NORGES HANDELSHØYSKOLE
Bergen, June 2011

Capital Structure

An Analysis of the Shipping Market

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MSc. Economics and Business Administration

Specialization: Financial Economics

Master Thesis

NORGES HANDELSHØYSKOLE

Abstract

Capital structure in shipping has proven to be complex. The market is known for high volatility and the financial funding alternatives have changed as a result of these cycles.

This master thesis introduces the shipping market with focus on the dry bulk and tanker segments. It then discusses capital structure theory and relates it to shipping. These theories form the basis of the analysis. Evaluating the segments does not give a clear answer to the best way of financing given the market conditions. However, it seems like the industry prefer owning vessels instead of leasing and the average debt-equity market ratios have been quite low and stable between 2005 and 2010. Both segments have experienced a reduction of ROE and ROIC to approximately the same values as in 2002. The expected increase in fleet size implies that calmer seas will not be reached in the near future.

Preface

This master thesis marks the end of my master degree in Financial Economics and thereby five years at the Norwegian School of Economics and Business Administration (NHH).

The process of finding a subject for my master thesis started last autumn. I have always thought of shipping as an interesting industry. The interest increased after attending the course INB426 Shipping Economics in 2009. I therefore decided to choose a topic within this area, which also could be related to my major in financial economics.

I have during the process of writing this thesis gained new educational understanding about both capital structure and the shipping industry, which have been very interesting. This will be useful later in my professional career.

I would like to express my gratitude to Professor Karin Thorburn for valuable guidance and comments during the process. In addition, I want to thank Fearnleys AS for providing me with shipping market data and information about the industry.

Bergen, June 2011

Christian Melsom Myhre

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1. Introduction

In this master thesis, I have studied capital structure in the shipping industry. I first introduce the industry and two of its main segments in chapter 2. Theories related to capital structure are then presented and discussed in chapter 3, before they are connected to shipping in chapter 4. I have in chapter 5 and 6 studied different types of funding and some affecting variables. The last part of this thesis examines financial- and market data, with the purpose of finding relations. In addition, I wanted to study whether or not the companies had the same reactions to changes in the market conditions.

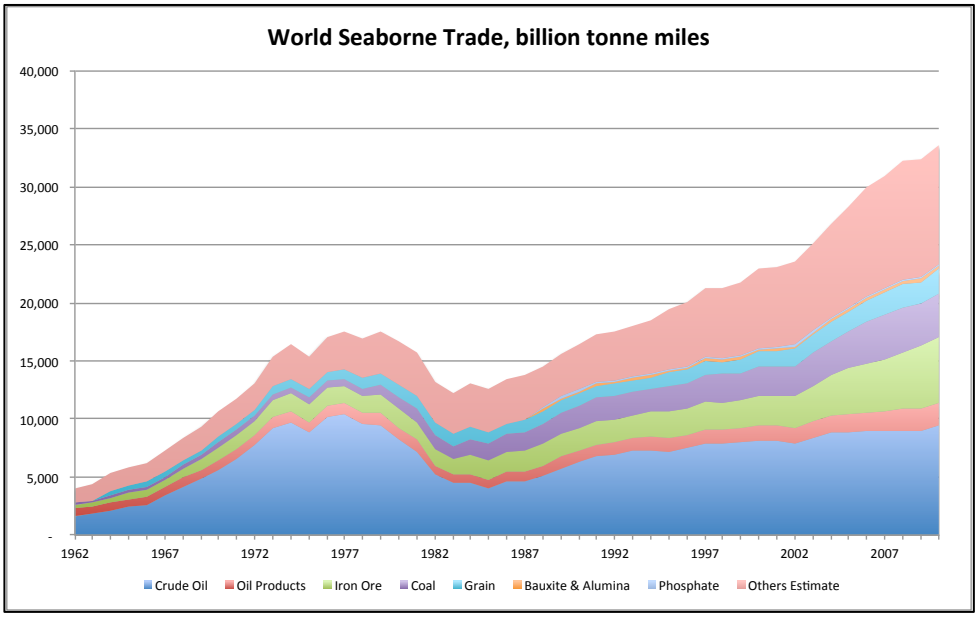
The dataset consist of 24 shipping companies, divided into 11 dry bulk- and 13 tanker companies. A list of the companies is found in Appendix C. I have decided to examine these segments, as they have several similarities and therefore are influenced by many of the same market variables. Studying additional segments would increase the number of variables, and thereby make it more difficult to compare.

2. Shipping market

"Shipping is a cheap source of transport which can open up wider markets to specialisation, offering shipment of even the most everyday products at prices far below those that can be achieved by any other means" (Smith, 1776, referred to by Kavussanos and Marcoulis, 2005, pp. 107).

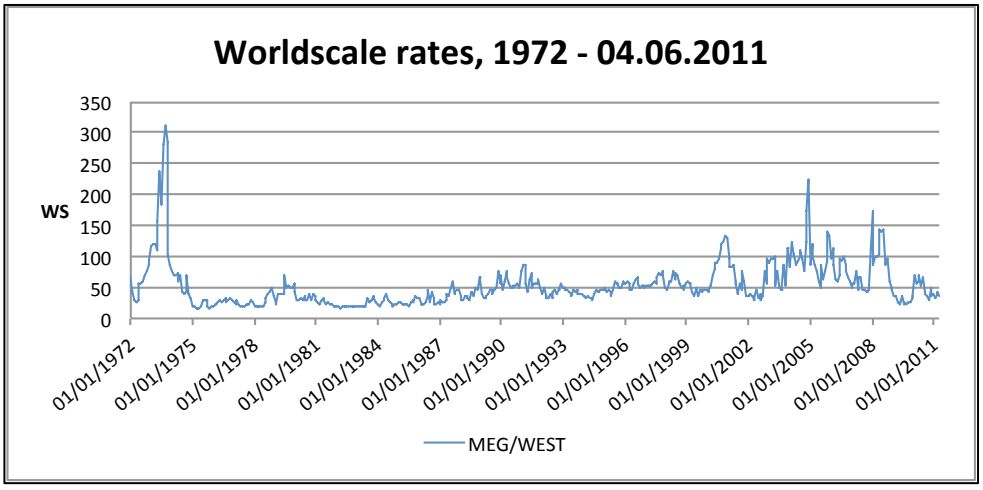
Seaborne trade has existed for several thousand years. The world has been discovered and conquered by the means of ships in various shapes and forms throughout the centuries. This has increased the demand for transportation of goods and merchandise over large distances. The possibilities of moving large volumes of cargo made the maritime industry ideal. Today, international shipping is responsible for transporting approximately 90% of the world's cargo (Shipping Facts). The increase in the world seaborne trade is illustrated by graph 1. It shows how the world's seaborne trade, measured in tonne miles, has developed from 1962 to 2010. Tonne mile is a measurement used in shipping and can be defined as the tonnage of cargo shipped multiplied with the distance it is shipped.

After the industrial revolution and through the nineteenth century steel vessels with steam engines replaced sailing ships made of wood. This development was the foundation of the diversifications found in the maritime industry throughout the last couple of decades. Today, most shipping companies tend to operate within one market segment. However, an investor often owns firms in different markets, making it possible to combine specialization with diversification. The tradition of privately owned family companies are today partly replaced by companies listed on the stock exchanges, as the industry has become more capital intensive.

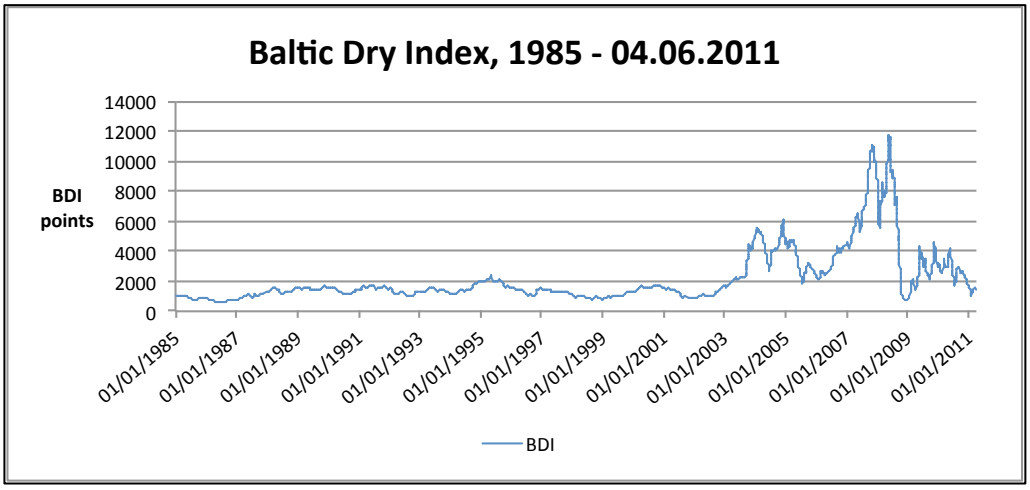


Graph 1: **World seaborne trade in billion tonne miles from 1962 to 2010** (Fearnleys). Graph 1 illustrates the total amount of cargo shipped, divided into different types of cargoes. The large increase during the 1970s was due to the conflicts in the Middle East and the closure of the Suez Canal.

