz et al. (2013) found only slightly slower adjustment speeds during recession than normal economic conditions.

[3] The details of the Arellano-Bond and Blundell-Bond estimators are outlined in section 5.3

4. Regression Variables

In this section we begin by defining what leverage ratio we will study in our analysis. Then the included independent variables on both firm- and macroeconomic levels are defined and discussed.

4.1 Dependent Variable: Leverage

The choice between market or book leverage, as the applied definition of leverage, has been widely discussed in academic literature. On the one hand, a large number of researchers support using the market leverage definition when making financial decisions. Welch (2004) argues that book leverage is not managerially relevant and that its main use is operating as a plug for the balance sheet. Barclay et al. (2006) emphasize that book debt is backward looking, whereas the market most often is forward looking. Frank and Goyal (2009) believe that market leverage is preferred for the purpose of analyzing companies' capital structure.

One the other hand, many scholars argue that book leverage represents the correct measurement. Myers (1977) advocates that decision makers should focus on book leverage since it is the asset base, and not the outlook for future growth, that is the underlying support for debt obligations. Getzmann and Lang (2010) find that since the bias of future expectations are excluded the retrospective explanation offered by analyzing book leverage is superior to the market value approach. Additionally, Frank and Goyal (2009) report that financial managers regard the market leverage measurement as too volatile to function as an appropriate base for funding decisions. Specifically for shipbuilders we observe highly volatile market values[4]. Should financial managers make capital structure decisions based on market values, alterations would have to be made very often. This can be assumed to be expensive (e.g. listing fees, advisory costs). Graham and Harvey (2001) also support the book leverage definition as they found that managers do not adjust their funding decisions based on capital market fluctuations. Another argument favoring the use of book leverage is that debt's market value is difficult to reliably

[4] The volatile nature of market leverage is assessed in the descriptive statistics of section 6.3.1.

quantify. Additionally, it is common to assume that there are negligible differences between the absolute book and market values of debt (Koller et al., 2010).

Considering all the abovementioned factors we base our study on the book leverage definition[5]. Only interest bearing debt is included as we wish to exclude debt types whose costs are accounted for in the operating expenses.

$$Leverage = \frac{Long\ Term\ Debt + Short\ Term\ portion\ of\ Long\ Term\ Debt}{Total\ Book\ Value\ of\ Assets}$$

4.2 Independent Variables

This section provides an overview of the independent variables and their theoretical predictions. We start by discussing the included firm specific variables and follow up with the macroeconomic factors.

Table 4-1: Predictions from a theoretical perspective

	Trade-Off Theory	Pecking Order Theory	Market Timing Theory	Prediction for Shipbuilders
Firm Specific Variables:				
Taxes	+			+
Tangiblity	+	-/+		+
Market to book	-	+	-	-
Company Size	+	-		+
Profitability	+/-	-		-
Dividends	-	+/-		-
Asset Risk	-	+		-
Operating Leverage	-			-
Rating probability	+	-		+
Macroeconomic Indicators:				
Macroeconomic Cycles	+	-	-	-
Shipyard Specific Indicators	+	-	-	-

The table displays the different explanatory variables and the effects the trade-off theory, pecking order theory, and the market timing theory are expected to have on a shipyard's leverage ratio. For the macroeconomic indicators, a "+" sign indicates pro-cyclical leverage ratios, whereas a "-" sign indicates counter-cyclical leverage ratios

[5] The regression results using market leverage are provided in the appendix. The regressions based on market leverage yield somewhat different results. This is not unexpected, as market leverage is extremely volatile due to the high asset risk.

4.2.1 Firm Specific Variables

Taxes (Corporate Tax Rate)

Following thoughts from the trade-off theory, the presence of taxes should lead companies to take on more leverage as interest payments are tax deductible (Frank & Goyal, 2009). Additionally, shipyards would be incentivized to initiate more projects in the presence of a higher tax rate. This is because the downside is reduced due to the ability to carry forward tax-losses. However, empirical findings are not consistent with the trade-off theory regarding the effect of taxes. Frank and Goyals (2009) find tax effects hard to assess when studying capital structure determinants. Hennesy and Whited (2005) report that transaction costs make the effect from taxes difficult to empirically identify although they are a part of the company's funding decision. Frank and Goyal (2009) provide a range of measures suitable for detecting the effect of taxes on corporate financial decisions such as top tax rate, investment tax credits in relation to assets, net operational carryforwards, and depreciations to assets. We have chosen the top tax rate/statutory corporate tax rate as our independent variable. In line with the trade-off theory, we posit that shipbuilders' leverage ratios should be positively influenced by the statutory tax rate.

$$Taxes = Statutory\ Tax\ Rate$$

Tangibility

The trade-off theory implies that companies with identifiable and tangible assets have lower bankruptcy costs. Asset tangibility makes the value of a company transparent and reduces information asymmetry, making it easier for outsiders to value the firm correctly (Drobetz et al., 2013). Thus, one can expect a higher degree of asset tangibility to lead to a higher leverage ratio. However, Harris and Raviv (1991) argue that the cost of equity is reduced when there is less information asymmetry. This is more in line with the pecking order theory and should lead to lower debt levels. Frank and Goyal (2009) claim there exists ambiguity in the pecking order theory when the adverse selection costs are connected to the assets in place. Under those circumstances one would expect to see higher debt levels when tangibility increases. Following findings from Frank and Goyal (2009) we propose a positive relationship between tangibility and leverage for the shipbuilders.

$$Tangibility = \frac{Net\ Property, Plant, and\ Equipment\ (PP\&E)}{Total\ Book\ Value\ of\ Assets}$$

Market to Book (Growth Opportunities)

The trade-off theory predicts that firms experiencing and expecting high growth, face increased costs from agency problems related to debt and elevated financial distress costs (Myers, 1977). Thus, one would expect a negative relationship between growth and leverage. However, the pecking order theory implies that constant profits will lead growth opportunities to have a positive impact on leverage ratios. When new investments eventually exceed retained earnings a company will start financing through debt, which increases the debt-ratio (Frank & Goyal, 2009). Drobetz et al. (2013) report that most empirical findings coincide with the expectations from the trade-off theory. They also state that a company's market to book ratio serves well to capture the impact from expected growth opportunities. Market timing theory says that a high market to book ratio would give managers incentives to reduce the company's debt level (Frank & Goyal, 2009). This is because equity issuances are relatively cheap for existing shareholders. In line with previous studies supporting the trade-off theory, we hypothesize that shipbuilders will experience a negative relationship between the market to book ratio and leverage.

$$Growth\ Opportunities = Market\ to\ Book = \frac{Market\ Value\ of\ Assets}{Total\ Book\ Value\ of\ Assets}$$

Size

Higher operational transparency is often associated with larger firms. From a pecking order perspective this will lower the cost of equity issuances and supports lower debt levels. However, Frank and Goyal (2009) argue that large and diversified firms face lower risks of default. Mature firms are more often recognized in the capital markets, which reduce their debt-related agency costs. Based on the trade-off theory, company size should exert a positive influence on the leverage ratio. Drobetz et al. (2013) comment that empirical findings support the trade-off theory. We measure company size by the natural logarithm of the total value of book assets and decide to follow the trade-off theory's prediction of a positive correlation between leverage and size.

$$Size = \ln(Total\ Book\ Value\ of\ Assets)$$

Profitability

The pecking order theory posits that companies with high profits have lower leverage ratios because internal funds are preferred over external funds. This is well illustrated when holding dividends and investments constant, as growing profits would finance an ever-increasing part of the operations. On the contrary, trade-off theory states that profitable firms have a higher debt capacity and require higher levels of debt in order to discipline management (Jensen & Meckling, 1976). Frank and Goyal (2009) make the argument that a dynamic trade-off theory could lead companies to have lower debt ratios, as leverage can be negatively related to profits due to different market frictions (e.g. passive accumulation of profits). The pecking order perspective has received the most empirical support and following this we expect profitability to be negatively correlated with leverage for our shipbuilders.

$$Profitability = \frac{Earnings\ Before\ Interest, Depreciations, and\ Amortizations}{Total\ Book\ Value\ of\ Assets}$$

Dividend Payer

Many firms attempt to maintain a constant dividend pay-out ratio and this affects their capital structure decisions (Johnsen, 2012). The pecking order theory does not explicitly predict a consistent relationship between leverage and the dividend status of a company (Drobetz et al. 2013). Initially one would expect dividend-paying firms to issue more debt since it is preferred to equity as a source of financing. However, dividends are disciplining to the firm's management and reduce information asymmetries, which could lead to more equity. From a trade-off perspective this implies lower leverage. Findings from studies done on other industries have shown that dividend payers have lower debt levels than their counterparties (Frank & Goyal, 2009; Drobetz et al., 2013). Accordingly, we expect the same effect for globally listed shipbuilders.

$$Dividend\ Payer = 1\ if\ dividends > 0\ in\ year\ i$$

Asset Risk

As outlined by Drobetz et al. (2013) the financial distress costs increase with the volatility of a firm's assets. The type of shipbuilding orders can change quickly from one type of ships to another (Stopford, 2012), which should result in increased volatility for specialized firms. Additionally, specialized vessels should have less functioning second hand markets, given that their area of usage cannot easily be expanded to new freight areas. This should further elevate the asset risk. Certain assets can be temporary illiquid and hard to redeploy under difficult macroeconomic conditions. Following the trade-off theory asset risk should relate negatively with leverage. The pecking order theory suggests that higher adverse selection costs associated with asset volatility will lead managers to choose higher levels of debt. Evidence for the impact of asset risk on leverage ratios is scarce. Gropp and Heider (2010) and Drobetz et al. (2013) found asset risk to exert a negative impact on book leverage. In line with Frank and Goyal (2009) and Drobetz et al. (2013)'s definition, we use the unlevered volatility of stock returns as our measure of asset risk and expect to see a negative relationship with leverage.

$$Asset\ risk = Unlevered\ Volatility\ of\ Stock\ Returns = \sigma_u$$
$$= \sigma_l * \frac{Market\ Value\ of\ Equity}{Market\ Value\ of\ Assets}$$

Operating Leverage

Drobetz et al. (2013) posit that operational leverage complements asset risk when measuring a firm's risk. The operating risk of a firm increases with the size of the fixed production costs. With high financial leverage, operating leverage should be comparatively lower when following the trade-off theory. Previous literature shows that leverage relates negatively to operating leverage in capital-intensive industries such as shipping (Drobetz et al., 2013) and REITs (Harrison et al., 2011). Given the similarities between shipbuilding and the industries mentioned above we expect to see a negative connection between operating and financial leverage.

$$Operating\ Leverage = \frac{Operating\ expenses}{Total\ Book\ Value\ of\ Assets}$$

Rating Probability (Supply of Debt Capital)

Firms are constrained in their access to capital markets and are rationed by investors (Stiglitz & Weiss, 1981). Restrictions to enter debt capital markets are widely acknowledged in academia. Faulkender and Petersen (2006) state that a company can be categorized with a high debt capacity if it is credit rated. A credit rated company should experience less difficulties of raising debt, both in terms volume and spread. Credit ratings are positively related to leverage from a trade-off theory perspective. The pecking order theory predicts that ratings could potentially decrease the debt ratio, since lower information asymmetries lead to decreased equity issuance costs (Drobetz et al., 2013).

Not all firms receive a credit rating and thus Lemmon and Zender (2010) criticize using them as leverage ratio predictors. They argue that firms may intentionally exclude debt issues from their financing decisions. Therefore, some firms do not possess a credit rating even though they are equally capable of utilizing the debt markets as companies already holding a credit rating. An approach to minimize this bias used in recent academic papers, such as Lemmon and Zender

(2010) and Drobetz et al. (2013), is to estimate the probability a firm has of obtaining a rating given a set of firm-specific characteristics. Size, profitability, tangibility, market to book, age, share of research and development expenses to sales, volatility of stock returns, and industry of the company are the predictors used to compose a rating probability with a logistic regression[6]. Increased rating probability creates easier access to debt capital markets and we hypothesize that shipbuilders will experience higher leverage ratios given this development.

$$Rating\ Probability = \frac{1}{1 + e^{-(\beta_o + \beta_i * Company\ Specific\ Factor\ i)}}$$

4.2.2 Macroeconomic Factors

Macroeconomic conditions heavily influence the shipping industry (Stopford, 2009). Drobetz et al. (2013) promote that the capital need of the shipping industry is a consequence of the demand for seaborne trade. The sensitivity towards macroeconomic conditions is transferable to the shipyards given their role as suppliers to the shipping industry. To illustrate the possible influence of macroeconomic conditions, we introduce macroeconomic factors as potential determinants in the examination of shipbuilders' capital structure. Accompanied by other capital structure studies, Korajczyk and Levy (2003) and Drobetz et al. (2013) provide precedence for performing regressions which include both level and return based variables simultaneously. As such, we feel confident in adopting their approach.

Leverage and Economic Cycles

We use indicator variables to isolate the effects of general economic cycles. Two dummies are included in the regressions; (1) the industrial growth of the Pacific region and (2) the state of shipping market[7]. Total economic output consists of both services and goods, but only the latter are transported physically. Additionally, several countries located in the pacific region have large industrial sectors (e.g. China accounts for approximately one fifth of the world's manufacturing (the Economist, 2012)). Thus, it is fair to assume that the industrial production growth of the

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[6] Rebekka Haller and Wolfgang Drobetz provided us with the results of the rating probability logit regression of their study. The regression is based on data from a comprehensive sample of firms in G20 (a total of 244,380 observations) retrieved from Compustat.