Transporting 90% of the world's cargoes make shipping an industry exposed to the world economy and stability. This gives markets cycles, as shown by graph 2 and graph 3 on the next page. Each cycle last, according to Martin Stopford (2009), eight years if the last fifty years are used as basis. None are similar in either length or seriousness. Therefore, predicting the market can be a challenge for all parties involved. In addition, high level of standardisation leads to many participants. This results in a market with almost perfect competition. Significant exposure to the world's economy, combined with the level of competitors, creates a highly volatile industry.



Graph 2: **Tanker freight rates in Worldscale between 1972 and 04.06.2011** (Fearnleys). The graph illustrates the volatility in freight rates for VLCCs loading in the Middle East Gulf and discharging in the U.S. Gulf, Canada or Europe. This voyage is representative for the development in the crude oil freight rates. The peak in the early 1970s was a result of the conflicts in the Middle East, where among other things the Suez Canal was closed.



Graph 3: **Baltic Dry Index between 1985 and 04.06.2011** (Fearnleys). The graph illustrates the development and volatility in the dry bulk shipping market. BDI is based on different shipbrokers view of the current freight costs and reported to the Baltic Exchange every working day.

2.1. Currency

A large business like shipping tends to favour the use of one currency in transactions. As most international markets, the standard currency is the US Dollar (USD). Other currencies can be used, but USD seems to be preferred in the daily trade. There are

several advantages by using one major currency in daily trade which all parties involved are familiar with. Key points as exchange rates and liquidity in international markets are vital issues when otherwise complicated agreements are worked out. Using one currency removes the risk related to exchange rates as revenues and expenses are paid and received in the same currency.

2.2. Structure of the business

The Shipping industry can roughly be divided into charterers, shipbrokers, shipbuilders and ship-owners. As this master thesis focuses on capital structure, ship-owners are the most relevant and are briefly introduced below.

2.2.1. Ship-owners

A widely used technique in the United Kingdom some 150 years ago was to register each vessel as 64 shares, with the option to attract different investors (Stopford, 2009). The majority of ships were privately owned, but joint stock partnership took over as vessels grew in size and became more expensive. This way of organizing a company protected the investors from the company's creditors.

Even though the companies had public financing, those allowed to invest were strictly controlled. Cash flow or borrowings were still primarily used to finance new investments. This structure changed during the middle of the twentieth century, as charterers required larger and more specialized vessels. In return ship-owners got long time charter contracts. This gave the opportunity to reduce the level of equity when investing in new vessels. As demand changed and financing turned towards charter-backed and asset-backed, new ways of structuring the corporations were developed. One example is the one-vessel company, where the vessels in a ship-owning firm were registered as individual companies. This provided the opportunity to finance each ship separately, giving banks mortgage on both hull and contracts. Owners then got the option to use different flag states for each vessel, choosing the one most suitable. Financial or operational problems would then be isolated and only affect the involved vessels.

2.3. Contracts

Today, vessels transport cargoes based on different types of charter parties[1]. It is normal to distinguish between the spot- and long term market, which consist of bare boat charter and time charter. The use of the different alternatives varies between the four strategic types of shipping (figure 1).

2.3.1. Spot market

In the spot market, each voyage is negotiated individually. This means that the same voyage with the same cargo can be priced differently. Fixing a vessel in the spot market makes the charterer responsible for supplying the cargo, while the ship-owner is responsible for providing the vessel and carry out loading, transportation and discharging within the agreed timeframe.

2.3.2. Bare boat market

A bare boat charter gives the charterer the possibility to lease a vessel and have full operational responsibility. The charterer is then responsible for both operating costs like maintenance and crew wages, and commercial operation cost like voyage costs and cargo handling costs. The time frame of a contract is often between 10 and 20 years.

2.3.3. Time charter market

Time charter is an agreement to lease a vessel without having the operational responsibility. The charterer pays the owner a predetermined fixed daily rate, called the time charter equivalent (TCE). Owner of the vessel is then responsible for the operating costs, while charterer pays commercial operation costs. The time frame is normally shorter than bare boat charters and can vary from one voyage to several years.

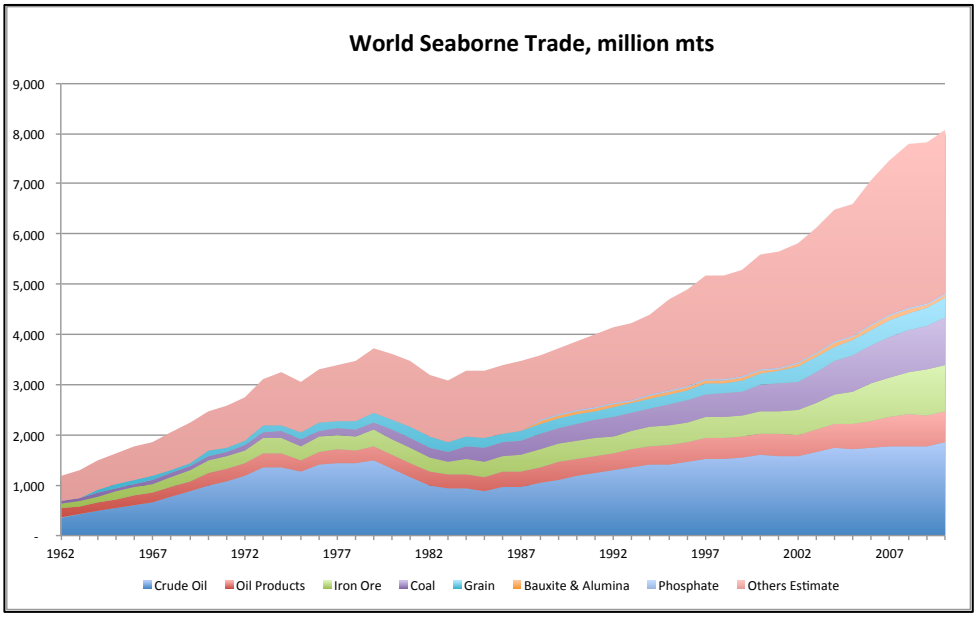
[1] A charter party is the contract setting out terms and details of a fixture.

2.4. Segments

The shipping market consists of many different segments, simplistically divided into two categories, the bulk and the liner markets (Cullinane, 2005). Figure 1 describes the four different strategic types of shipping and graph 4 shows the development in the world trade, measured in metric tonne, from 1962 to 2010. This thesis focuses on the bulk market, divided into dry bulk and tank, as they are responsible for transporting a significant part of the world's seaborne trade. The two markets are primarily to be found in the commodity and contract sectors in figure 1. Bulk shipping can be characterized as "*one ship – one cargo*" (Kavussanos and Marcoulis, 2005, pp. 108) as vessels handle fewer, but significantly larger cargoes than those operating in liner shipping.

Strategic types of shipping			
Wijnolst and Wergeland (2008)			
Economy of scale	**Significant**	**Contract shipping** - Concentrated industry - Positive scale effect of fleet size - Fairly homogeneous service - Liquid second-hand market - Close customer relations	**Industry shipping** - Concentrated industry - Positive scale effects of fleet size - Specialised services - Difficult second-hand market - Tailor-made customer service
	Insignificant	- Fragmented industry - No scale effect in fleet - Homogeneous service - Liquid second-hand market - Little direct customer contact **Commodity shipping**	- Local monopolies - Limited scale effects - Specialised services - Difficult second-hand market - Direct customer contact **Specialty shipping**
		Insignificant	**Significant**
		Differentiation	

Figure 1: **Strategic types of shipping** (Wijnolst and Wergeland, 2008). The table divides the shipping industry into four sectors and briefly define these. The part of the tanker market transporting oil is to be found in the commodity sector, while chemicals and gas are found in both the contract and industry sectors. Large dry bulk is located in the commodity sector, while handy bulk lies somewhere between the commodity and contract sectors.



Graph 4: **The world's seaborne trade in million metric tonne** (Fearnleys). The graph illustrates the total amount of cargo shipped divided into different types of cargoes.

2.4.1. Tanker market

The market for transportation of oil can be divided into two main segments such as crude oil and refined products. Refined products can then be split into clean and dirty products. Clean products are refined petroleum products like gasoline, naphtha and diesel, while dirty primarily is fuel oil. Chemicals and gas (LNG/LPG) are also important tanker markets. The vessels used vary in size, depending on cargo and volume. It has however been a clear trend to move larger lots to decrease the cost per tonne transported.

Different types of tanker vessels Fearnleys		
Type	Size (dwt)	Cargo
VLCC	200' - 320'	Crude
Suezmax	120' - 180'	Crude
Aframax	85' - 120'	Crude, refined products
Panamax	55' - 85'	Crude, refined products

Table 1: **Different types of tanker vessels**[2] (Fearnleys).

[2] VLCC is used to define all vessels above 200,000 dwt. As of today, only a few vessels traded in the spot market can be classified as ULCC (a previously used category for vessels above 320' dwt). This is the TI Oceania (442' dwt) owned by Overseas Shipholding Group Inc. (OSG) and TI Europa (442' dwt) owned by Euronav.

Transporting oil includes an environmental risk, although very small compared to the volume moved. A few major disasters, such as Exxon Valdez in 1989 and Prestige in 2002, created serious pollution problems. In both incidents persisted oil such as crude oil and fuel oil were involved, which makes the pollution more severe. In an attempt to reduce risk, new tankers with double hull have been designed. These have been constructed since the early 1990's and single hull tankers will have to be phased out latest by the end of 2015 (Fearnleys).

2.4.1.1. Contract

Tankers can be chartered either on a voyage basis in the spot market, or on time charter. The freight rate in the spot market is determined by the Worldscale system or as a lump sum in USD, while time charter uses a time charter equivalent (TCE). This is a daily rate measured in USD. Worldscale calculates the cost of freight as shown by equation 1.

$$Lump\ sum\ freight = Size\ of\ cargo \cdot rate \cdot \frac{flat\ rate}{100}$$

Equation 1: **Worldscale formula.**

Worldscale Association decides and publishes the flat rate once a year through a book and the Internet. This value, called the flat rate, shows the cost per metric tonne for a round trip performed by a standard vessel[3] between two ports. The flat rate is set to be 100%. Size of cargo is the volume to be transported. The rate is a variable and decided by the market. It is measured in per cent of the flat rate and is negotiated individually for every cargo, making it highly volatile. Using the Worldscale system provides the possibility to compare revenues for various types of vessels sailing different routes, and thereby determine the most profitable voyages. Tanker freight rates in the spot market are referred to as Worldscale or just WS.

The TCE can be found by restructuring the Worldscale lump sum freight equation. Typical maturities in the TCE market are 12 months, 5 years and 10 years (C.R. Weber), but any period can be negotiated.

[3] A standard vessel is set to be 75' dwt. operating with a service speed of 14.5 knots.

$$TCE = \frac{Lump\ sum\ freight - Voyage\ costs}{Voyage\ time\ including\ ballast,\ loading\ and\ discharging}$$

Equation 2: **Time charter equivalent in the tanker market** (Stopford, 2009).

2.4.1.2. Market today

The tanker market reached a peak in the first half of 2008, before the world economy affected by the financial crisis triggered a downturn in the shipping market. Large ordering of new vessels during this decade, with delivery in the following years, created a significant oversupply of tonnage (table 2). Even though contracts were cancelled, more ships have been added than demolished, contributing to the low rates found in the market today. The existing fleet will by the end of 2014 have grown with 18% if today's fleet are kept constant and all vessels on order are delivered. Freight rates can be expected to stay low as long as the oversupply of tonnage continues to influence the market. The high supply will continue to keep the utilization rate down, as shown by graph 14 in Appendix B.

Tanker Fleet profile as end of April 2011 (Fearnleys)							
		25-55' dwt	Panamax	Aframax	Suezmax	VLCC	Total
Existing Fleet		1735	450	869	423	572	4049
Delivered so far 2011		33	9	19	14	22	97
Contracted so far 2011		5	1	2	5	1	14
Deletions so far 2011		5	1	3	1	0	10
Sold for demo. so far 2011		4	0	4	0	1	9
On Order	2011 del	138	31	51	49	57	326
	2012 del	81	18	60	57	59	275
	2013 del	18	9	13	28	40	108
	2014 del	2	2	3	3	10	20
Total order book		**239**	**60**	**127**	**137**	**166**	**729**
VLCC = 200' dwt + Suezmax = 120 - 200' dwt				Aframax = 85 - 120' dwt Panamax = 55 - 85' dwt			

Table 2: **Tanker fleet profile as end of April 2011**[4] (Fearnresearch Bulk fleet update, April 2011). The table provides an overview of existing vessels and those to be delivered between 2011 and 2014.

2.4.2. Dry bulk market

Dry bulk covers a wide range of cargoes like coal, iron ore, cement fertilise and grain. These cargoes have one thing in common; they are all shipped in large volume.

[4] The two existing ULCCs are included in the VLCC class.

Table 3 defines the size of the different vessels used. A dry bulk vessel can load and discharge most places in the world, as it does not require the same specialized cargo-handling terminals as a tanker. It is also easier and less costly for a dry bulk vessel to switch between different types of cargoes.

Different types of dry bulk vessels Fearnresearch	
Type	Size (dwt)
Capesize	80' -
Panamax	60' - 80'
Handymax	50' - 60'
Handysize	10' - 50'

Table 3: **Different types of dry bulk vessels** (Fearnresearch Dry bulk market report, April 2004).

2.4.2.1. Contracts

Cargoes and vessels can, as the tanker market, be traded in the spot and time charter market. The freight rate is given as either USD/day or USD/tonne. Rates as USD/day are calculated almost the same way as the TCE in the tanker market. Equation 3 illustrates the modified formula.

$$TCE = \frac{Cargo \cdot USD/tonne - Voyage\ costs}{Voyage\ time\ including\ ballast,\ loading\ and\ discharging}$$

Equation 3: **Time charter equivalent in the dry bulk market** (Stopford, 2009).

In dry bulk, time charter is used frequently and often to price individual voyages. This is related to the absence of a spot freight rate system like Worldscale. It is not possible to create such system, as it exists too many possible ports able for loading and discharging. Instead, time charter is used. The charter party then define the areas for which the vessel should be loading and discharging.

2.4.2.2. Market today

The dry bulk market has, as the tanker market, struggled with oversupply of tonnage the last couple of years. During the first quarter of 2011, the dry bulk fleet grew with approximately 4% (RS Platou monthly report, April 2011). This growth is still

affected by the ordering of vessels done before the top of the cycle in 2008. As shown by graph 15 in Appendix B, the utilization in dry bulk peaked that year with a rate close to 1. The financial crisis reduced the activity in the world economy, and decreased the demand for natural resources and other dry bulk cargoes. This generated a downturn in the market.

Demand for dry bulk tonnage is expected to increase in the coming years, but the large order book indicates prolonged troubles (RS Platou monthly report, April 2011). In other words, the increase in demand is not high enough to cover the growth of tonnage. This problem is illustrated by table 4, which shows the deliveries of vessels between 2011 and 2014. The number of vessels on order will create an increase in the existing fleet by 34%, if the current fleet is kept constant.

Dry bulk Fleet profile as end of April 2011 (Fearnleys)									
		10-25' dwt	25-50' dwt	50-60' dwt	60-100' dwt	100-150' dwt	150-200' dwt	200'+ dwt	Total
Existing Fleet		1058	2968	1263	1901	171	868	212	8441
Delivered so far 2011		6	68	100	69	12	60	11	326
Contracted so far 2011		1	25	14	41		3	1	85
Deletions so far 2011		8	12	1	10	6		1	38
Sold for demo. so far 2011		7	7	2	4	5	4	1	30
On Order	2011 del	30	339	396	378	49	185	54	1431
	2012 del	18	245	227	415	26	110	69	1110
	2013 del	8	72	63	111	8	20	33	315
	2014 del	2			13	2	2	3	22
Total order book		**58**	**656**	**686**	**917**	**85**	**317**	**159**	**2878**
Capesize = 80' dwt +			Handymax = 50 - 60' dwt						
Panamax = 60 - 80'' dwt			Handysize = 10 - 50' dwt						

Table 4: **Dry bulk fleet profile as end of April 2011** (Fearnresearch Bulk fleet update, April 2011). The table provides an overview of existing vessels and those to be delivered between 2011 and 2014.

3. Theory - Capital structure

"The leading theories of capital structure attempt to explain the proportions of debt and equity observed on the right- hand side of corporations' balance sheets" (Myers, 2002, pp. 217).

The composition of capital structure depends on several external and internal factors, like the line of business, economic conditions, and the firm's strategy. Firms with low credit rating tend to have a multi-tiered capital structure consisting of different types of debt, while higher rated firms use fewer layers (Rauh and Sufi, 2010). The following chapter will go into theory relevant to this master thesis.