[7] The industrial growth of the pacific region is collected from Clarksons (Clarksons, 2014h) and is set equal to 0 when the growth rate is positive, and 1 in the case of negative growth. The resulting periods of recessions are 1998, 2001, and 2009. The shipping dummies are collected from Drobetz et al. (2013), which constitutes the periods from 1998-2002 and 2009-2013.

Pacific region may influence shipbuilders' capital structure decisions. Considering the shipping market, the demand for ships ultimately depends on the demand for seaborne trade. Thus, the economic state of the shipping market should influence shipbuilders' corporate financial decisions. Halling et al. (2012) support the prediction of a counter-cyclical leverage ratio due to firms' market timing behavior. Pecking order theory argues that less debt will be issued in good economic times since the firms experience stronger cash flows and generate more internal funds. Firms will also be induced to issue securities that are less information sensitive during poor macroeconomic conditions. However, higher bankruptcy costs combined with lower taxable income and cash flows favor a pro-cyclical leverage-ratio according to the trade-off theory (Frank & Goyal, 2009). In line with Halling et al. (2012) and Drobetz et al. (2013), we expect shipbuilders' leverage ratios to also exhibit a counter-cyclical behavior.

For the standard macroeconomic indicators we adopt a similar set of variables as Ferson and Harvey (1994) and Drobetz et al. (2013). To account for market cyclicality we include the lagged term spread, which is calculated through subtracting a 1-year from a 10-year US treasury bill. One can argue that a tight term spread is a predictor of recessions (Dahlquist & Harvey, 2001). A negative relationship between leverage and the lagged term spread would, thus, be in support of a counter-cyclical leverage ratio. A positive coefficient would favour a pro-cyclical leverage ratio and is consistent with the trade-off theory. For our shipbuilding companies we expect a negative relationship, which is in line with the shipping industry's counter-cyclical leverage ratios.

The real growth rate of the G7 countries' aggregated gross domestic product (GDP) is included as a benchmark for the direction and state of the global economy. This particular proxy was preferred to others to make our findings comparable with previous studies such as Drobetz et. al. (2013). During boom periods shipowners tend to order new ships despite having available capacity within the overall fleet, as they are hoping to take advantages of the prosperous earnings potential (Stopford, 2009). Accordingly, the rate of GDP growth is expected to have an impact on the leverage ratios of the shipbuilding industry. A positive coefficient is in line with the trade-off theory, whereas the opposite is expected under the pecking order theory. Following the empirical observations of counter-cyclical leverage ratios, we expect a negative coefficient for the GDP growth.

A positive return on the Brent Crude oil price can indicate a booming economy, but also be a result of extraordinary events related to the oil industry. The recent high oil prices have increased the focus on cost efficiency amongst ship-owners (Fearnleys, 2014). As they undergo measures to lower their bunker costs they are more likely to order new and more efficient ships, ultimately affecting the capital structure decisions of shipbuilders. At the same time exogenous factors can also cause oil price changes. For example, the Arab spring in 2011 significantly drove up oil prices worldwide (Blas, 2011) despite that the overall world economy was only just recovering from the 2008-2009 recession. This creates ambiguity in relation to which underlying factors drive the coefficient of the Brent Crude oil price return. Regardless of the underlying reason for an oil price change, we can assume that it will affect the shipbuilders' capital structure decisions. However, predicting a general explicit direction of the relationship will be imprecise unless we know the underlying reason. Thus, we offer an ex-post interpretation of the relationship between the return on the Brent Crude oil price and leverage ratios.

The annual return on the MSCI World Index is also included. Given that high stock price returns are results of correct stock pricing, they should be accompanied with increased internal funds available to finance operations. In the presence of a pecking order leverage should then be lower when stock returns are higher. The trade-off theory implies the opposite to be true as higher free cash flows can result in increased agency costs and firms would issue more debt to discipline management. Following the expectation of a counter-cyclical behavior we expect a negative relationship between leverage and the return of the MSCI index.

Shipbuilding Specific Indicators

We include four return based shipbuilding industry specific variables: the Clarkson Newbuilding Price Index, the world orderbook in terms of value, the world deliveries measured in DWT, and the Real Trade Weighted US Dollar Index: Major Currencies.

The return on the Clarksons Newbuilding Price Index directly affects investment decisions of shipping investors because the level influences supply and alters financial flexibility as more investors are attracted to prosperous periods compared to depressed times. Thus, the index also affects the capital structure decisions for shipbuilders. Given that higher vessel prices are resulting from increased demand as opposed to higher input factor costs, an increase in the index indicates a boom period for shipbuilders. A positive relationship between the price index return and leverage ratio implies that shipbuilder's act based on the trade-off theory. Observing a negative coefficient indicates that the pecking order theory is dominant. However, it must be noted that increased vessel prices could be expected to affect demand negatively as some shipowners may find new vessels too expensive and rather keep their existing fleet. All factors considered we hypothesize a negative relationship between leverage and the price index.

The orderbook value is directly connected to all shipyards as a highly tangible measure of how much work each shipbuilder has contracted. Increasing values of the orderbook entail more secure operations for the shipbuilder and indicate a positive market development. A negative coefficient in front of the orderbook change favors the counter-cyclical prediction of the pecking order theory. On the contrary, it must be noted that an increase in orderbook could be the result of delays or postponed deliveries due to requests from the customers. Given that the postponement is the result of a downward market trend, as opposed to an individual customer's failure to serve the requirements of their shipbuilding contract, a negative coefficient would be in line with a pro-cyclical leverage ratio. The empirical findings of Drobetz et al. (2013) showed counter-cyclical leverage ratios for the shipping companies. Overall we hypothesize a counter-cyclical leverage ratio for shipbuilders, but since the interpretation of the orderbook value holds an inherent ambiguity we will give an ex-post assessment.

Given that shipbuilders are dependent on a continuous flow of work to optimize operations, the change in new orders is an alternative measure for the developments covered by the change in world orderbook. However, the change in new contracts only accounts for new business, whereas the change in the overall orderbook includes information about all operations and past influences. Accordingly, we decide to use the return on the world orderbook. Nevertheless, we acknowledge that the new orders variable can provide an equally good measure.

The relationship between book leverage and return on world deliveries is ambiguous. Generally, we hypothesize that shipbuilders experience counter-cyclical leverage ratios. Two different interpretations can be presented depending on the sign of the observed coefficient of world deliveries. On the one hand, a positive relationship can imply that shipbuilders are positive with regards to earnings outlook from an increase in aggregated deliveries. On the other hand, a negative relationship could entail that a potential capacity increase in the overall fleet from an upturn in deliveries would mean that the shipbuilders face tougher market conditions in the future. Given the ambiguity, we will offer an ex-post interpretation of the change in deliveries and its relationship to book leverage.

The Real Trade Weighted US Dollar Index: Major Currencies represents the value of the US dollar against seven currencies that are widespread outside the country of issuance[8] (St Louis

[8] The countries included in the Real Trade Weighted US Dollar Index: Major Currencies are the Euro Area, Canada, Japan, United Kingdom, Sweden, Switzerland, and Australia.

Fed, 2014). An increase in the index entails that a larger amount of foreign exchange is required to buy US dollars. We include this measure because foreign exchange is of vast importance to shipyards worldwide. Shipowners often demand that the contracts on loans provided are denominated in a currency of their choosing, which most likely is the US dollar (European Commission, 2003). Stopford (2009) highlights that most shipyards' competitiveness are negatively exposed to the value of the US dollar. When the US Dollar index increases, the shipyards should respond by increasing their leverage ratios. This is given that they follow the pecking order's dynamic of counter-cyclical leverage ratios. Following Stopford (2009) and our former prediction of counter-cyclical leverage ratios, shipbuilders should experience a positive relationship between leverage and the return of the US dollar index.

5. Methodology

5.1 Ordinary Least Squares Multiple Regression

A multiple regression model is a well-suited tool to explain the value of one dependent variable based on a set of independent variables. Stock and Watson (2012) outline the characteristics of an ordinary least squares (OLS) model. In contrast to a regression with one explanatory variable, a multiple regression model increasingly explains the variance of the predicted values, as more independent factors are included. Equation 1 illustrates the general multiple regression formula, where β_0 is the constant value, $\beta_1, \dots, \beta_n$ are the isolated effects on the predicted value y, and ε is the error term.

(1) $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_{ni} + \varepsilon$

The coefficients are estimated by minimizing the errors between the predicted ŷ and y.

(2) $\sum_{i=1}^{n}(Y_i - \beta_o - \beta_1 x_{1i} - \cdots - \beta_n x_{ni})^2$

For an ordinary OLS model to be valid, the conditions of linearity, normality, homoscedasticity, multicollinearity, and autocorrelation must be fulfilled[9].

When assessing a regression model it is important to be aware of the possible omitted variable bias (Stock & Watson, 2012). Two conditions must be fulfilled for the omitted variable bias to occur: (A) if the omitted variable correlates with the regressor and (B) if the omitted variable is part of determining the independent variable. The effect of the omitted variables will be captured in the error term, and thus including more omitted variables into the model will increase its explanatory power (Stock & Watson, 2012).

5.2 Fixed and Random Effects Models

A fixed effect model allows $Cov(X_{k,it}, u_{it}) \neq 0$ (Wooldridge, 2009), making it a powerful tool for analyzing panel data (Stock & Watson, 2012)[10]. If all variables occur for each time-period

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[9] For the interested reader these conditions are outlined in the appendix.

and entity the panel data is balanced. An unbalanced panel data set includes missing data points. Introducing fixed effects allows to adjust for either unobserved effects that vary across entities, but are constant over time, or effects that are constant across entities, but vary over time. The adjustment can also be made for both simultaneously. The fixed effect regression model can be illustrated as:

(3) $Y_{it} = \beta_0 + \beta_1 X_{1,it} + \cdots + \beta_k X_{k,it} + \alpha_i + \lambda_t + u_{it}$

where $i = 1, \ldots, n$; $t = 1, \ldots, T$; $X_{n,it}$ is the value of the nth regressor for entity i in time period t, and $\alpha_1, \ldots, \alpha_n$ and $\lambda_1, \ldots, \lambda_t$ are the specific intercepts for the entities/time-periods (i.e. dummy variables). In order to avoid the dummy variable trap of perfect multicollinearity, only $n - 1$ and $t - 1$ dummy variables are included for the respective categories.

Where the fixed effect model allows $Cov(X_{k,it}, u_{it}) \neq 0$, a random effects model requires $Cov(X_{k,it}, u_{it}) = 0$. Zero correlation between the independent variables and the error term can be observed when one has controlled for all factors that may influence the dependent variable or when the error term u_{it} is very small (Wooldridge, 2009). The random effects model provides the chance of estimating the effect from the explanatory variables that are constant over time and still account for unobserved individual specific effects (Balsvik, 2012).

To determine which model is best suited one can perform a Hausman test (Wooldridge, 2009). The test checks to see if $Cov(X_{k,it}, u_{it}) = 0$. When $Cov(X_{k,it}, u_{it}) = 0$ both the random and fixed effect results will be consistent. The main difference is found in the standard deviation, which will be significantly smaller for the random-effect model (Wooldridge, 2009). If the circumstances allow it, using the random-effects model is preferable. However, when the unobserved effect u_{it} correlates with at least one of the explanatory variables the fixed effect model provides superior results.

5.3 Speed of Adjustment Estimators

In an assessment of the determinants of capital structure for shipbuilders, it is interesting to estimate how quickly the sample companies adjust when there is a deviation between the current

[10] Panel data means that one has observation for n different entities for t different time-periods

and the optimal capital structure. Drobetz et al. (2013) outlines the econometric specifications to assess the speed of adjustment, a methodology that has become increasingly popular in recent capital structure research.

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

The change in leverage is dependent on λ (the adjustment speed) and how far the leverage ratio in the last period $L_{i,t-1}$ was from the target leverage ratio $L^*_{i,t}$. $\lambda = 0$ represents no adjustment, whereas a $\lambda = 1$ entails a full adjustment in the first period following a shock. The target leverage-ratio $L^*_{i,t}$ is dependent on a set of factors relevant to the firm, $X_{i,t}$. Through rearranging equation 4 and substituting $\beta X_{i,t}$ for $L^*_{i,t}$, the following equation is reached:

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

$X_{i,t}$ is the vector of firm-specific leverage factors that are to be determined through an OLS-regression model and β is a vector of coefficients. An OLS estimator will be biased upwards because it omits fixed effects (Nickell, 1981). Thus, the error term $\delta_{i,t}$ is divided between Gaussian white noise $\delta_{i,t}$ and a firm-fixed effect α_i.

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

Research from Baltagi (2005) says that a fixed effect (FE) estimator will not completely remove the bias of unobserved heterogeneity. Lagged leverage L_{t-1} correlates with the part of the regression residuals related to the firm's fixed effects α_i and the error term $\delta_{i,t}$. The time-invariant effect can be removed by instrumenting the variables using the Arellano Bond (AB) (1991) difference generalized method of moments (GMM) estimator. This estimator allows all lagged estimators to be used as instruments and will be unbiased when the residuals are free from second order serial correlation.

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

The AB estimator can become problematic when the instruments provide little information about why the leverage changes. Consequently, Blundell Bond (BB) (1998) introduced the system GMM-estimator. Not only does it include the difference equation (8), but it also includes the level equation (9).