3.1. Modigliani-Miller theorem

Developed by Modigliani and Miller (1958), the theorem forms a fundament of modern business finance theory. It states that the market value of any firm is constant and independent of its capital structure. The level of debt, the gearing-ratio, does not influence the value because investors can create and remove leverage privately. This is possible since Modigliani and Miller (1958) assume that investors and firms have access to the same financial markets.

Modigliani and Miller (1958) present two propositions:

Proposition I: *"The average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class"* (Modigliani and Miller, 1958, pp. 268-269).

Proposition II: *"The expected yield of a share of stock is equal to the appropriate capitalization rate for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between the capitalization rate and rate of interest"* (Modigliani and Miller, 1958, pp. 271).

The value of a firm is influenced by risk and other variables like market conditions. In order to test proposition I, these effects need to be adjusted for. Proposition I can be written as the weighted average cost of capital before tax (WACC), with r_D and r_E as the cost of debt and cost of equity. D, E and V are then debt, equity and total value. This equation can be rewritten and give proposition II.

Proposition I: $$WACC = r_A = r_D \frac{D}{V} + r_E \frac{E}{V}$$

Equation 4: **Proposition I** (Myers, 2002).

Proposition II: $$r_E = r_A + (r_A - r_D) \frac{D}{E}$$

Equation 5: **Proposition II** (Myers, 2002).

When cheap debt is used as a substitute for expensive equity, the remaining equity gets more expensive. This is shown by proposition II.

The Modigliani-Miller theorem became the basis for much research and was proven not to hold under a variety of circumstances. Frank and Goyal (2007) state some of the most common elements as consideration of taxes, transaction costs, bankruptcy costs, agency conflicts, adverse selection, lack of separability between financing and operations, time-varying financial market opportunities and investor clientele effects.

In 1963, Modigliani and Miller published a correction of their original article, due to an error in their *"discussion of the effects of the present method of taxing corporations on the valuation of firms"* (Modigliani and Miller, 1963, pp. 433). One of the assumptions in Modigliani and Miller (1958) was the dividing of firms into classes. Each class consist of firms with equivalent returns, i.e. return on shares issued by one firm is proportional and correlate with return from other firms in the same class. They write: *"the market values of firms in each class must be proportional in equilibrium to their expected returns net of taxes (that is, to the sum of the interest paid and expected net stockholder income)"* (Modigliani and Miller, 1963, pp. 434). A firm with higher expected return after tax than other firms in the same class should always have a higher return and the difference between the returns has to be constant. This statement was proven wrong and rewritten in their correction in 1963. Arbitrage

cannot be obtained from just expected after tax return, it also depend on tax rate and leverage ratio. The tax advantage of debt financing was therefore proven to be greater than expected in Modigliani and Miller (1958).

3.2. The trade-off theory

The trade-off theory can be divided into two categories, static and dynamic, and is a result of the debate following Modigliani-Miller proposition I and Modigliani and Miller (1963). This correction, as mentioned above, increases the tax advantages of debt compared to using equity. However, according to Frank and Goyal (2008), the new version did not create any offsetting cost of debt. This gives an optimal level of debt equal to 100% of the required financing. Trade-off theory was developed to provide an intersection between tax benefits of debt and deadweight cost of bankruptcy. Modigliani-Miller proposition I can, based on trade-off theory, be rewritten as equation 6 (Myers, 2002).

$$V = D + E = \bar{V} + PV(interest\ tax\ shields) - PV(cost\ of\ financial\ distress)$$

Equation 6: **Rewriting of proposition I** (Myers, 2002).

$\bar{V}$ is the firm value when only equity is used, PV(interest tax shields) is present value of future tax saved due to interest tax deduction and PV(cost of financial distress) is the present value of future costs related to distress. Optimal value (V) is given when PV(interest tax shields) is offset by PV(cost of financial distress). Therefore, the level of debt is increased until the point where the optimal value is reached.

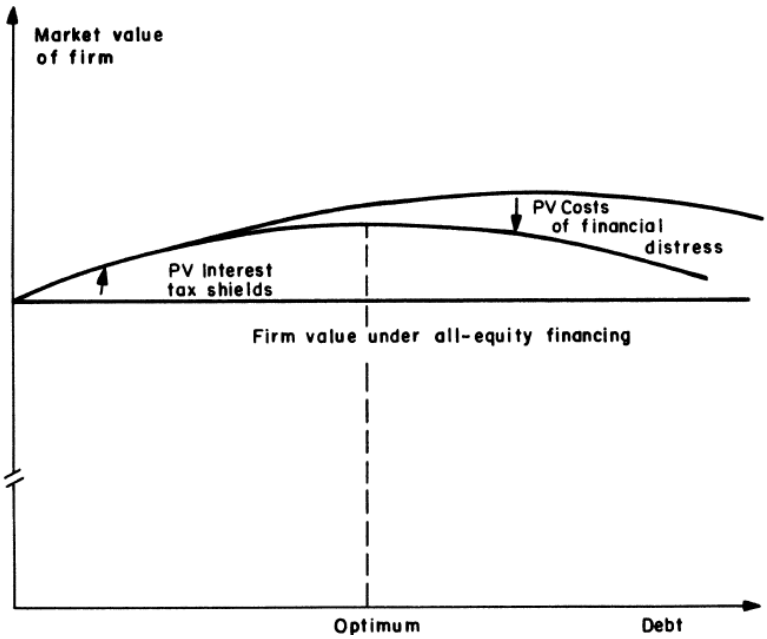
How management handles the combination of debt and equity might form the basis of conflicts between creditors and shareholders and generate agency costs. A common share is equivalent to a call option on a firm's asset and the exercise price is similar to the face value of the outstanding debt (Black and Scholes, 1973). A decrease in the value of the debt will then give shareholders a gain. Management can, based on this relation, choose to favour their shareholders by transferring values from creditors. If the level of risk increases, the value of existing debt will decrease. This is also a fact

if the level of debt is increased in order to pay dividend. Management can reduce the amount of investments financed by equity. The market value of existing debt increases with equity-financed investments, since creditors obtain better protection as the value of tangible assets increase. This change in value can be looked upon as a tax and thereby discourage investments. Instead, it can act as an incentive to pay dividend. Myers (1977) addresses this as the debt overhang problem. Creditors try to oppose this displacement of value by writing restrictive debt contracts, with covenants controlling the possibilities of additional borrowings and dividend payouts.

3.2.1. Static trade-off theory

Myers (1984) defines the static theory as *"setting a target debt-to-value ratio and then gradually moving towards it"* (Myers, 1984, pp. 576).

Optimal debt ratio is a combination of benefits and costs related to borrowing. The time period for the trade-off must be, according to Frank and Goyal (2007), one single period. This includes balancing debt tax shields against the cost of bankruptcy. Equity is substituted by debt and the opposite way around until the maximal value of the firm is reached (Myers, 1984). He illustrates this with graph 5.



Graph 5: **The static trade-off theory of capital structure** (Myers, 1984). The figure shows the balance between interest tax shields and cost of financial distress. A firm will substitute debt for equity and the other way around until the value of the firm is maximized.

3.2.1.1. Cost of adjustments

Without cost of adjustments, the optimal debt ratio would be the observed debt-to-value ratio. However, the presence of adjustment costs and fluctuation between firms creates a spread in debt-ratios across business sectors.

3.2.1.2. Debt and taxes

In the static trade-off theory, the tax structure has to be modified in order to fit the model (Bradley, Jarrel and Kim, 1984). This is necessary since most taxation systems depend on more than one period. Further, Bradley, Jarrel and Kim (1984) assume:

- Investors are risk-neutral.
- Investors face a progressive tax rate on returns from bonds.
- As corporate taxation, investors face taxes based on end-of period wealth.
- Dividends and capital gains have a constant tax rate.
- Non-debt tax shields exist.
- The corporation will incur cost related to financial distress if failing to pay required end-off period payments.
- If failing to meet required payments, costs related to financial distress will reduce the value of the firm.

Combining equity and debt creates an optimizing problem. What level of debt is maximizing the value of the firm? The answer can be either an interior point or on a boundary (Frank and Goyal, 2007). Bradley, Jarrel and Kim (1984) created a formula based on the assumptions mentioned above. If the optimal solution is interior, the formula will calculate the highest market value of the firm.

$$V_Y = \frac{\partial V}{\partial \hat{Y}} = V_{\hat{Y}} = \frac{\left(1-t_{pb}\right)}{r_0}\left\{\left[1-F\left(\hat{Y}\right)\right]\left[1-\frac{\left(1-t_c\right)\left(1-t_{ps}\right)}{1-t_{pb}}\right]-\frac{\left(1-t_{ps}\right)t_c}{1-t_{pb}}\left[F\left(\hat{Y}+\phi/t_c\right)-F\left(\hat{Y}\right)\right]-k\hat{Y}f\left(\hat{Y}\right)\right\}$$

Equation 7: **Optimal value of a firm** (Bradley, Jarrel and Kim, 1984).

Optimal value of a firm, a description of terms used and some predictions Bradley, Jarrell and Kim (1984)		
Term	Description	If increase
φ	Total after-tax value of non-debt shields if they are fully utilized at the end-of-period.	Reduce optimal debt level.
F(.)	Cumulative probability density function.	
k	Cost of financial distress.	Reduce optimal debt level.
r_0	One plus the rate of return on default-free, tax-exempt bonds.	
t_c	Constant statutory marginal tax rate.	
t_{pb}	Progressive tax rate on return from bonds.	Reduce optimal debt level.
t_{ps}	Equity returns.	Increase optimal debt level.
V	Market value of the firm.	
$\hat{Y}$	Total end-of-period promised payment to bondholders.	

Table 5: **Description of terms used and main predictions in Equation 7**.

Equation 7 can be divided into three expressions; explaining marginal net tax benefit of debt, probability of wasting net debt tax shields and marginal increase in expected costs of distress (Frank and Goyal, 2007). Contrary to the Miller capital structure irrelevance model (Miller 1977), equation 7 assumes a personal tax on income from stocks and leverage-related costs.

3.2.1.3. Cost of financial distress

Bankruptcy costs are, together with moral hazard, monitoring- and contracting costs, a part of costs related to financial distress and can severely reduce the value of a firm. The literature discussing the cost of financial distress forms two statements about financing.

"Risky firms ought to borrow less, other things equal" (Myers, 1984, pp. 581). Risk is defined as the variance in market value of a firm's assets. The probability of default increases as the variance raises. Less risky firms should therefore be able to borrow more before the tax advantage of debt is offset by expected cost of financial distress.

"Firms holding tangible assets-in-place having active second-hand markets will borrow less than firms holding specialized, intangible assets or valuable growth opportunities" (Myers, 1984, pp. 581). In order to find the expected financial cost of distress, the probability of getting into financial difficulties must be combined with the value lost if the firm gets in trouble.

3.2.1.4. Discussion

Myers definition and explanation of the trade-off theory raise questions for discussion. Frank and Goyal (2007) argue that a target debt-to-value ratio is not directly observable. Further, the tax code is said to be more complex than assumed by Myers (1984) and bankruptcy cost must be a deadweight cost. In addition, transaction costs need to increase gradually and not abrupt (Leary and Roberts, 2005).

Equation 7 (Bradley, Jarrel and Kim, 1984) contains elements difficult to measure, which makes the use of proxies necessary. This can create problems when using the model and raise questions like whether the finding is a result of the proxy or the theory. In addition, the equation does not include retained earnings, since it is a one period model. In real life, firms tend to keep some of their earnings. Retained earnings can be defined as equity and is generated by all profitable firms (Frank and Goyal, 2007). Forming a theory means taking assumptions and make simplifications. Not including retained earnings as an individual factor is an example of this.

The static trade-off model gives only the option to use the optimal level of debt. This, together with assumptions mentioned above, has been important in the view of the trade-off theory since the 1980s.

3.2.2. Dynamic trade-off theory

"The dynamic models contain features that allow the trade-off theory to provide a better account of how firms finance their operations than had been previously thought" (Frank and Goyal, 2007, pp. 146). Unlike the static trade-off theory, a dynamic theory contains multiple periods. This makes it possible to include adjustment costs and expectations for the future. Dividend payments and raising funds exemplify actions that might take place in a future period. Whether they take place today or later, depend on expected development in the economy. This raise questions like when is it most profitable to pay dividend or raise money. A company's tax rate and rate of return must be compared to tax on dividend and rate of return required by the shareholders (Frank and Goyal, 2007). This suggests that profitable companies, with higher rate of return than its shareholders, should retain

more than a less profitable firm. When earnings are retained, equity increases and the leverage is expected to decrease.

According to Frank and Goyal (2007), Brennan and Schwartz (1984) and Kane, Marcus and McDonald (1984) created the first dynamic models discussing tax-savings versus bankruptcy cost trade-off. These models, containing uncertainty, taxes and bankruptcy cost, supported findings made by Miller (1977). He found that trade-off theory predicts higher debt levels than observed in many firms. Fischer, Heinkel and Zechner (1989) solve this problem by adding transaction costs to their model. Without transaction costs, *"firms could carry large amounts of debt and, by the appropriate repurchase strategy, capture large tax shields while keeping the debt essentially riskless"* (Fischer, Heinkel and Zechner, 1989, pp. 19). Costs related to recapitalisation make financial structures change over time, but prevent continuous changes. The optimal ratio is to be found in an interval and give quite similar firms the option to customize their debt level. There are two reasons for recapitalisation if the leverage ratio increases, avoiding bankruptcy costs and compensate for equityholders' limited liability (Fischer, Heinkel and Zechner, 1989). Equityholders cannot sell assets to make coupon payments, as investment decisions are fixed. The coupon payments therefore reduce the dividend paid to the equityholders (Fischer, Heinkel and Zechner, 1989).

Dynamic trade-off articles can be distinguished depending on the assumptions they use. The classic view assumes a firm's cash flow as exogenous and includes among others Modigliani and Miller (1958) and Fischer, Heinkel and Zechner (1989), while others assume a relation between financing and cash flow. Taxation is handled differently across articles; some exclude it while others assume taxation on corporate payouts.

When leverage ratio is optional to increase in the next period, dynamic trade-off theory suggests a reduction in today's optimal level of debt (Goldstein et al, 2001). However, a firm will in most situations not be able to reach an optimal debt ratio when transaction costs exists and financing is done periodically (Frank and Goyal, 2007).

Dynamic trade-off theory has some general views. The most important is probably the fact that today's optimal financial structure depends on expected optimal structure in the future (Frank and Goyal, 2007).

3.3. Pecking Order Theory

The pecking order theory was developed by Myers (1984) and defines a ranking of preferred capital. Myers define the theory as *"A firm is said to follow a pecking order if it prefers internal to external financing and debt to equity if it issues securities"* (Myers, 1984, pp. 576). Contrary to the trade-off theory, pecking order does not have a given debt-to-value ratio. When external financing is needed, the safest security is issued first. Straight debt is issued first, before securities as convertible bonds and in the end equity. Therefore, equity is to be found at the top of the list as retained earnings and as external equity at the bottom.

A survey (Myers, 1984) examining companies from 1973-1982 revealed that approximately 60% of capital expenditures were covered by internal capital. This includes cash needed for new investments. The remaining 40% were covered by external capital, primarily debt. Issuing equity did only count for a small part of external capital. The survey illustrates a combined use of both external and internal capital. Most firms have some internal funds, kept as cash and short-term investments. This form of internal capital is so common that, according to Frank and Goyal (2007), it is often excluded when the pecking order theory is tested.

3.3.1. Asymmetric information

Pecking order behaviour follows from simple asymmetric information models (Myers and Majluf (1984) and Myers (1984)). True value of a firm and growth opportunities are best known by the managers. External investors can only estimate the values. Therefore, asymmetric information reduces the market value of shares when issued, as the fear of buying a lemon exists (Akerlof, 1970). Akerlof (1970) uses the automobile market to illustrate how "bad" cars, called lemons, reduce the prices of all used cars and drive out the good ones. The value will increase as investors learn what

managers already know. In other words, managers will use equation 8 to decide whether or not to issue and invest. Companies with strong investment opportunities, but with high cost of financial distress tend to issue convertible bonds instead of equity. This give access to external finance without the lemon problem related to equity issuance (Rauh and Sufi, 2010).

$$\Delta N = N_1 - N$$

Equation 8: **The amount by which shares are over- or undervalued** (Myers, 1984).

N and N_1 represent true value and investor's expected value. ΔN tells whether a firm is over- or undervalued. It will always have a lower value for debt than equity when new shares or debt is underpriced (Myers, 1984). The benefits of an issue can be symbolized with y. Managers issue shares if $y \geq \Delta N$. From this, it is important to be aware that negative inside information always lead to issuing. When inside information is positive, managers might choose not to issue undervalued shares and miss out on investments with positive net present value (NPV). Still, Myers and Majluf (1984) think a firm is better off issuing equity when the alternative is to lose profitable projects. Undervalued shares would transfer value from existing shareholders to new investors. However, equity is never issued when the option to issue debt exists. An investment with positive NPV is always exploited if default-risk free debt can be issued and sometimes passed if only risky debt exists. From this, Myers and Majluf (1984, pp. 207) summarise with the rule *"better to issue safe securities than risky ones"* and the conclusion that a firm will always issue debt and never equity. The general rule is also to be found in Myers (1984).