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

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

According to Drobetz et al. (2013) the lagged first difference variables prove as valid instruments for equation 8. The same is true for equation 9 when using the lagged independent variables. As the BB-estimator allows for more instruments the efficiency can increase dramatically (Roodman, 2009). It must be noted that when the lagged variables' coefficients are close to unity or when second order serial correlation is present, a BB estimator will still be biased (Huang & Ritter, 2009; Flannery & Hankins, 2012).

A valid GMM estimator model must fulfil two criteria to provide valid results: (1) no second order autocorrelation and (2) exogenous instruments. In order to verify unaccounted autocorrelation in the fixed effects one can use the Arellano Bond (AR) tests. The test assumes no autocorrelation in the residuals as its null hypothesis (Roodman, 2009). In a valid model one expects first order correlation in differences, but second order correlation should be absent. Regarding the second criteria of exogenous instruments, it is possible to utilize the Sargans/Hansen-test for overridden restrictions (Stock & Watson, 2012). The results of the model should be interpreted with caution if the null hypothesis of truly exogenous instruments is rejected.

GMM estimators are best intended for panel data that have a large number of groups N compared to periods T (Roodman, 2009). There is no definition of what size defines a large group, but panel data with less than 20 groups may become worrisome. A too small N can make the Arellano Bond test for autocorrelation and the clustered standard errors unreliable. With a smaller number of groups, chances are that the number of instruments can approach the number of observations as the instrument counts quadratic in T. Too many instruments can be limited by collapsing them (Roodman, 2009).

There are many potential biases associated with speed of adjustment estimates and in line with Drobetz et al. (2013) we will outline two potential biases. Debt ratios are in the interval of 0 to 1, which econometric estimators assume is due to mean reversion. Thus, even when corporate financial decisions are made randomly the speed of adjustment estimators can be positive (Chang & Dasgupta, 2009). Additionally, the use of leverage ratios will bring speed of adjustment biases upward (Iliev & Welch, 2010). Roodman (2009) states that as indicated by Sargan statistic with p-value equal to one, a large number of instruments compared to the number of observation will lead to biased estimates.

The speed of adjustment, λ, is given by one minus the coefficient of the lagged leverage ratio L_{t-1} (Drobetz et al., 2013). A more tangible measure of λ is the half-life of deviation from target leverage, which is given by $\frac{\log(0.5)}{Log(1-\lambda)}$.

6. Data

In this section we first describe the data sample and elaborate on our data gathering process. Then we discuss the limitations of the representativeness of our sample. Further on descriptive statistics are provided for both the firm specific variables and macroeconomic variables.

6.1 Data Sampling Process

Our sample consists of 23 listed shipbuilding companies, generating 285 firm year observations in the timeframe between 1997 and 2013. Financial statements are collected through ThomsonOne/Worldscope[11] on an annual basis[12] and converted into US dollars for comparability. In wider terms the shipbuilding industry includes companies that build ships and/or contribute the necessary supplies and facilitate services to complete shipbuilding activities. Shipbuilding is a versatile industry and the companies differ greatly. To compile a refined and appropriate sample of companies, a narrower definition of shipbuilding was chosen for our study. Thus, the selection criteria to be included in our sample were a public listing and

Table 6-1: Firm years and shipyards by country of incorporation

Country	**Companies**	**Sum of #**
Bermuda	2	27
China	3	34
India	2	20
Japan	4	64
Norway	2	15
Singapore	2	25
South Korea	7	93
Taiwan	1	7
Grand Total	23	285

The table displays the firm year observations and the number of firms in the data sample according to incorporation country. Overall, the sample consists of 23 globally listed shipyards, with annual data retreived from ThomsonOne (Worldscope). Country of incorporation is based on Bloomberg.

11 In the situation of an incomplete financial statement derived from ThomsonOne – the missing data was filled in manually from Bloomberg. However, all sourced from Worldscope.

12 Reporting of a fiscal year differs in certain accounting standards. If the fiscal year ends 31.03, we have chosen to include the statement as a reflection of the previous calendar year. If the fiscal year ends 31.12 the statements are included as the current year.

that the shipbuilders primary operation was building ships for commercial trade. Further we have required that all firm year observations have non-missing data for total book assets.

Our initial selection of companies was decided from a comprehensive list of internationally listed shipbuilding companies available through Bloomberg. The list was compared with company descriptions from ThomsonOne. Thirty-five false listings, e.g. naval companies, personal leisure boat builders, military shipyards or shipping companies, included in the Bloomberg list were excluded. Following this professor Roar Os Ådland validated our list, which lead to the exclusion of thirteen additional companies that were not primarily involved in shipbuilding. An example of such a company is ES Group whose activities are firstly supply functions and secondary shipbuilding. The final data sample contains both newer companies, with only 4 years of financial statements (i.e. China Shipbuilding Industry Company) and older traditional shipyards such as Hyundai Heavy Industries.

For the macroeconomic input factors we demanded that the chosen source provided both reliable and up-to-date information. Generally, Clarksons has been our primary source of shipbuilding specific information such as the Newbuilding Price Index, deliveries and orderbook. The Brent Crude oil price and the Pacific region's industrial production were also gathered from Clarksons. For equity capital markets our source was Datastream. American government agencies, such as the National Bureau of Economic Research (NBER) and the Federal Reserve Bank of St Louis, were chosen to provide the data for the term spread and the Real Trade Weighted US Dollar Index: Major Currencies. The shipping recessions are collected from Drobetz et al. (2013).

6.2 Representativeness of Data Sample

Since our final sample consists of 23 companies one can question how representative our selection is for the overall shipbuilding industry. The somewhat limited number of observations is the major drawback of our study and we acknowledge that it could potentially influence the results. In addition to this we have chosen to only include listed shipbuilders due to the ease of access to financial accounting information. This criterion has excluded some large players (e.g. Italian Fincantieri).

Despite the sample size, we have indications that our sample is representative for the total industry. Our selected companies are overrepresented amongst the strongest and largest shipbuilders. As of April 2014, seven of our included yards rank as global top ten shipyards in terms of orderbook and combined they hold approximately 27% of the total world orderbook volume (Clarksons, 2014a). In terms of geographical location our sample is somewhat skewed towards Asia. Asian shipbuilders possess 91% of the world's orderbook (Clarksons, 2014a). For our sample Asian companies own approximately 99% of the combined orderbooks, indicating the slight skew. However, in terms of the number of companies our sample has a split of 91% Asian and 9% European shipbuilders.

All factors considered we believe our sample to be a representative illustration of the shipbuilding industry. However, the reader should bare in mind the concerns regarding the sample size when assessing the results.

6.3 Descriptive Statistics

6.3.1 Firm Spesific Descriptive Statistics

Previous research on similar capital structure determinants have been conducted in both related and unrelated industries. In order to provide a more holistic picture of our data, results and observations from Frank and Goyal (2009) on the US Market, Bessler et al. (2013) for the G7

Table 6-2: Firm specific descriptive statistics

					Percentiles			
	Obs.	Mean	SD	Median	25th	75th	Min	Max
Book Leverage	285	0.226	0.160	0.213	0.094	0.336	0.000	0.765
Market Leverage	267	0.752	2.854	0.561	0.113	0.873	-14.408	39.653
Operating Leverage	285	0.640	0.284	0.658	0.454	0.817	0.000	1.737
Tangibility	285	0.285	0.126	0.297	0.201	0.358	0.000	0.631
Market to book	267	0.542	0.636	0.438	0.268	0.646	-0.391	6.088
Book Assets (USDm)	285	1 346	5	987	423	5 953	6	49 935
Profitability	285	0.054	0.074	0.062	0.032	0.088	-0.430	0.256
Dividend Payer	285	0.670	0.471	1.000	0.000	1.000	0.000	1.000
Asset Risk	262	0.512	1.535	0.382	0.187	0.618	-10.275	15.819
Rating Probability	258	0.176	0.227	0.043	0.010	0.287	0.000	0.999
Company Age	285	40.4	23.4	37.0	27.0	50.0	2.0	101.0
Corporate Tax Rate	285	0.279	0.121	0.280	0.242	0.340	0.000	0.516

The table displays the number of firm-year observations, the mean, the standard deviation, the median, the 25th and 75th percentile, as well as the minimum and the maximum of each factor. All data are unwinsorized, raw data.

firms and Drobetz et al. (2013) will be used as benchmarks for our discussion of the descriptive statistics[13].

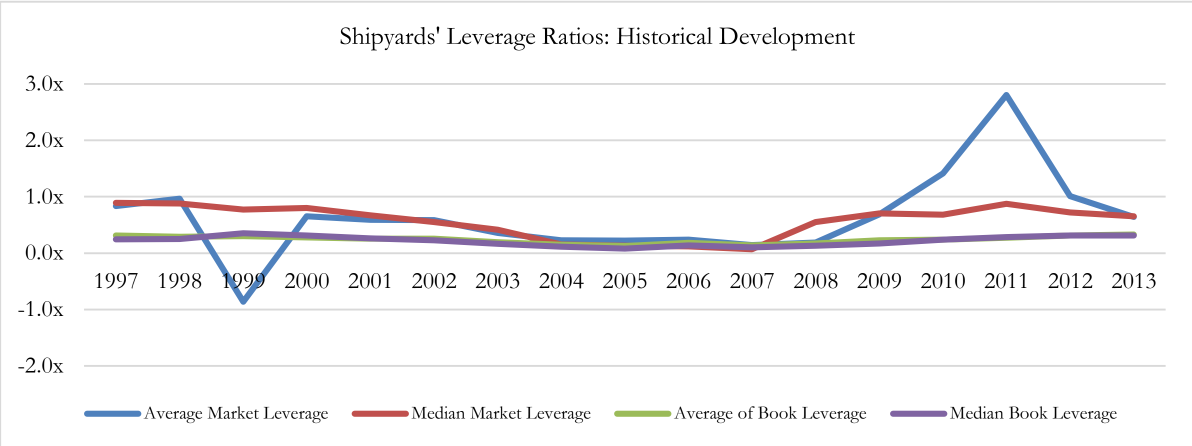

Figure 6-1: Shipyards' median and mean leverage ratios. Data sourced from ThomsonOne/Worldscope

Observations regarding the leverage ratios are of essential importance to this study and will be thoroughly examined. For our sample the mean book- and market leverage indicate that there are large differences between book and market measures. There is also heterogeneity in the observed leverage ratios within each measure. Some firm year observations have no book debt, whereas the maximum book leverage observation is 0.76. The equivalent figures for the market leverage show an even more extreme variation. The year 2011 holds the observation of maximum market leverage, which belongs to Guangzhou Shipyard International Company Ltd. Due to unexplained company specific events the firms market leverage increased with 2,768.07% going from 2010 to 2011, before it decreased by 98.43% in 2012. The extreme variation in the market leverage seems unreasonable and makes the measure an unreliable representation of the true target leverage ratio of the shipbuilders in our sample[14]. When assessing the medians we observe a closer relationship between the development of book and market leverage, which gives further support to the existence of outliers within the leverage ratios.

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13 As a comparative benchmark for our sample we have, in line with Bessler et al. (2013), chosen to use the characteristics of a sample of G7 firms. In short the sample contains 233,146 firm-year observations and the estimation period is from 1989 to 2010.

14 Data on Guangzhou Shipyard International Company Ltd from Bloomberg indicate that there may be a false data entry in ThomsonOne/Worldscope in 2011. However, we cannot be absolutely certain of this, as Bloomberg reports the accounting measures somewhat differently from ThomsonOne/Worldscope on a general basis.

Table 6-3 gives an overview of the observations sorted into quartile portfolios for each variable and the large differences within the market based variables become increasingly apparent. Based on the large market fluctuations, the median book and market leverage might be better representations of the industry's target leverage than the mean values. Compared to shipbuilders, the listed shipping companies studied by Drobetz et al. (2013) experience a higher mean book leverage of 0.407, but a lower mean market leverage of 0.386. The shipbuilding industry experiences similar leverage levels as the G7 firms presented by Bessler et al. (2013).

Table 6-3: Quartile means by firm specific variable

	Q1	Q2	Q3	Q4	Total
Book Leverage	0.042	0.150	0.265	0.446	0.226
Market Leverage	-0.309	0.353	0.711	2.276	0.752
Operating Leverage	0.278	0.564	0.734	0.986	0.640
Tangibility	0.120	0.255	0.323	0.440	0.285
Market to book	0.078	0.360	0.530	1.202	0.542
Size	5.119	6.480	7.908	9.303	7.205
Profitability	-0.032	0.049	0.073	0.124	0.054
Asset Risk	-0.367	0.277	0.498	1.655	0.512

The table displays the quartile means of the different independent variables. All variables are raw, unwinzorized data

Shipbuilders in our sample have substantially lower average and median operating leverages than the G7 firms, who experience an average operating leverage of 1.07. Given our previous observation that shipbuilders experience similar financial leverages as the G7 firms, this becomes an interesting characteristic of the shipbuilding industry. Kavussanos and Visvikis (2006) state that within the shipping industry the convention is high financial and operating leverage. Our observations seem contrary to this, but in line with recent findings by Drobetz et al. (2013) from the merchant shipping industry.

Shipbuilders display a modest degree of tangibility during our sample period. This is roughly in line with the standard in both the US markets and other G7 countries, whose mean values are 0.34 and 0.29 respectively. The observation is quite surprising as shipbuilding is a regarded capital-intensive industry and we expected the level of PP&E to be higher. A possible explanation could be that ships in progress, which constitute a large share of shipbuilders' capital costs, are capitalized as work in progress and not PP&E (European Commission, 2009).

The market to book ratio indicates that the shipbuilding companies achieved poor average market valuations during our sample period. While the trend of poor evaluation seems true for the 1st to 3rd quartiles, the 4th quartile including some of the strongest and most trusted companies, have an average level of 1.202. A general conclusion is that even the most prosperous shipyards are regarded as having fewer growth and earnings opportunities than the average G7 company, whose valuation is 1.7 times book value of assets.

Observations regarding the book assets exert a sample including both extremely large and somewhat smaller shipbuilders. The most extreme example is Hyundai Heavy Industries that hold book assets valued at $49.93 billion. This is large for a shipbuilder, but can be explained by the fact that the company is a conglomerate including several other operations besides shipbuilding.

Historically shipbuilding has experienced large increases in profitability through technological innovations reducing the construction time of vessels (Lutz, 1980). Despite continuous innovation throughout most of our sample period (Michel & Noble, 2008), the shipyards' profitability is rather poor. The shipbuilders experienced worse profitability than both the average G7 firm and the merchant shipping companies. However, the observation is in line with the documented high asset risk and the depressed market valuations represented by the market to book ratios. The results are again somewhat heterogeneous as the highest quartile portfolio's profitability exceeds the average company within the G7. Low profitability should affect the shipbuilder's attractiveness to investors, and as such the composition of their capital structure.

Up to 67% of the shipyards in our sample are dividend payers. As such, we would expect to observe few indications of free cash flow problems among shipbuilders. Shipbuilders do, however, pay dividends more seldom than their merchant shipping peers. Assuming that dividends are related to financial constraints, a high amount of dividend payments indicate unconstrained companies (Fazzari et al., 1988; Denis & Sibilkov, 2010).

The average asset risk for our sample is considerably higher than the US market risk of 0.13 or the G7 sample value of 0.113. Shipbuilders operate in a narrower industry than the average stock market company. Asset risk is the single variable that has the greatest variation across all four quartile portfolios[15]. Our sample is substantially more volatile than merchant shipping companies, indicating that shipbuilders might be more sensitive towards general macroeconomic conditions. The asset risk associated with different ship types should vary

[15] The average asset risk is negative for the 1st quartile of observations, which is due to the presence of negative enterprise values.

depending on both the volume and existence of a well functioning second hand marked. Common types of ships can be assumed to carry a lower risk than more specialized vessels, as the latter are most likely harder to re-sell. Therefore, it is expected that the asset risk of our sample is volatile given the heterogeneity of shipbuilders included in terms of orderbooks and product specializations.

The mean rating probability for a shipbuilders is higher than that of the average G7 firm, which according to Bessler et al. (2013) has a rating probability of 0.121. Compared to the shipping firms of Drobetz et al (2013), the shipbuilders have a slightly lower probability of obtaining a rating. The upper 25th percentiles' averages are approximately the same for shipping and shipbuilding companies. Drobetz et al. (2013) infers that about one fourth of the shipping companies are unconstrained, and as such the same conclusion seems valid for shipbuilders. This illustrates a point of careful consideration for our study as it shows many shipbuilding companies face though supply constraints in the debt capital market. Despite wishing to alter their capital structure they might not be able to access the public debt market for financing. However, the Economist (2014) reports that over approximately 75% of external financing in the overall shipping industry has been provided through bank loans. This indicates that the companies are in fact unconstrained when it comes to acquiring bank loans. As rating probability assesses the firms' ability to issue public debt and not their ability to achieve bank loans, the findings are not in conflict with our observed leverage ratios.

The oldest shipbuilding company in our sample is a centennial with 101 years since its incorporation. The average value is somewhat skewed upwards due to the presence of firm year observations, but it seems fair to assume that our shipbuilders represent a relatively stable group of companies based on their long lives. The relatively old average age is opposite of what one could expect based on the observation of a poor industry profitability and high asset risk. However, the unexpected relationship is in line with the shipping finance paradox that states that the shipping sector experiences an over supply of finance relative to the performance of the industry (Stopford, 2009).

Considering corporate tax rates, levels have varied greatly among the nations represented in our sample. While the minimum observation of zero taxes from Bermuda appears to be a tax haven, Japan displayed the maximum tax rate observation of 0.516 during the late 1990s. Since shipbuilding is a nearly perfectly competitive environment, large differences in tax schemes represent a major comparative advantage/disadvantage. Despite variations in our observations the median corporate tax rate is almost identical to the average observation. This indicates that overall the included shipbuilding nations have operated with relatively similar tax systems.

6.3.2 Macroeconomic Descriptive Statistics

Reporting the macroeconomic factors in terms of firm year observations does not make immediate sense. Hence, we display the observations across years instead in order to prevent skewed values towards the years that contain a higher number of year observations. A detailed description of each macroeconomic variable will not be undertaken. This is because we wish to highlight the major macroeconomic trends across our sample period and later employ these trends to illustrate how they have influenced the leverage ratios of our selected companies.

Table 6-4: Descriptive statistics macroeconomic factors

	Years	Mean	SD	Median	Min	Max
Ind. Prod. Growth Pacific Region	17	0.176	0.393	0.000	0.000	1.000
Recession Shipping	17	0.588	0.507	1.000	0.000	1.000
Term Spread	17	0.014	0.011	0.015	-0.001	0.029
GDP Growth	17	0.018	0.018	0.023	-0.041	0.039
Oil Price Change	17	0.191	0.516	0.108	-0.551	1.617
MSCI Stock Market Return	17	0.060	0.211	0.100	-0.426	0.418
World Orderbook Value Change	17	0.164	0.268	0.116	-0.164	0.639
Return Clarksons Newbuild Index	17	0.006	0.112	-0.015	-0.225	0.261
Annual Change Deliveries DWT	17	0.072	0.135	0.085	-0.301	0.295
Return Major Currencies	17	0.002	0.073	0.003	-0.145	0.105

The table displays the macroeconomic factors, the mean, the standard deviation, the median, as well as the minimum and the maximum of each factor. All observations are raw, unwinsorized data.

The industrial growth in the Pacific region was negative in the years 1998, 2001, and 2009 (Clarksons, 2014h). 1998-2002 and 2009-2013 are periods characterised as depressions for the overall shipping industry (Drobetz et al., 2013). The shipbuilding industry can be said to have experienced elongated periods of depression compared to the Pacific region's industrial production.

Across the sample period the observed term spread is rather stable. However, an observable trend is that the spread increases during times of recession mainly as a consequence of lower short-term interest rates. Empirical studies performed by Dahlquist and Harvey (2001) show that a small term spread can be a predictor of future recessions, which support the indications from our findings.

Compared to the world's real average GDP growth between 1900-1999 (Boltho & Toniolo, 1999), the real growth rate for the G7 countries is in line with the historical long-term growth trend. However, the real growth rate has been volatile and the minimum observation from 2009 is consistent with the end of the financial crisis. The maximum observation is from the year 2000 and corresponds with the world financial markets' peak right before the crash in 2001.

Oil price volatility can be characterized as extreme for our sample period. In absolute terms the price has grown from $17.1 in 1997 to an exceptional record of $110.34 in 2013. In connection with the great financial crisis the oil price did, however, drop by approximately 60% from 2007 to 2008. The variation in the oil price seems to correlate with world recessions, the MSCI index, and the GDP growth rate.

During 1997-2013 the average growth rate for the world's stock markets, represented by the MSCI world index, has outperformed the real GDP growth for the G7 countries. However, our chosen period includes the build up and collapses of two strong financial bubbles in 2001 and 2008. This might explain the short-term deviation between the two variables. The stock values of our shipbuilding companies follow the movements of the MSCI index.

Observations from three out of the four shipbuilding variables highlight relatively rough times for the shipbuilding companies within our sample period. Judging by the Newbuilding Price Index the obtained average price increase is barely positive, while the median is negative. In other words, as general prices have increased the prices of ships have been at a standstill despite volatility. The sector has seen an average annual increase in the value of the world orderbook even though the market has been influence by the global financial downturn. Strong continued building activity could partially be attributed to a high amount of new orders from Chinese investors and strategic state supported investments in increased capacity at Chinese shipyards (OECD, 2008; European Commission, 2013). The fluctuations of the orderbook value have followed a similar pattern as the developments of the global economy. Deliveries have across the period shown a slight positive trend. However, the industry has experienced an orderbook build-up, as deliveries have not kept up with new orders.

Over the sample period the US dollar has on average been fairly stable against other currencies. Despite this the US dollar is volatile, with the largest depreciation being -14.5% and appreciation 10.5%. As currency movements are vital to shipbuilders' operations, these movements should have an impact their financial performance and capital structure decisions.

7. Findings and Analysis

7.1 Detection and Handling of Outliers

Spurious outliers that create biased effects can influence the distribution of statistical data and undermine the performance and relevance of a model (Wooldridge, 2009). In our data sample it is especially the market based variables that experience outliers. Examples of this are asset risk that ranges from -10.275 to 15.819 and market leverage values observed between -14.408 and 39.653.

According to Stock and Watson (2012), outliers can be dealt with by either manually correcting the observation or excluding it entirely. In previous studies of capital structure determinants, the preferred methods are winsorization, removal of outliers through rule of thumb truncation or facilitating robust regressions (Getzmann & Lang, 2010). We apply the process of winsorization in order to reduce the effect of potentially extreme and unrealistic values. The method provides a systematic approach that prohibits data loss and enables us to compare our findings with different previous studies. More explicitly, winsorization entails replacing the outliers with the limit value of an upper and lower percentile (Dixon & Yuen, 1974). The technique is commonly used in empirical research and Frank and Goyal (2009) alongside Getzmann and Lang (2010) winsorize their datasets at 0.5%, whereas Drobetz et al. (2013) use 1%. Their reasoning behind the applied winsorization factor was that it had to be large enough to remove spurious outliers. After testing levels between 0% and 5%, we decided to use a 5% winsorization factor despite it being relatively high compared to previous studies. Given the large variation and observed extreme values a 5% factor was required for our dataset in order to remove spurious outliers.

7.2 Correlation Matrix Firm Specific Variables

Excluding the correlation between market and book leverage, the correlation values between the remaining variables are low and we do not regard any of the results as concerning for the performance of our models. We do, however, recognize that there are certain variables that correlate somewhat with each other and the most significant relationships are briefly outlined.

To some extent dividend payer and size correlates with a coefficient of 0.373. However, the overall size of the correlation is not substantial enough to be of any concern. Rating probability slightly correlates with the market-based variables and the largest observed correlation coefficient is with company size at 0.493. This relationship is expected since larger companies should be more likely to obtain a credit rating. Again the coefficient seems to be of insufficient size to seriously threaten the validity of our estimates.

Table 7-1: Correlation Matrix (Firm Specific Factors)

	Book Leverage	Market Leverage	Size	Tangibility	Market to book	Profitability	Corporate Tax Rate	Dividend Payer	Rating Probability	Asset Risk	Operating Leverage
Book Leverage	1										
Market Leverage	0.535***	1									
Size	0.0660	-0.149**	1								
Tangibility	0.224***	0.0676	0.0973	1							
Market to book	0.0104	-0.0709	-0.149**	-0.0925	1						
Profitability	-0.233***	-0.112*	0.138**	0.0517	0.149**	1					
Corporate Tax Rate	0.161***	0.184***	0.110*	0.199***	-0.221***	0.175***	1				
Dividend Payer	-0.303***	-0.326***	0.373***	-0.0718	-0.139**	0.332***	0.190***	1			
Rating Probability	0.0981*	0.128**	0.493***	0.0318	0.264***	0.115*	0.0349	0.0319	1		
Asset Risk	-0.285***	0.181***	-0.287***	-0.238***	0.302***	0.176***	-0.175***	-0.105*	0.113*	1	
Operating Leverage	-0.104*	0.00886	0.0548	0.328***	-0.168***	0.174***	0.336***	0.0411	-0.0114	-0.105*	1

P-values are displayed in parantheses. All data are winsorized at the upper and lower 5%.
* Statistical significance at 10% level
** Statistical significance at 5% level
*** Statistical significance at 1% level

7.3 Fixed versus Random Effects Model

The null hypothesis of the Hausman test is strongly rejected with a p-value of 0.000. This means that the unobserved effect u_{it} correlates with one or more of the independent variables. As a consequence, a random effects model will not be consistent and our results indicate that a fixed effects model is the preferred analytic tool to analyse the shipbuilder data sample.

Table 7-2: Hausman Test for Fixed vs. Random Effects Model

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_b))
	Fixed	Random	Difference	S.E.
Size	0.046	0.020	0.025	0.010
Tangibility	0.345	0.241	0.104	0.047
Market to book	0.074	0.055	0.019	0.008
Profitability	-0.249	-0.295	0.046	0.028
Corporate Tax Rate	0.458	0.243	0.215	0.269
Dividend Payer	-0.070	-0.085	0.016	0.005
Rating Probability	0.011	-0.001	0.012	0.015
Asset Risk	-0.050	-0.057	0.007	0.002
Operating Leverage	-0.027	-0.079	0.052	0.019

b = consistent under Ho and Ha
B = inconsistent under Ha, efficient under Ho
Ho: difference in coefficients not systematic

chi2(9) = 200.270
Prob>chi2 = 0.000

The table displays the results of the Hausman test for fixed vs. random effects regression.

7.4 Regression Conditions

The results from the regressions included in our model seem valid to draw statistical inference. Assessing the conditions for regressions in particular we observe seemingly normally distributed residuals. The histograms resemble the bell curve. Residuals lie tight on the normal probability plots with minor deviations for model 2, 4, and 6. Although the mentioned deviations are present, the amount of observations used is large enough to utilize the central limit theorem (Stock & Watson, 2012). We use clustered robust standard errors to overcome possible challenges associated with autocorrelation and heteroscedasticity, which are often present in panel data (Stock & Watson, 2012). Additionally, we do not observe problems of multicollinearity.