Asymmetric information can be two-sided, and not only one-sided as assumed by Myers and Majluf (1984). Two-sided asymmetric information means both bidder and seller have private information about the value. This gives multiple equilibriums and the preference of shares or combining shares with cash, rather than just choosing cash (Eckbo, Giammarino and Heinkel, 1990).

One way to decrease asymmetry is to involve existing shareholders when issuing new equity, which sends a strong optimistic signal to new investors. ΔN is then reduced as the expected value increases towards the true value.

As a result, a firm only issues equity when overpriced and debt when underpriced. Knowing this, an investor will not buy shares before the optimal debt level is reached. This somehow extreme conclusion, put forward by Myers (1984), forces a firm to adapt to the pecking order theory.

3.3.2. Agency theory

Managers (agents) will not always do what is best for shareholders (principals) as assumed so far. An agency problem arises when agents start to act in their own interest and seek private benefits (Myers, 2002). Owners can reduce this incentive by monitoring and compensating managers. Perfect monitoring and compensation are costly and difficult to achieve. This is included in the definition made by Jensen and Meckling (1976). Here, agency cost is the sum of monitoring expenditures by the principal, bond expenditures by the agent and the residual loss.

Agency costs are created when external owners have to bear parts of the private benefits going to internal owners. Internal financing is therefore preferred to external financing and a pecking order is created. Issuing debt does not affect the distribution of these costs. If the debt ratio gets too high, managers can be forced by creditors to increase equity by an external issue. Debt is in other words preferred before outside equity, which strengthens the pecking order theory. When external equity is issued, Jensen and Meckling (1976) prefer private equity to equity from the stock markets, since they face lower cost of monitoring. Nevertheless, equity investors should not be allowed too much power. Many firms, especially growth firms, choose to go public in order to reduce this influence.

The pecking order, described by Jensen and Meckling (1976), is most suitable for small firms where control and ownership is highly related. Control of managers in large firms must therefore be substituted by compensation and incentives like options and ownership. Compensation with shares is not only affected by the value of assets in place, but also by growth opportunities (Myers, 2002).

3.3.3. Discussion

Pecking order contains some problems. According to the theory, managers work to maximize the value of existing shares (Myers, 2002). However, why they should care about the valuation when equity is issued and not just maximize the firm's value ignoring both new and old shareholders, are not discussed. Pecking order does not contain theory explaining why the consequences of managers' superior information do affect financial tactics.

How does the theory hold with more complex capital structures, e.g. when choosing between straight and convertible debt? This question is not answered in Myers and Majluf (1984) and the weakness is criticised by Myers (2002).

Choosing to follow the pecking order theory means reducing the debt ratio in years with surplus and increase it in years with deficit, making the debt ratio appear to be mean-reverting (Myers, 2002).

3.4. Empirical evidence of the trade-off and pecking order theory

Examples of the theories can be found when capital structure is studied. Nevertheless, they have proven difficult to distinguish when empirical analyses are performed (Myers, 2002). Firms with a majority of tangible assets, which are large and safe, tend to borrow more than those having high profitability and valuable growth opportunities (Myers, 2002). This statement is supported by both theories.

In 1984, Myers (1984) concluded it did not exist any empirical studies indicating that taxation had a clear effect on a firm's debt policy. MacKie-Mason (1990, referred to by Myers, 2002) proved later that firms with low marginal tax rates had a greater probability of issuing equity than those having a higher tax rate. Demonstrating the positive correlation between tax and debt makes the result consistent with the trade-off theory. However, the result does not prove that the interest tax shields have a major influence on a firm's market value or that the trade-off theory determines debt ratios (Myers, 2002).

The empirical evidences of the trade-off theory are, according to Myers (2002), not as strong as they might look. This is a result of the fact that statistical results supporting the trade-off theory also support other theories. In addition, many companies operating with low debt ratios have proven to be successful and profitable. The trade-off theory would predict such firms to have a high debt ratio, as success means increased taxable revenues.

While the trade-off theory implies a target-adjusted model, the pecking order assumes the debt ratio to depend on a firm's cumulative financial deficit. A test of time-series performed by Shyam-Sunder and Myers (1999, referred to by Myers, 2002), found evidence supporting both theories. They calculated the exact annual debt ratios assuming firms to follow the pecking order exactly. Comparing these ratios with the target-adjusted model proved that the trade-off theory was constant with financial decisions based on the pecking order. Shyam-Sunder and Myers (1999, referred to by Myers, 2002) also ran a reversed test, assuming debt ratios are gradually adjusted toward the fixed ratios. This gave pecking order statistical power compared to the trade-off theory, i.e. pecking order theory had the best explanation of the financial behavior in the test. Frank and Goyal (2001, referred to by Myers, 2002) used the same time-series specification on a larger sample, and proved that financial behavior is more complicated than predicted by the pecking order. The theory does best explain large companies with moderate leverage (Frank and Goyal, 2001, referred to by Myers, 2002). Barclay and Smith (2005) support these findings and state that the pecking order cannot fully explain the financial policy choices.

Fama and French (2002) tested the dividend and leverage predictions in both theories. The predictions shared by the theories, are tested and mostly confirmed. They located disagreements between the trade-off theory and pecking order on two important issues. In addition, there is a third issue creating difficulties for the pecking order. The first issue is the relation between profitability and leverage. Fama and French (2002) support the pecking order theory, which predicts a negative relation between profitability and leverage. The trade-off theory assumes a positive correlation between the two variables, making this an "*important failure of the trade-off model*" (Fama and French, 2002, pp. 29). Leverage targets are used by the trade-off theory

and the leverage moves towards it. The pecking order does not use target ratios and the leverage in the model is therefore not mean-reverting. Fama and French (2002) find empirical evidence that the leverage is mean-reverting in their regressions, but the rates are weak. This made it impossible to draw a conclusion on the second issue. The third issue, which creates huge problems for the pecking order, is the large equity issues done by small-leveraged growth firms (Fama and French, 2002). They conclude that their article "*cannot tell whether the results are due to trade-off forces or pecking order forces or indeed other factors overlooked by both*" (Fama and French, 2002, pp. 30).

The key to reconcile the different theories is an increase in the understanding of "*stocks and flows*" (Barclay and Smith, 2005, pp. 16). Stocks are used to describe the level of debt and equity related to the target, while flows are used to define the decisions related to the issuing of different securities (Barclay and Smith, 2005). Further, they argue that the pecking order model is an information-based theory with focus on the flows, i.e. the cost of using debt or equity. The pecking order alone cannot offer a reliable guidance to the optimal capital structure, as both stocks and flows influence the choice between debt and equity (Barclay and Smith, 2005).

In order to create a sensible capital structure, costs related to deviating from the target capital structure and adjusting towards it must be understood (Barclay and Smith, 2005).

3.5. Taxation

When performing studies of capital structure, tax is often ignored in order to simplify the research. However, taxation does affect a firm and shareholders. Throughout the years, different hypotheses about tax effects have existed. Fama and French (1998) present some theories. These hypotheses have been rewritten as new research has proven the previous wrong or imperfect. Higher dividend payouts where assumed to give lower stock prices since dividends had a higher tax rate than capital gains (Brennan, 1970). Miller and Scholes (1978) found that tax on dividend could be

avoided if retirement plans or offsetting deduction of personal interest payments were used to invest in stocks. They later came with a new model (Miller and Scholes, 1982) saying *"firm value is unaffected by dividend policy because pricing is dominated by investors subject to symmetric taxation of dividends and capital gains"* (Fama and French, 1998, pp. 828).

According to (Fama and French, 1998), there is little convincing evidence on how the pricing of dividends and debt are affected by taxes. Pricing of dividend can give a negative tax effect. This predicts a positive relation between expected stock return and the percentage of expected stock return received as dividend (Fama and French, 1998). It is common to use a dividend-price ratio as proxy for the effect. However, the result from this test depends on how the dividend-price ratio is measured.

Fama and French (1998) use a cross-sectional regression model of firm value on earnings, investment and financing variables to measure how taxation of dividend and debt affects the firm value. Should the regression be able to capture and isolate the tax effect of debt, all information related to profitability has to be captured by the earnings, dividend and investment variables. If not, the debt slopes from the model would be a mix of agency, asymmetric-information, bankruptcy, proxy and tax effects. The debt slope measures the sensitivity of firm value to the level of debt.

3.6. Debt

A multi-tiered capital structure consists of both secured debt and subordinated debt. The secured debt is often bank debt with tighter covenants than the subordinated debt. Rauh and Sufi (2010) classify debt into categories, described in table 6.

Classification of debt Rauh and Sufi (2010)	
Category	Consist of
Bank debt	Revolving bank debt and term bank debt.
Bonds	Public debt issues, industrial revenue bonds, Rule 144A private placements.
Private placements	Non-Rule 144A private placed debt issues.
Mortgage/equipment debt	Mortgage bonds, -loans, equipment trust certificates and other equipment based debt.
Convertible debt	
Other debt	Capitalized leases, unclassified debt.