7.5 Discussion of Results

7.5.1 Standard Leverage Regressions

In the following discussion of our findings we facilitate the expected relationships that were previously outlined in section 4. We will address the models overall explanatory power, the coefficients of independent variables and their statistical significance.

The standard leverage regressions are run stepwise. First, we run the models with the standard leverage determinants inspired by Frank and Goyal (2009). Results are presented in column 1. As shown by column 2, we run the regressions with additional variables influenced by the study from Drobetz et al. (2013). We add firm and year fixed effects separately. Through this process we are able to distinguish between the time invariant and time varying effects. The results of which are shown in column 3 to 6. Finally, we run the complete model including all independent variables and fixed effects. Results from the final regressions can be found in column 7-8.

Table 7-3: Standard leverage regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Size	0.00862	0.00822	0.0513***	0.0456***	-0.00110	0.00118	0.0455*	0.0459*
	(0.009)	(0.010)	(0.013)	(0.014)	(0.009)	(0.010)	(0.025)	(0.027)
Tangibility	0.268	0.220	0.484*	0.345	0.278	0.274*	0.266	0.175
	(0.162)	(0.151)	(0.245)	(0.264)	(0.165)	(0.150)	(0.208)	(0.215)
Market to book	0.0485	0.0311	0.0741***	0.0742**	0.0945**	0.0664	0.109***	0.113***
	(0.030)	(0.040)	(0.023)	(0.027)	(0.040)	(0.045)	(0.030)	(0.029)
Profitability	-0.937***	-0.377	-0.478	-0.249	-1.035***	-0.554*	-0.487**	-0.369
	(0.277)	(0.288)	(0.281)	(0.307)	(0.292)	(0.284)	(0.222)	(0.253)
Corporate Tax Rate	0.243*	0.316***	0.539	0.458	0.355**	0.410***	0.299	0.109
	(0.133)	(0.105)	(0.424)	(0.319)	(0.141)	(0.130)	(0.626)	(0.562)
Dividend Payer		-0.108***		-0.0698**		-0.0903***		-0.0433
		(0.026)		(0.029)		(0.026)		(0.027)
Rating Probability		0.0461		0.0110		0.0350		-0.0234
		(0.071)		(0.077)		(0.073)		(0.087)
Asset Risk		-0.0635**		-0.0501**		-0.0395*		-0.0291**
		(0.024)		(0.022)		(0.022)		(0.014)
Operating Leverage		-0.135*		-0.0269		-0.124*		0.0263
		(0.069)		(0.064)		(0.069)		(0.071)
Firm Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Observations	285	285	285	285	285	285	285	285
Adjusted R-squared	0.141	0.293	0.424	0.469	0.278	0.367	0.560	0.574

The table displays the standard leverage regression results with a sample of 23 globally listed shipping companies in the time period 1997-2013. All variables are winsorized at the lower and upper 5th percentile. Clustered, robust standard error at firm level are given in the parentheses. Firm and time fixed effects indicates what fixed effects are included in the specification.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

Results in column 1 indicate that the estimated coefficients of size, tangibility, profitability, and corporate tax rate exhibit the same patterns as observed by prior studies on the capital structures of other industries (Frank & Goyal, 2009; Drobetz et al., 2013). The explanatory power of regression model 1 is rather weak of only 14.1%. At a 10% significance level profitability has a negative impact on a shipbuilder's leverage ratio. This result is in line with the pecking order theory, as increased profitability will give a firm increased free cash flows and earnings that will be used as financing instead of additional external financing. It is also somewhat in line with the dynamic trade-off theory when using Frank and Goyal (2009)'s argument of passive profit accumulation. Corporate tax rate is the second significant variable, however, only at a 10% significance level. The results suggest a positive relationship between increased corporate tax rate and leverage, which is in line with our prediction for shipbuilders following the trade-off theory. As debt carries a tax shield, increased corporate tax will increase the attractiveness of debt at a diminishing rate.

Including dividend payer, rating probability, asset risk, and operating leverage to the regression instantly increases its explanatory power to 29.3%. Corporate tax rate significantly indicates a positive relationship with leverage, now reliable at a 1% level. The dividend payer variable, also significant at a 1% level, shows a negative relationship with leverage. This result is in line with our former prediction and also the related study by Frank and Goyal (2009). From a trade-off theory perspective dividend payments should lead to lower leverage as managers have less free cash flows at hand and less need for increased debt to handle agency issues. In line with our prediction asset risk exhibits a negative relationship with leverage at a 5% significance level. The trade-off theory provides an explanation for this, as increased asset risk is associated with higher probability of default and bankruptcy costs. This will decrease the attractiveness of debt and lead to higher levels of equity. Operating leverage is the final significant variable, however, only at a 10% level. The result indicates a negative relationship with leverage, which is in line with the trade-off theory. Since the financing is situated on the operating side the need for book leverage decreases and the negative relationship is expected.

In line with earlier studies such as Lemmon et al. (2008) and Drobetz et al. (2013), we should experience a considerably higher explanatory power from the models when we add fixed effects to the standard OLS leverage regression. Companies' capital structures are to a large extent caused by unobserved components connected to individual differences on a firm and/or time level. Thus, one can expect certain of the standard capital structure factors to lose some of their statistical significance as the regression also accounts for the year and firm fixed effects

(Drobetz et al., 2013). For our regression model the explanatory power increases substantially to 42.4% and 46.9% when we introduce firm fixed effects in model 3 and 4. It is worth noticing that the additional explained variance from adding the extra factors to make model 4 is smaller than what is achieved moving from model 1 to model 2. This gives further support to the inference that a large part of shipbuilder's capital structure decisions is based on the unobserved company specific rather than the observable effects.

Looking to column 3 both size and market to book exhibit positive relationships with leverage at a 1% significance level. Accordingly, the company size is in line with the trade-off theory, whereas the coefficient of the market to book ratio is in line with counter-cyclical leverage ratio implied by the pecking order theory. In reality there is often a relationship between stability of profits and company size (Hall & Weiss, 1967). Hence, the observed positive influence on leverage from size might be attributed to an increase in the firms' debt capacity. Considering the market to book ratio, the positive relationship with book leverage is the opposite of our initial prediction. However, it is in line with Drobetz et al. (2013)'s findings from the merchant shipping industry. Given the shipbuilders' poor market valuations a possible interpretation of the coefficient, supporting the trade-off theory, is that the higher market to book ratios belong to the shipbuilders with the highest debt capacities. Consistent with the trade-off theory and partially with the pecking order theory, tangibility exhibits a positive relationship with leverage despite being significant at only a 10% level.

When adding the additional explanatory variables to model 4, both size and market-to-book stay significant, the latter now at a 5% level. In addition to the two variables both dividend payer and asset risk become significant at a 5% level. This observation supports the previously analyzed findings from column 2.

Column 5 and 6 show the results from the regressions run with year-fixed effects. Compared to the regressions run in column 1 and 2, adding the year fixed effects increases the explanatory power to 27.8% and 36.7%. The additional explained variance is lower than what is achieved through adding firm fixed effects, implying that time invariant factors play the larger role in explaining a shipbuilder's capital structure. Nevertheless, the year-fixed effects regression generates regression coefficients indicating the same patterns, with regards to capital structure theories, as shown in columns 1 through 4. In column 5 the market to book ratio displays a positive relationship with leverage on a 5% significance level. The result for profitability is again negative, but is now at a 1% level. Corporate tax rate also shows a positive influence on leverage. In column 6 the market to book ratio loses its statistical significance and dividend payer exhibits a negative significant relationship on a 1% level with the leverage ratio. Asset risk and operating leverage maintain their weakly significant negative correlation with leverage, which provides further support to our initial predictions.

Our final step is to include both year- and firm fixed effects to the regression model, which further improves the models' explanatory powers. Including all explanatory variables and fixed effects yields the highest explanatory power of our models of 57.4%. However, the incremental explanatory power of including the additional independent variables is quite modest of only 1.4%. As such, it seems that the largest share of shipbuilders' capital structure decisions is based on unobserved company and year specific effects. Additionally, there are no changes in the economic rationales behind the effect of the variables seeing as the coefficients display the same direction as in previous regressions. Size and market to book show significantly positive relationships with book leverage, while asset risk has a significantly negative correlation in our final regression model.

Based on the results of the different models a major part of the variance in shipbuilders' capital structures is explained by time invariant factors. Another interesting finding is that the market value based factors seem to influence shipbuilders' capital structure decisions the most. The relatively expensive companies, as measured by the market to book ratio, are likely to have more debt. A possible explanation is that the shipbuilders with higher market to book ratios are the most financially sound companies. When those companies no longer have enough internal funds to finance their investments, they reach out to the debt capital markets. Overall there seems to be more support for the trade-off than the pecking order theory for our globally listed shipbuilders. Given the fact that most shipyards have owners with large ownership shares, it is natural for them to emphasize the trade-off costs associated with debt. Revealing information through capital issues can, therefore, be assumed to be less concerning to the shipbuilder when their ownership is dominated by a few influential owners. This is because large investors might possess more information about the company than the average investor. Excluding the market to book ratio, our findings are in line with all five studies outlined in section 2.3.1. Additionally, the direction of our coefficients matches those found for shipping companies. This indicates that shipbuilders follow similar patterns in their capital structure decisions as merchant shipping companies.

7.5.2 Impact of Macroeconomic Factors

In this section we discuss the impact of macroeconomic factors through running separate regressions. The underlying reason is that we wish to isolate the effects that originate from the cyclicality of leverage. We assess the cyclicality by four different measures. In column 1 we

Table 7-4: Macroeconomic determinants of leverage

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: Book Leverage					
Size	0.0456***	0.0453***	0.0378**	0.0597***	0.0342*
	(0.014)	(0.014)	(0.017)	(0.016)	(0.018)
Tangibility	0.345	0.340	0.248	0.323	0.248
	(0.264)	(0.261)	(0.228)	(0.271)	(0.229)
Market to book	0.0742**	0.0760**	0.0861***	0.0757**	0.100***
	(0.027)	(0.027)	(0.026)	(0.031)	(0.030)
Profitability	-0.249	-0.264	-0.416	-0.115	-0.380
	(0.307)	(0.309)	(0.244)	(0.303)	(0.256)
Corporate Tax Rate	0.458	0.422	0.730**	0.657*	0.875**
	(0.319)	(0.324)	(0.341)	(0.359)	(0.373)
Operating Leverage	-0.0269	-0.0259	0.00764	-0.0245	0.00531
	(0.064)	(0.064)	(0.063)	(0.079)	(0.063)
Dividend Payer	-0.0698**	-0.0686**	-0.0452*	-0.0721**	-0.0421*
	(0.029)	(0.028)	(0.024)	(0.031)	(0.023)
Asset Risk	-0.0501**	-0.0494**	-0.0287	-0.0567**	-0.0277
	(0.022)	(0.022)	(0.017)	(0.024)	(0.017)
Rating Probability	0.0110	0.00899	-0.00996	-0.00800	-0.0209
	(0.077)	(0.078)	(0.080)	(0.073)	(0.081)
Industrial Production Pacific Region		0.0221			
		(0.014)			
Recession (Shipping)			0.0915***		
			(0.020)		
Lagged Term Spread				1.457*	
				(0.827)	
GDP Growth				1.129	
				(0.740)	
Oil Price Change				-0.0223*	
				(0.013)	
Stock Market Return Annual MSCI				-0.137**	
				(0.061)	
World Orderbook Value Change					-0.147***
					(0.049)
Return Newbuild Price Index					-0.221***
					(0.075)
Annual Change Deliveries DWT					-0.0762
					(0.059)
Return Major Currencies					0.304***
					(0.078)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	285	285	285	269	285
Adjusted R-squared	0.469	0.470	0.544	0.521	0.562

The table displays the standard leverage regression results with a sample of 23 globally listed shipping companies in the time period 1997-2013. The model is complemented with possible macroeconomic determinants of leverage. All variables are winsorized at the lower and upper 5th percentile, except the macroeconomic variables. Clustered, robust standard error at firm level are given in the parentheses. Firm fixed effects indicates what fixed effects are included in the specification.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

repeat the results from the firm-fixed effects model from column 4 in table 7-4. We include firm fixed effects to control for unobserved factors varying across shipbuilders. However, following convention when assessing macroeconomic factors in previous capital structure research (see for example Korajczyk and Levy (2003) and Drobetz et al. (2013)) we do not include year fixed effects. The findings in column 2 and 3 display the results of adding indicator variables of economic cycles to our benchmark regression model, respectively recessions indicated by the industrial production of the Pacific region followed by shipping recession. Running the regressions with additional macroeconomic indicators gives the results displayed in column 4. Column 5 shows the results from including the shipyard specific macroeconomic factors.

As it was assumed that the growth in industrial production would influence shipbuilders, we are a bit surprised by its insignificant relationship with leverage ratios[16]. Even though the shipyards should be affected by decreases in industrial production, their financial leverage seems unaffected. According to Drobetz et al. (2013) the capital structures of shipping companies seem unaffected by general macroeconomic recessions. From this one can infer that merchant shippers might not substantially change their amount of ships on order given a short-term recession. As shipbuilders are suppliers to the shipping industry, this might partially explain the insignificant relationship between leverage and the Pacific region's industrial production growth.