Table 6: **Classification of debt**[5] (Rauh and Sufi, 2010). The table divides debt into different categories.

Debt can be secured, unsecured or subordinated. This describes the priority of the different tiers. Debt is secured if it has collateral in any of the firm's assets, is a mortgage bond or an equipment loan.

Low credit rated companies spread the priority of their capital structure, which means using multiple tiers of debt divided into secured, unsecured and subordinated issues. Higher rating reduces the number of tiers to unsecured debt and equity. The credit rating influences the use of tiers, as the rating level determines the access to liquidity. A speculative credit rating will limit the access to different types of credit. Firms in this category must rely on debt issued by banks.

This illustrates the fact that firms simultaneously use different types of debt. They often change the composition of their capital structure, even though total debt is constant. The level of debt used depends on whether the firm has a high market-to-book value or high asset tangibility. E.g. a regression analysis performed by Rauh and Sufi (2010) shows that firms with high market-to-book value tend to use less debt than those with high asset tangibility. This result has a high level of heterogeneity, which is an important factor of the pecking order theory. It can be found when debt is categorized and individual correlations are calculated. While convertible bonds and non-rule 144A private placements contribute to a negative correlation, bank debt gives a weak positive correlation between profitability and leverage (Rauh and Sufi, 2010).

[5] Rule 144 regulates public resale of restricted and control securities (SEC). Rule 144A regulates private resale of securities to institutions (University of Cincinnati).

3.7. Leasing

Leasing can be defined as selling the rights to use an asset for a given period of time, without the transfer of ownership (Grenadier, 1996). It can be looked upon as a substitute to debt. This is suggested by prevailing theories within finance and economics (Ang and Peterson, 1984). Ang and Peterson (1984) define the debt-to-lease displacement ratio, α, as shown by equation 9.

$$DR_{NL} = DR_L + \alpha LR_L$$

Equation 9: **The debt-to-lease displacement ratio** (Ang and Peterson, 1984).

The debt ratio to a firm that does not lease is defined as DR_{NL}, while DR_L is the debt ratio to a firm that leases. LR_L is then the leasing ratio to the latter. α must have a value which makes the aggregate debt levels of the two firms identical, as leasing and debt is defined as substitutes. Different theories propose three values of α: equal to 1, between 0 and 1 and larger than 1 (Ang and Peterson, 1984). These alternatives suggest that debt and leasing is perfect substitutes, leasing generate risk not inherent in debt contracts and the debt displacement by leases is greater than one to one. Debt capacity is, for all alternatives, expected to decrease when leasing is used (Ang and Peterson, 1984). An empirical study performed by Ang and Peterson (1984) reveals that firms with leasing had higher debt ratios[6] than those who did not use leasing. Further analysis found a positive relation between debt and leases, while the relation between the operating leverage and leases was negative. In other words, Ang and Peterson (1984) could not find a trade-off between debt and leasing. Instead they find a complementary relationship, which was the opposite of prevailing theories.

Smith and Wakeman (1985) prove that the coexistence of leased and purchased assets is uniformly neither positive nor negative. However, this result might vary between industries, as the benefits from leasing fluctuate (Smith and Wakeman, 1985). The majority of leasing theories keep cash flow from both leasing and owning constant and focus on the tax benefits. Smith and Wakeman (1985) found eight nontax incentives to lease an asset, given by table 7. These, together with other findings in

[6] Ang and Peterson (1984) calculated the debt ratios as debt divided by book value of equity, market value of equity and total assets for both leasing firms and non-leasing firms.

their article, help explaining Ang and Peterson (1984). In addition, investment opportunities providing high debt capacity tend to make leasing more profitable (Smith and Wakeman, 1985).

Eight nontax incentives to lease an asset	
Smith and Wakeman (1985)	
1	Lease if the value is less sensitive to use and maintenance decisions.
2	Lease if the asset is not specialized to the firm.
3	Lease if the expected period of use is short relative to the useful life of the asset.
4	Lease if corporate bond contracts contain specific financial policy covenants.
5	Lease if management compensation contracts contain provisions specifying payoffs as a function of the return on invested capital.
6	Lease if the firm is closely held so that risk reduction is important.
7	Lease if the lessor has market power.
8	Lease if the lessor has a comparative advantage in asset disposal.

Table 7: **Eight nontax incentives to lease an asset** (Smith and Wakeman, 1985).

4. Relating capital structure theory to shipping

Financing has changed during the last centuries and decades. Earlier, trading companies owned vessels to carry their cargo. This is a contrast to today's market, where most ships are owned and traded in the spot and time charter market.

In general, shipping companies can find financing from four sources, the shipbuilder, financial institutions, commercial banks and the security market (James, 1929). It is most common to use one of the three last alternatives or a combination of two or more of them.

Managing capital structure is a trade-off between financial flexibility and fiscal discipline, i.e. a balancing act (Goedhart, Koller and Rehm, 2006). From this point of view, assuming a normal debt level, the trade-off is more important than tax benefits. The capital structures used by shipping companies vary. Some, like Nordic American Tanker Shipping[7], prefer to rely on internal funds and the issue of equity. Others use the wide range of different funding alternatives. The choice of using internal capital is probably related to the high volatility in the freight rates and thereby the revenues. At the same time as internal capital is preferred, keeping up with the competitors and finance investments requires a substantial level of capital. In addition, investments are often done long before the vessels starts to generate revenues and the use of debt might be the only way to acquire the capital required. This might be one of the reasons why shipping companies traditionally have been looked upon as high leveraged companies.

A volatile and capital-intensive industry depends not only on internal but also external capital. Investors often have difficulties getting the same information as the management about a company before they invest. The use of debt, combined with uncertainty, increases the probability of financial distress and thereby the investors fear of investing in a lemon (Akerlof, 1970). I.e. the pecking order can be found among shipping companies.

[7] They do however have a USD 500 million Credit Facility (http://www.nat.bm/).

Shipping companies' tend to pay little tax, since they are either registered in tax havens or got adjusted tax regulation like the Norwegian tax regulation of shipping companies, which was a part of the national budget in 2008 (Norwegian Ministry of Finance). Taxation in shipping can be divided into three categories (PWC, 2009):

- Tonnage tax regimes
- Shipping incentives regimes
- Tax efficient regimes

Tonnage tax regimes base their taxation of ship-owners on the tonnage of vessel registered, and not the income they generate. Examples of countries using this type of taxation are Cyprus, Malta, Norway, the United Kingdom and the United States. Norway started offering this in 2008, as it reregulated the taxation for the Norwegian International Ship Register (NIS).

Shipping incentives regimes are countries offering tax provisions aimed at shipping companies. Examples are Hong Kong, Liberia, Marshall Islands, Panama and Singapore. These countries decrease the tax burden by reducing the tax base or the tax rate.

Tax efficient regimes are countries with no special treatment of shipping companies. However, they attract vessels by offering a low efficient tax rate. Many of the islands located in the Caribbean have this type of taxation.

The many different registry flags, combined with complex corporate structures, gives the opportunity to switch towards more favourable taxation policies. With low or no taxation, one of the debt arguments presented in the trade-off theory disappears since tax shields no longer can be used. Without the tax shield, debt only creates costs related to financial distress.

5. The different types of funding in shipping

Finance in shipping plays a major role in the maritime economics. According to Cullinane (2005) the role is higher than what is found in other transportation sectors.

5.1. Equity

Equity has always been the most important way of financing new investments. During the twentieth century, the level of equity needed decreased as new types of freight contracts were created and ownership changed from private family owned to public companies registered on stock exchanges. However, family ownership is still an important way of financing in traditional shipping locations like Greece, Norway and Hong Kong (Stopford, 2009)

Nevertheless, equity is still essential, as the level of equity decide the level of leverage a company can get. It is also the capital representing the owners. Today, with many publicly owned shipping companies, owners can be banks, funds or private investors.

Equity is, as written earlier, located in both ends of the capital structure. In the case of bankruptcy, equity investors are the last to get their money back as equity has very low priority.

5.2. Debt

There are many types of debt, but the most commonly used is bank debt. It can be divided into long and short term, depending on the maturity. This is probably the most secure debt among a company's liabilities as banks demand access to financial information before and after lending money, in addition to collateral. The level of debt in shipping companies varies, depending on the investment strategies and market

situation. However, these companies are ideal for the use of debt, with vessels qualifying as long-term assets and thereby collateral. Nordic American Tanker Shipping is an example of a company relying on equity and use only small fractions of debt.