In line with our prediction there is a clear counter-cyclical relationship in shipbuilders' leverage ratios when examining the industry specific market conditions through the shipping recession dummy. The negative relationship supports the predictions of the pecking order theory. At a 1% significance level the relationship appears to be quite strong. Poor macroeconomic conditions may increase risk aversion amongst investors and restrict the supply of equity capital. Hence, increased leverage ratios can be a result of companies taking on additional debt in lack of other opportunities to raise capital. Another argument is that issuing more debt during recessions enables the shipbuilder to reveal less adverse selection information to its investors. Equity issuances are on a general basis expensive and if investors believe that a shipbuilder is experiencing financial distress one can expect the cost to increase further. Based on our observations, it seems like shipbuilders' financial managers carry the same concerns. Including the shipping cycles strengthens the explanatory power of our model to 54.4%.

[16] In results not tabulated, we used the state of the US economy, the growth in industrial production dummy for the Atlantic region, as well as the OECD. These regressions yielded approximately the same results as using the growth in industrial production dummy for the Pacific region.

Although international trade and the state of the world economy are very important to the shipping industry, their indicators seem to affect the capital structure decisions of shipbuilders to a smaller extent than first anticipated. The model's explanatory power is lower when adding the second set of factors compared to column 3. We find only weak significance at a 10% level of the lagged term spread and the Brent Crude oil price change. The lagged term spread supports a pro-cyclical leverage ratio and the trade-off theory with a seemingly large coefficient. This is against our initial prediction. The return of the Brent Crude oil price seems to exert a negative impact on leverage ratios. In light of this and our general prediction of counter-cyclical leverage ratios, it can be inferred that shipbuilders are somewhat positively exposed to the oil price development.

The return on the MSCI also supports the pecking order theory. When examining firm level factors we did not find any evidence of market timing behavior among shipbuilders. However, the MSCI return's effect on book leverage suggests that the shipbuilders do exhibit some behavior in line with the market timing theory. An explanation may be that shipbuilders' financial managers pay more attention to the general capital market conditions than their own stock prices. Drobetz et al. (2013) were not able to find a relationship between market stock returns and leverage. This indicates that shipbuilders differentiate their capital structure decisions somewhat from merchant shipping companies by including evaluations of stock market movements.

Including shipbuilder specific macroeconomic indicators yields the model with the highest explanatory power of 56.2%, as shown in column 5. Again the signs of the coefficients give support to our prediction of counter-cyclical leverage ratios. The effect of changes in the world orderbook, return on newbuilding prices and return of the Real Trade Weighted US Dollar Index: Major Currencies are strongly significant on a 1% level. Shipbuilders seem to be more sensitive to changes in newbuild prices than to the overall changes in the world orderbook. Leverage shows a negative relationship with changes in the world orderbook. Based on the notion of a counter-cyclical leverage ratio and following the discussion in section 4.2.2, it can be inferred that shipbuilders associate an increase in the world orderbook value with a favorable market development. The large positive coefficient from US Dollar Index is consistent with both our prediction and prior empirical evidence stating that the variable is the most important factor for shipbuilders leverage ratios. The effect from changes in world deliveries yields insignificant results, and accordingly we deem world deliveries to have a much smaller impact on leverage ratios than first expected.

Combined our analysis suggests that including macroeconomic variables significantly increases the explanatory strength of our regression models. Overall, our results support the notion of a counter-cyclical leverage ratio within the shipbuilding industry. However, our results are not conclusive given the ambiguous results shown from the lagged term spread's effect. Another interesting result is that macroeconomic conditions seem to influence capital structure decisions of shipbuilders to a much larger extent than for the closely related shipping industry. A pattern of differences between the firm and macroeconomic indicators' effect on capital structure decisions emerge when assessing both simultaneously. On a firm specific level shipbuilders generally seem to follow a capital structure largely based on thoughts from the trade-off theory. When it comes to the effects from the macroeconomic environment, relationships predicted by the pecking-order theory seem to dominate the movements of our shipbuilders' leverage ratios.

7.5.3 Speed of Adjustment Estimators

We now turn to the dynamics of capital structure decisions. Corresponding with the theory outlined in section 5.3 we estimate the speed of adjustment for a shipbuilder to achieve its target capital structure. The model parameters from section 7.5.1 can be seen as factors that indicate the target capital structure for a shipbuilding company at a given point in time. To determine if the decision dynamics alter depending on economic cycles, we include a cross product term for speed of adjustment during recessions[17].

Table 7-5 displays the results from the speed of adjustment estimation. The AB and BB estimators have been calculated using the xtabond2 program in Stata made by Roodman (2009). With 285 individual firm years the shipbuilding dataset is rather small. Therefore, we created one instrument per lag distance and variable. The more conventional procedure would be to create one instrument per year, lag distance, and variable. Although it reduces the efficiency in large samples, it can avoid the bias created when the number of instruments goes towards the number of observations (Roodman, no date). The predetermined variable is the lagged leverage. Firm specific variables have been treated as exogenous. The AB and BB estimators do not show signs of autocorrelation on levels through the AR(2) test (Roodman, 2009). There is no second

[17] When using the shipping recession dummy, we observe the same relationship for the speed of adjustment during recessions as when using the growth in Pacific region's industrial production dummy. However, with 10 out of 17 years of our sample being characterised as recession years for the shipping industry, we do not find these results appropriate to present, as it would rather indicate a difference between two distinctive periods and not the dynamics of macroeconomic cyclicality.

order correlation in differences. The restrictions are over-identified and performing the Sargans test of truly exogenous instruments is possible (Stock & Watson, 2012). With the null hypothesis of exogenous instruments strongly rejected, the validity of the results can be seriously questioned. Additionally, our sample of 23 firms over 17 years raises the question of fit. It is arguable that the sample matrix might not be of sufficient size to fulfill the criteria of small T and large N. Consequently, we tabulate the GMM-estimators, but we refrain from discussing them and leave interpretations up to the reader. Although the OLS estimator is biased upwards and the FE estimator does not provide complete control for unobserved heterogeneity, they seem to be the most valid estimates of adjustment speeds. Because of this our discussion is based solely on inferences from the OLS and FE models.

Table 7-5: Speed of Adjustment

	OLS	FE	AB	BB
Dependent variable: Book Leverage				
Book Leverage (t-1)	0.708***	0.458***	0.108*	0.155**
	(0.053)	(0.126)	(0.063)	(0.063)
Book Leverage (t-1)*Ind. Prod. Pacific Region	0.0965**	0.242**	0.170***	0.143***
	(0.041)	(0.104)	(0.047)	(0.046)
Speed of Adjustment	29 %	54 %	89 %	85 %
Speed of Adjustment in Recession	20 %	30 %	72 %	70 %
Size	0.00704	0.0317*	0.0244*	0.00985**
	(0.006)	(0.017)	(0.015)	(0.005)
Tangibility	0.00783	0.0405	0.448***	0.177***
	(0.076)	(0.131)	(0.119)	(0.054)
Market to book	-0.0154	0.0332	-0.00626	-0.00111
	(0.020)	(0.032)	(0.019)	(0.015)
Profitability	-0.166	-0.246	-0.0385	-0.318***
	(0.179)	(0.192)	(0.168)	(0.117)
Corporate Tax Rate	0.0265	0.229	-0.371	0.191***
	(0.068)	(0.323)	(0.321)	(0.048)
Dividend Payer	-0.0191	-0.0164	-0.0244	-0.0521***
	(0.012)	(0.014)	(0.018)	(0.014)
Rating Probability	-0.0103	-0.0102	0.0320	-0.00738
	(0.033)	(0.051)	(0.039)	(0.029)
Asset Risk	-0.0361***	-0.0209*	-0.0242*	-0.0493***
	(0.011)	(0.011)	(0.013)	(0.011)
Operating Leverage	-0.0706**	0.0257	-0.0477	-0.111***
	(0.029)	(0.049)	(0.041)	(0.023)
Observations	262	262	239	262

The table displays the different adjustment speeds for OLS, FE, AB, and BB estimators for the sample of 23 shipbuilders in the period 1997-2013. Standard errors are given in parantheses. Firm and Year fixed effects included for the FE estimator. The percentage speed of adjustment, i.e. how much of the gap from target leverage is closed within one year, is given in rows 3 and 4. For the AB and BB estimators, the lagged leverage is treated as the predetermined variable and the firm specific variables are exogenous.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

Both the OLS and FE speed of adjustment estimates are significant at a 5% level. The findings from our sample are relatively in line with expectations from other previous empirical studies, but hold some distinctive differences. Shipbuilders seem to adjust their capital structure significantly faster than the firms studied by Kayhan and Titman (2007). Additionally, shipbuilders seem to adjust their capital structure twice as fast as the non-financial firms investigated by Lemmon et al. (2008). Accordingly, one can claim that shipbuilders compared to other industries face lower adjustment costs relative to deviation costs. The question remains whether it is the adjustment costs that are lower, the deviation costs that are higher, or a combination of both.

In line with Hackbarth et al. (2006), Cook and Tang (2010) and Halling et al. (2012), we find substantially slower adjustment speeds during recessions. Under normal economic conditions shipbuilders seem to adjust faster towards their target capital structure than companies in the closely related shipping industry (Drobetz et al., 2013). As pointed out by Drobetz et al (2013) shipping companies are highly influenced by business cycles and should exhibit a large difference between adjustment speeds under prosperous and poor economic conditions. This development is also true for our estimates as shipbuilders adjust 31%-44% slower during recessions as measured by the OLS and FE estimators. When a shipyard goes into a recession, our results imply that they need approximately 1.05-1.10 years longer to half the deviation from their current target capital structure than during normal economic conditions. During recessions the cost of debt capital and probability of default will increase, which will substantially influence adjustment speeds (Drobetz et al., 2013).

Table 7-6: Comparison between speed of adjustment between the merchant shipping and shipyard industry

	OLS	FE	AB	BB
Iversen & Noraas (2014)				
Speed of Adjustment	29 %	54 %	89 %	85 %
Half-life	*2.01*	*0.89*	*0.31*	*0.37*
Speed of Adjustment in recessions	20 %	30 %	72 %	70 %
Half-life	*3.11*	*1.94*	*0.54*	*0.58*
Drobetz et al. (2013)				
Speed of Adjustment	22 %	42 %	59 %	47 %
Half-life	*2.79*	*1.27*	*0.78*	*1.10*
Speed of Adjustment in recessions	18 %	40 %	57 %	45 %
Half-life	*3.54*	*1.34*	*0.81*	*1.15*

The table displays the speed of adjustment of our studies and the results from Drobetz et al. (2013). Our studies is calculated using a sample of 23 firms in the time period 1997-2013. Drobetz et al.'s (2013) sample is of 115 shipping companies between 1992 and 2010. Half life is given by log(0.5)/Log(1-λ)

In times of recessions shipbuilders adjust their capital structures slower than merchant shipping companies. Being highly leveraged, merchant shipping companies have high costs of financial distress and need to quickly adjust their capital structure to meet the bank's requirements (Drobetz et al., 2013). In other words they face relatively high deviation costs. Shipbuilders can be assumed to experience lower costs of financial distress due to an overall lower leverage ratio. Additionally, many shipbuilders are major corporations in terms of size, important to the home nation's economy and often face owners with large ownership shares who are well positioned and trusted in the market. For example one investor owns 67.3% of ABG Shipyard, 45.8% of CSIC is owned by the Chinese government and Daewoo is 31.5% owned by the Korea Development Bank. Consequently, we suggest that the slower observed adjustment by shipbuilders indicates lower deviation costs rather than higher adjustment costs.

8. Conclusion

This master thesis aims to provide insights to the underlying determinants driving capital structure decisions for globally listed shipbuilding companies. Data was collected from 23 companies over the period 1997-2013. Combined our dataset of 285 firms year observations sourced from ThomsonOne/Worldscope, Clarksons, NBER, and the Federal Reserve Bank of St. Louis helped us describe and analyze the capital structures of our chosen shipbuilders.

Our regression results indicate that there are differences between firm specific and macroeconomic factors for shipbuilders' capital structure decisions. On a firm specific level the trade-off theory seems most applicable to understand the determinants of capital structure. Size and asset risk exhibit the strongest relationships in line with the trade-off theory. However, the evidence is not conclusive as the market to book ratio gives support to decisions being based on the pecking-order theory. The explanatory power of our model increases by adding more independent determinants, but the effect is smaller when adjusting for firm and time fixed effects. Overall, unobserved company specific effects seem to play the larger role in explaining shipbuilders' capital structure decisions.

The capital structure decisions, as a function of the macroeconomic environment, are best understood from a pecking-order perspective. Shipbuilders display a large degree of counter-cyclicality in their leverage ratios. An appreciation of the US dollar leads to shipbuilders taking on more debt, which confirms earlier studies' findings of currency being of major importance to shipyards. Findings related to the MSCI World Index support that shipbuilders act consistently with the market timing theory.

Although it is important to remember that our models carry certain biases, shipbuilders seem to use approximately 0.89-2.01 years to half the deviation from their target capital structures during normal economic conditions. Compared to other industries that were researched using the same estimators, this is relatively fast. Our findings imply that the cost of adjustment in relation to the deviation cost is relatively lower in the shipbuilding industry. Another key finding for capital structure dynamics is the distinct difference between normal economic conditions and recessions. During recessions shipbuilders display adjustment speeds of 31%-44% slower than during normal economic conditions. The results indicate that shipbuilders experience increased adjustment costs during recessions.

9. Limitations and Further Research

With a rather small sample size of 285 individual firm-year observations from 23 different companies the results may be skewed towards the capital structure of certain companies. A larger sample would increase the statistical reliability. For instance, a larger sample size would be preferable for the GMM-estimators, which are intended for "small T, large N" samples (Roodman, 2009). Considering our applied selection requirements we have chosen to include only listed companies instead of all shipbuilders. Loosening up the requirements and including a wider spectrum of shipbuilding companies could potentially give other insights.

Winsorizing the variables has been a proactive solution for dealing with the bias created by what is assumed to be spurious outliers. However, the heterogeneity itself could provide interesting insights to the industry's capital structure determinants and by adjusting the dataset the potential effect might be eliminated. Our choice of 5% winsorization could be a limitation as it goes against the 1% convention from related studies.

First, analyzing alternative determinants than those included in our study is an area of future research. Alternative variables can be chosen based on measurement methods, e.g. to check the robustness of our results. Completely new determinants would also have the potential to yield interesting insights to capital structure decisions. In order to determine new variables we believe a case study based approach interviewing CFOs of shipbuilding companies would be interesting. A second opportunity for further research is a deeper understanding of the composition of shipbuilders' leverage ratios. Looking into what kind of debt shipbuilders most commonly possess such as bank loans, long-term financing or bonds could create a better understanding of their leverage ratios. Thirdly, the shipbuilding industry seems to offer different payment schedules based on market conditions, which indirectly should affect the leverage ratios of shipyards. Thus, a deeper study of the connection between payment schedules and leverage ratios also offers an exciting area of future research.

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11. Appendix

11.1 Variable Definitions

Table 11-1: Variable definitions (1/2)

	Definition	Source	Database code/Variable explanation
Firm-level Variables			
Book-leverage	Ratio of long- and short-term debt tot total book assets	ThomsonOne	(LT + ST Debt) / Total Book Assets
Market-leverage	Ratio of long- and short- term debt to the market value of assets	ThomsonOne	(LT + ST Debt) / Enterprise Value
Tangibility	Ratio of fixed to total book assets	ThomsonOne	Net PP&E / Total Book Assets
Growth Opportunities	Market-to-Book ratio equal to ratio of market value of assets to book value of assets	ThomsonOne	Enterprise Value / Total Book Assets
Company Size	Natural logarithm of total book assets	ThomsonOne	ln(Total Book Assets)
Profitability	Ratio of earnings before interest, depreciation and amortization to total book assets	ThomsonOne	EBITDA / Total Book Assets
Dividend payer	Indicator dummy variable equal to one if the company pays dividends in the given year	ThomsonOne	-
Asset Risk	Unlevered volatility of stock returns,	Datastream	SD(stock in year t) * (Mkt Value of Equity)/Enterprise Value)
Operating leverage	Ratio of operating expese to total book assets	ThomsonOne	Operating Expenses / Total Book Assets
Rating probability	Estimated rating probability for a firm that year	Drobetz et al. (2013), ThomsonOne	Logit function of tangibility, market to book, profitability, R&D/Sales, age, and volatility
Price Run-up	Stock return over 12 months immediately preceding the leverage observation	Datastream	(P(year t) / P (year t-1)) - 1
Incorporation Country	Juristiction the company is incorporated in	Bloomberg	-
Company Age	Years since foundation	ThomsonOne	Year of observation - year of incorporation
Corporate Tax Rate	Corporate Tax Rate of the incorporation country	KPMG, OECD	-
Orderbook	Annual deadweight tons in order per company's affiliated shipyards	Clarksons	-

Table 11-2: Variable definitions (2/2)

	Definition	Source	Database code/Variable explanation
Macroeconomic Variables			
Growth Industrial Production	Indicator dummy variable equal to 1 if the industrial production growth is negative, 0 otherwise. The induded countries are China, Japan, Singapore, South Korea, Taiwan, Hong Kong, Philippines, Thailand, Malaysia, Indonesia and India	Clarksons	55763
Recession (shipping)	Indicator dummy variable equal to one during depressed periods in the shipping industry	Drobetz et al. (2013)	-
Term Spread	One period lagged term spread between the 10-year interest series and the one-year interest series of US treasuries	St. Louis Fed	-
GDP Growth	Aggregated growth rate in the G7 countries	Datastream	G7OCFGDR
Brent crude oil	Annual change in the brent crude oil price	Clarksons	19710
MSCI World Index	Annual return from MSCI world index		MSWRLD$
Shipbuilding Market Variables			
Newbuilding Price In	Annual change in the Clarksons Newbuilding Price Index	Clarksons	11649
Deliveries	Annual change in the Total Deliveries by Region - World DWT		40994
World Orderbook	Annual change in the value of Orderbook by Area - World		61607
US dollar Index	Annual change in the real-trade weighted US dollar index "Majon Currencies"	St. Louis Fed	-

11.2 Company List, Yards by Size, and Financing Choices

Table 11-3: Company list, data sourced from ThompsonOne

Company Name	Largest Owner	Ownership Percentage
ABG Shipyard Ltd	ABG International Pvt. Ltd.	67.3 %
Aker Shipyard	Converto Capital Fund AS	57.6 %
Bergen Group	Magnus Stangeland	29.5 %
Bharati Shipyard Limited	Bharti Infratech Projects Pvt. Ltd.	32.0 %
China CSSC Holdings Limited	China State Shipbuilding Corporation	61.1 %
China Ocean Shipbuilding Industry Group Limited	Li Ming	6.3 %
China Shipbuilding Industry company Limited	China Shipbulding Industry Corporation	45.8 %
CSBC Corporation, Taiwan	Ministry of Economic Affairs	33.6 %
Daewoo Shipbuilding & Marine Engineering Co., Ltd.	Korea Development Bank	31.5 %
Guangzhou Shipyard International Company Limited	China State Shipbuilding Corporation	52.4 %
Hanjin Heavy Industries & Construction Co.,Ltd	National Pension Service	8.4 %
Hyundai Heavy Industries Co.,Ltd	Jeong Mong Jun	10.2 %
Hyundai Mipo Dockyard Co.,Ltd	Hyundai Samho Heavy Industries Co., Ltd.	45.2 %
JES International Holdings Limited	JES Overseas Investment Ltd.	50.8 %
Mitsui Engineering & Shipbuilding Co.,Ltd.	Mitsui & Co Ltd	5.2 %
Naikai Zosen Corporation	Hitachi Zosen Corp	29.6 %
Nam Cheong Limited	S.K. Tiong Enterprise Sdn Bhd	27.3 %
Namura Shipbuilding Co.,Ltd.	Nippon Steel & Sumitomo Metal Corp	6.4 %
Samsung Heavy Industries Co.,Ltd	Samsung Electronics Co Ltd	17.6 %
Sasebo Heavy Industries Co., Ltd.	Nippon Steel & Sumitomo Metal Corp	9.7 %
Sembcorp Marine Ltd	Temasek Holdings Pte. Ltd.	60.7 %
STX Offshore & Shipbuilding Co.,Ltd.	Not Available	Not Available
Yangzijiang Shipbuilding (Holdings) Ltd.	Newyard Worldwide Holdings Ltd.	26.1 %

The table displays the included companies and their respective ownership structures as of 13.05.2014. STX is not available due to restructurings

Table 11-4: List of yards by size (Clarksons, 2014a)

Rank	Shipbuilder	Shipyard	Orderbook CGT	Orderbook DWT	Capacity CGT 000'	Capacity DWT 000'
1.	Hyundai Heavy Industries	Ulsan	7559	17844	3840	12651
2.	Daewoo	Okpo	5702	13472	3094	9723
3.	Samsung Heavy Industries	Geoje	5398	8768	2972	8712
4.	Hyundai Mipo	Ulsan	4196	8470	1557	3274
5.	Hyundai Samho	Samho	3187	10277	1745	5880
6.	Shanghai Waigaoqiao	Shanghai	2456	15030	796	4510
7.	Jiangsu New YZJ	Jingjian	2452	8762	700	2574
8.	Hudong Zhonghua	Shanghai	2137	4036	646	2083
9.	Dalian Shipbuilding	Dalian	1870	7808	1131	6057
10.	STX Shipbuilding	Dalian	1758	4904	1238	5082

The table displays the ten largest shipbuilders according to size of orderbook in terms of CGT as of March 2014

Table 11-5: Financing opportunities for shipbuilders (OECD, 2007, p. 6)

Instrument	Leading Provider/Advisor	Loan to value	Active Markets	Vessel Type	Tax Benefits
Debt Markets					
Bilateral Loans	HSH Nordbank	65 %	Germany	Any	No
Syndicated Loans	Nordea	65 %	Norway	Any	No
Finance Companies	GE Capital	75 %	USA	Any	No
Subordinated Debt	Navigation Finance	100 %	USA	Any	No
High Yield Bonds	Jefferies & Co	<=100%	USA/Norway	Any	No
Export Credit	KEXIM	<=80%	Korea	Newbuilds	No
Equity Markets		Min. size			
SPAC	Maxim Group	USD 100m	USA	Any	No
Private Equity	Dahlman Rose	USD 100m	USA	Any	Sometimes
Public Equity	Merrill Lynch	USD 100m	USA/Singapore/ Norway	Any	No
Vessel Leasing					
German KG	Konig & Co.	100 %	Germany	Newbuilds	Yes
Norwegian KS	Ness & Risan	100 %	Norway	Any	No
Private Leasing Co's	First Ship Lease	100 %	Global	Any	No
Public Leasing Co's	Ship Finance International	100 %	USA/Singapore	Any	No

The table displays different methods of finance within the shipping/shipbuilding industry.

11.3 Pre-requisites for Regression Models

In order for a multiple regression OLS to be valid four assumptions must be met. These will briefly be outlined in the coming sections.

Linearity

The dependent variable y must be a linear function of each of the independent variables in order for the regression to be valid. The model will try to estimate a linear relationship between the variables, even when the linearity criteria is unfulfilled, which will result in an unreliable model. Transforming the variables (e.g. to logarithmic form) can be helpful in order to overcome this challenge (Keller, 2008).

Normality

The residuals (i.e. the distance one single observation is from the mean) must be normally distributed with a mean $\mu = 0$ and variance of σ^2 ($e \sim N(0, \sigma^2)$. A test for normality will reveal if there is either skewness and/or kurtosis present. The level of skewness depends on the degree to which the distribution is symmetrical around the average. Kurtosis measures the thickness of the distribution's tails. In case the null hypothesis H_0, which states that the observations are normally distributed and that the kurtosis and skewness in line with the normal distribution is not rejected, then normality can be assumed (Keller, 2008).

Homoscedasticity

A third criteria for a multiple regression to be valid is whether or not the residuals have constant variance ($Var(e|x) = \sigma^2$), meaning that they should be independent of the value of x. OLS will not be the best estimator and inferences based on the model will be invalid when the residuals show signs of heteroscedasticity (e.g. trending/varying variance). Heteroscedastic error terms can be overcome by calculating Eicker-Huber-White standard errors (Stock & Watson, 2012), which are used in this thesis.

Multicollinearity

Multicollinearity occurs when two or more of the independent variables are correlated, which reduces the robustness of the model. When presumably independent variables correlate, it becomes more difficult to determine the causality relationship (i.e. which independent variable actually has what effect on the dependent factor) (Keller, 2008). We have tested this by looking at the correlation matrix.

Autocorrelation

According to Stock and Watson (2012), autocorrelation occurs when the residuals correlate over time, which often is the case when working with time-series data. Autocorrelation will lead to erroneous standard errors, and positive autocorrelation will lead to a higher probability of making type I errors. Panel data sets may be tested for autocorrelation with a Wooldridge test (Wooldridge, 2009).

For fixed effect regressions the standard errors may be both heteroscedastic and autocorrelated. This challenge can be resolved through the use of clustered and robust standard errors. These standard errors allow for correlation within a cluster, as long as the error terms are uncorrelated across clusters. However, it must be noted that the clustered standard errors may deviate significantly from standard errors that do not allow for heteroscedasticity/autocorrelation. (Stock & Watson, 2012).

11.4 Illustration of Variables

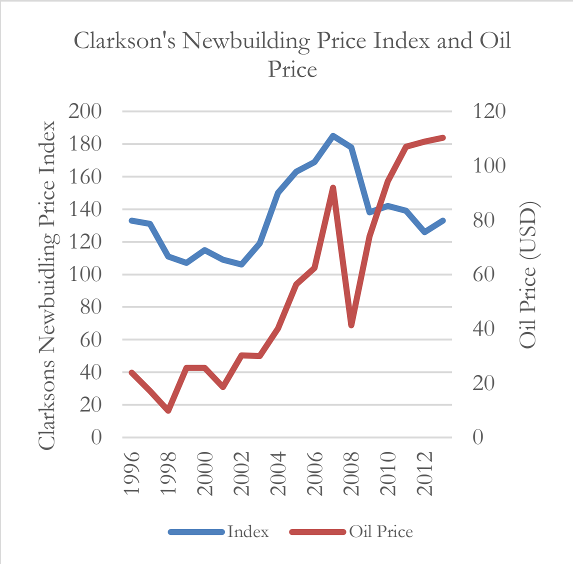

Figure 11-3: Clarksons Newbuild Price (Clarksons, 2014d) & Oil price (Clarksons, 2014e)

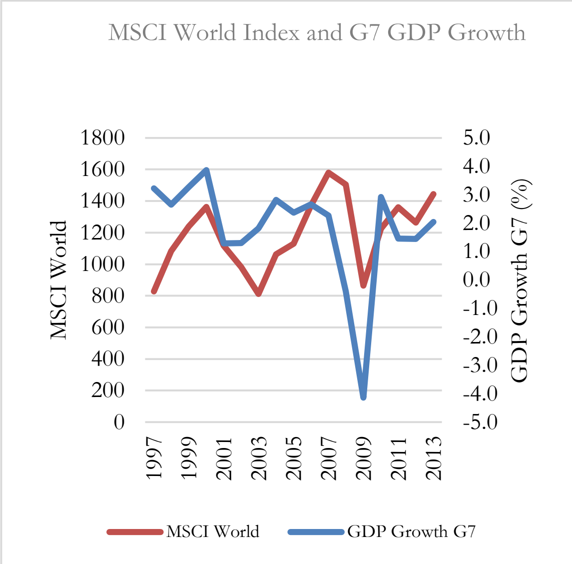

Figure 11-2: MSCI and G7 GDP Growth, both sourced from Datastream

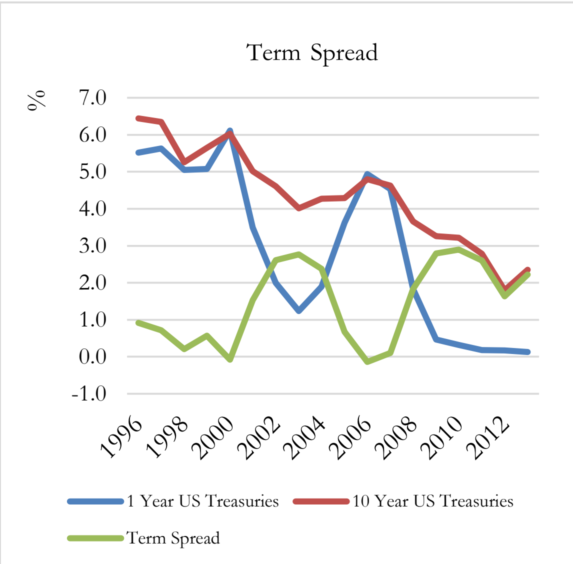

Figure 11-1: Historical term spread (NBER, 2014)

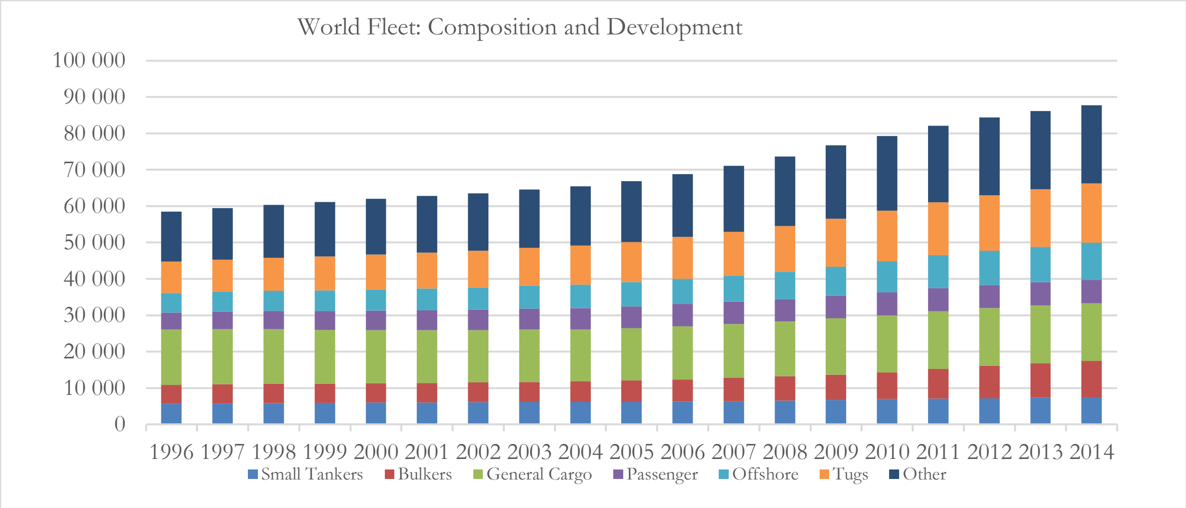

Figure 11-5: World fleet composition and development (Clarksons, 2014b)

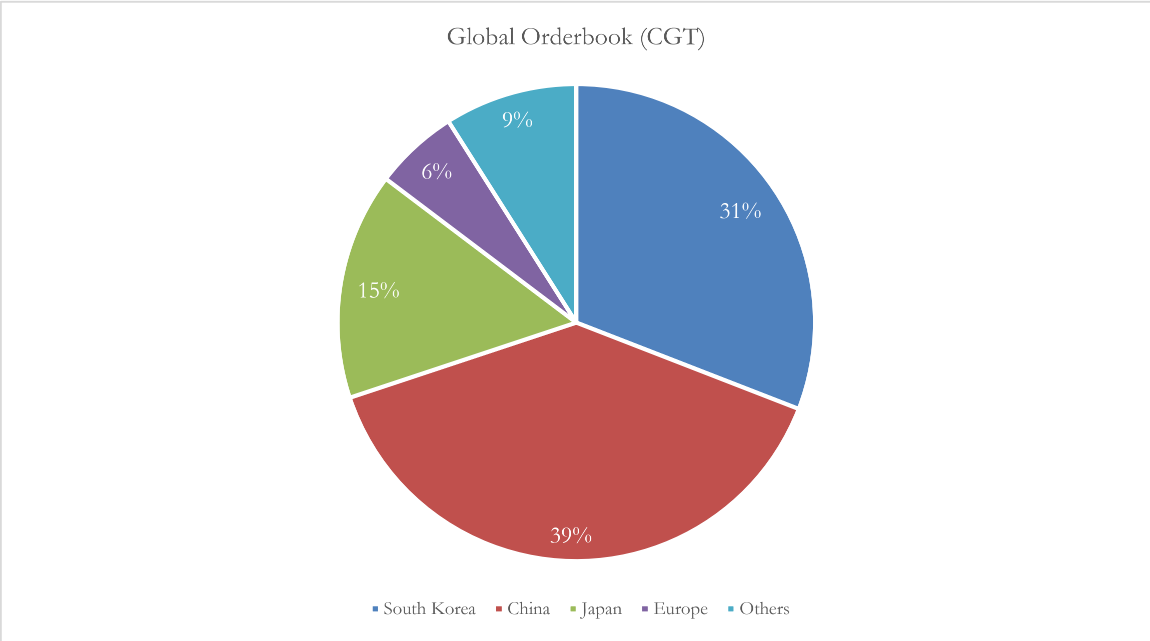

Figure 11-4: Global orderbook composition by geography (Clarksons, 2014a)

11.5 Alternative Regressions: Market Leverage

Table 11-6: Standard leverage regression with market leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: market leverage								
Size	-0.0543**	-0.0465	0.0111	0.0747	-0.0837***	-0.0753**	-0.0629	0.00998
	(0.023)	(0.036)	(0.080)	(0.080)	(0.023)	(0.035)	(0.105)	(0.079)
Tangibility	0.202	0.252	0.308	0.887	0.291	0.448	-0.116	0.623
	(0.402)	(0.412)	(0.662)	(0.744)	(0.379)	(0.328)	(0.563)	(0.583)
Market to book	-0.0325	-0.245**	0.0806	-0.155	0.142	-0.0778	0.275**	0.0328
	(0.126)	(0.101)	(0.124)	(0.097)	(0.118)	(0.077)	(0.120)	(0.076)
Profitability	-1.268*	-0.594	-0.548	-0.599	-1.804**	-1.612**	-1.274	-1.627**
	(0.697)	(0.789)	(0.824)	(0.868)	(0.693)	(0.646)	(0.813)	(0.642)
Corporate Tax Rate	0.882***	1.132***	1.734	1.039	1.287***	1.521***	3.841	3.189
	(0.308)	(0.289)	(1.510)	(1.298)	(0.330)	(0.327)	(2.628)	(2.278)
Dividend Payer		-0.337***		-0.360***		-0.241***		-0.241**
		(0.076)		(0.091)		(0.084)		(0.086)
Rating Probability		0.502*		0.553		0.470*		0.405
		(0.252)		(0.327)		(0.235)		(0.297)
Asset Risk		0.177*		0.231*		0.275***		0.314***
		(0.092)		(0.114)		(0.093)		(0.102)
Operating Leverage		-0.159		-0.159		-0.0779		-0.0201
		(0.128)		(0.232)		(0.126)		(0.216)
Firm Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Observations	285	285	285	285	285	285	285	285
Adjusted R-squared	0.065	0.238	0.159	0.314	0.196	0.379	0.309	0.448

The table displays the standard leverage regression results with a sample of 23 globally listed shipping companies in the time period 1997-2013. All variables are winsorized at the lower and upper 5th percentile. Clustered, robust standard error at firm level are given in the parentheses. Firm and time fixed effects indicates what fixed effects are included in the specification.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

Table 11-7: Macroeconomics determinants of leverage with market leverage

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Market Leverage					
Size	0.0747	0.0728	0.0438	0.126	0.0276
	(0.080)	(0.079)	(0.079)	(0.077)	(0.076)
Tangibility	0.887	0.855	0.501	1.086	0.533
	(0.744)	(0.734)	(0.609)	(0.740)	(0.566)
Market to book	-0.155	-0.142	-0.108	-0.133	-0.0198
	(0.097)	(0.094)	(0.087)	(0.112)	(0.074)
Profitability	-0.599	-0.715	-1.268*	-0.628	-1.394*
	(0.868)	(0.858)	(0.729)	(0.772)	(0.690)
Corporate Tax Rate	1.039	0.769	2.123	2.262	2.704**
	(1.298)	(1.287)	(1.281)	(1.396)	(1.259)
Operating Leverage	-0.159	-0.152	-0.0216	-0.381	-0.0115
	(0.232)	(0.230)	(0.204)	(0.230)	(0.206)
Dividend Payer	-0.360***	-0.351***	-0.262***	-0.310**	-0.255***
	(0.091)	(0.088)	(0.088)	(0.114)	(0.083)
Asset Risk	0.231*	0.236**	0.316***	0.206	0.314***
	(0.114)	(0.112)	(0.107)	(0.120)	(0.104)
Rating Probability	0.553	0.538	0.469	0.249	0.422
	(0.327)	(0.322)	(0.336)	(0.325)	(0.330)
Industrial Production Pacific Region		0.166***			
		(0.056)			
Recession (Shipping)			0.366***		
			(0.069)		
Lagged Term Spread				6.338**	
				(2.834)	
GDP Growth				-2.628	
				(3.344)	
Oil Price Change				-0.0659	
				(0.057)	
Stock Market Return Annual MSCI				-0.0589	
				(0.211)	
World Orderbook Value Change					-0.547***
					(0.101)
Return Newbuild Price Index					-1.123***
					(0.235)
Annual Change Deliveries DWT					0.0675
					(0.256)
Return Major Currencies					1.148***
					(0.343)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	285	285	285	269	285
Adjusted R-squared	0.314	0.327	0.420	0.296	0.443

The table displays the standard leverage regression results with a sample of 23 globally listed shipping companies in the time period 1997-2013. The model is complemented with possible macroeconomic determinants of leverage. All variables are winsorized at the lower and upper 5th percentile, except the macroeconomic variables. Clustered, robust standard error at firm level are given in the parentheses. Firm fixed effects indicates what fixed effects are included in the specification.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

Table 11-8: Speed of adjustment with market leverage

	OLS	FE	AB	BB
Dependent variable: Market Leverage				
Market Leverage (t-1)	0.470***	0.276***	-0.114*	-0.108*
	(0.060)	(0.075)	(0.060)	(0.059)
Market Leverage (t-1)*Ind. Prod. Pacific Region	0.149	0.178	0.272***	0.283***
	(0.106)	(0.195)	(0.062)	(0.057)
Speed of Adjustment	53 %	72 %	111 %	110 %
Speed of Adjustment in Recession	38 %	55 %	84 %	82 %
Size	0.0278	0.0428	0.0736	-0.0160
	(0.031)	(0.067)	(0.059)	(0.019)
Tangibility	0.273	0.756**	1.734***	0.543***
	(0.278)	(0.359)	(0.478)	(0.198)
Market to book	-0.322***	-0.106	-0.250***	-0.396***
	(0.089)	(0.088)	(0.078)	(0.058)
Profitability	-0.427	-1.468***	0.835	-0.433
	(0.510)	(0.468)	(0.704)	(0.465)
Corporate Tax Rate	0.280	2.278	-0.301	0.856***
	(0.196)	(1.838)	(1.336)	(0.187)
Dividend Payer	-0.122*	-0.117	-0.264***	-0.234***
	(0.068)	(0.088)	(0.075)	(0.054)
Rating Probability	-0.116	-0.0259	0.441***	0.160
	(0.244)	(0.299)	(0.170)	(0.125)
Asset Risk	0.0929	0.238**	0.264***	0.172***
	(0.082)	(0.100)	(0.054)	(0.042)
Operating Leverage	-0.241**	-0.209	-0.531***	-0.315***
	(0.091)	(0.181)	(0.169)	(0.092)
Observations	262	262	239	262

The table displays the different adjustment speeds for OLS, FE, AB, and BB estimators for the sample of 23 shipbuilders in the period 1997-2013. Standard errors are given in parantheses. Firm and Year fixed effects included for the FE estimator. The percentage speed of adjustment, i.e. how much of the gap from target leverage is closed within one year, is given in rows 3 and 4. For the AB and BB estimators, the lagged leverage is treated as the predetermined variable and the firm specific variables are exogenous.

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level