Shipping often requires significant investments. When lending to shipping companies, banks often form loan syndicates to diversify risk and reduce exposure to one borrower. A loan syndicate consists of several banks. Besides diversifying risk, syndicates give less experienced banks an opportunity to get involved without having detailed knowledge since one bank is responsible and leads the syndicate. The leading bank is responsible for the relationship with the borrower and gathering the required amount of capital, in other word acting as an agent. It normally charges a fee for this work. If the syndicate is large, a management group might be established to handle issues without having to contact all participants every time a problem arises (Stopford, 2009).

Syndicates do often get problems when the borrower gets financial difficulties and the participants have different experience with shipping. A bank without the understanding might not handle the cycles the same way as those with knowledge. Therefore, banks offering joint financing are preferred to a diversified syndicate.

5.3. Bonds

Capital can also be raised in the bond market. Bonds are interest-bearing securities with more than one-year maturity. In the shipping industry, most bonds are issued with a five-year maturity (Liang, Liu, Lin and Yeh, 2006).

The companies are responsible for issuing bonds and the level of security is decided by the bond ratings. Moody's and Standard & Poor's (S&P) are two of the world's larges rating agencies. Interest rate paid on a bond depend on the rating, e.g. a bond rated AAA by S&P is more secure and pay less interest than a bond rated BB.

When issuing bonds, an indenture is made between issuer and the buyer. The purpose is to protect the bondholder and it contains property pledges, protective covenants and working capital requirements.

Evaluation of the risk related to bonds is important for both investors and managers, as shipping is capital intensive with high debt ratios. Bond ratings are also affected by revenues and thereby the significant volatility in freight rates. Oil prices and exchange rates are other variables influencing the financial stability.

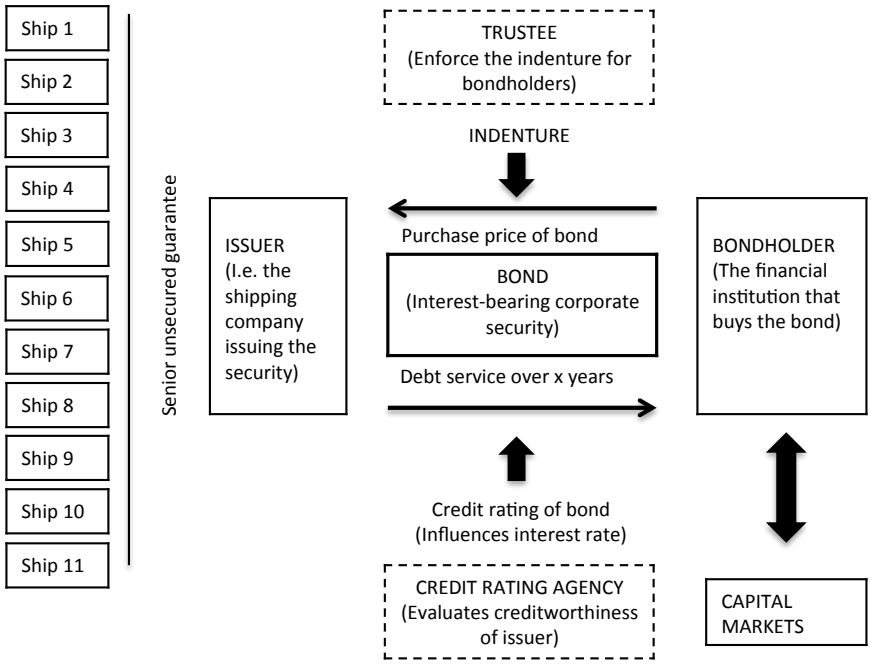


Figure 2: **Basic structure of shipping bond issue** (Stopford, 2009).

5.3.1.Convertible bonds

A convertible bond is a bond issued as debt with the right to convert to shares before or at a certain date. The owner of a bond decides whether or not to take advantage of the conversion right. This makes, in many situations, convertible bonds more attractive to investors than straight bonds.

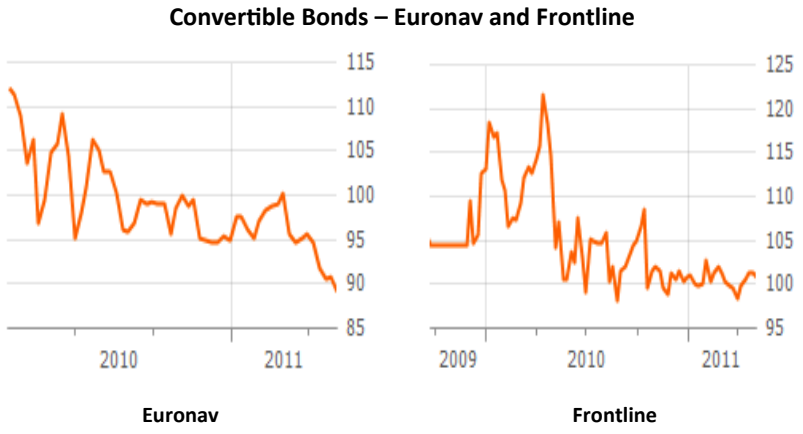
Convertible debt is often subordinated to other debt, and carries a lower coupon rate (Brennan and Schwartz, 1980). The lower rate can be explained by the conversion opportunity, which often is a significant part of the bond value.

Shipping companies frequently uses this type of bond. Table 8 illustrates the convertible bonds currently held by Euronav and Frontline.

Convertible bonds		
	Euronav	Frontline
Issued amount (in million)	USD 150	USD 225
Date of issue	September 24, 2009	April 14, 2010
Maturity	January 31, 2015	April 14, 2015
Coupon	6,5%	4,5%
Issue price	100%	100%
Conversion premium	0.25	
Initial conversion price	EUR 16.2838	USD 36.5567
Stock exchange	Luxemburg	Not listed

Table 8: **Convertible bonds** (http://www.frontline.bm and http://www.euronav.com).

Graph 6 shows the development in the value of these convertible bonds from the date of issue until beginning of May 2011.



Graph 6: **Development in value of convertible bonds in per cent of value at issuing date** (Datastream).

5.3.2. Junk bonds

Junk bonds are also called high yield and speculative bonds, and are bonds with credit rating BB (S&P) or lower. The low rating is a result of a high risk of default and gives the bond an interest rate above those with better rating. High yield bonds

experienced a boom in the 1980s, even though they have been around for a long time (Gilson and Warner, 1997). The issuers of such bonds tend to have high debt ratios, often as high as 90% or 95%, which gives a high rate of defaults (Brealey, Myers and Allen, 2008).

Firms with high growth can use junk bonds together with, or as an alternative to bank debt (Gilson and Warner, 1997). Historically, high yield bonds are issued in order to pay back bank debt. Gilson and Warner (1997) found that most bank debt is not straight debt, but revolving credit agreements[8]. Compared to bank debt, junk bonds have fewer covenants attached and are less secure. In addition, maturity on high yield bonds is often longer than on bank debt. Both revolving debt and junk bonds give flexibility, but in different ways (Gilson and Warner, 1997). Therefore, the optimal mix of debt will follow a company's financial needs. Junk bonds are often issued when revenues decline and bank debt must be repaid, as mentioned above.

The owners of bonds have a huge influence on the company. In fact, they have the power to take over the control. Michael Milken, one of the most important and dominant bond traders in the 1980s pointed this out by declaring: "*if you miss one payment, we'll take the company away*"(Lewis, 2006, pp. 256).

Most of the shipping companies get the junk bond grade on their bonds due to the high volatility in the freight market (Stopford 2009).

After the financial crisis in 2008, the central banks have pushed down the LIBOR interest rate. However, this reduction in cost has not been passed on from banks to their costumers (Kaminska, 2009). This is especially the case in the shipping industry and it had in late 2009 to pay a premium above LIBOR, which was higher than during the peak of the financial crisis (Kaminska, 2009). This creates difficulties for an industry already struggling to get credit. Covenants like loan-to-value tests reinforce the problem, as the entire business battle with reduced revenues and depreciating assets.

[8] The borrower has the option to obtain additional funds as long as predetermined financial benchmarks are met (Gilson and Warner, 1997).

Issuing equity as an initial public offering (IPO) or secondary public offering (SPO) will dilute existing owners and is not a preferred option to access new capital in an industry with a high level of family owned companies. Instead Kaminska (2009) refers to ICAP[9], which predict an increase in shipping companies using non-bank finance to refinance and repay debt.

5.4. Mezzanine financing

Mezzanine financing is high yield debt often attached with an equity kicker like equity warrants (Stopford, 2009). The equity warrant gives the opportunity to convert from debt to preference shares or common shares at a certain time and is therefore an equity-based European option. As high yield debt, the interest rate following mezzanine financing is normally considerably higher than LIBOR. The preferred shares include payments as a fixed annual dividend, a percentage of the cash flow after interest and the repayment of the principal.

The difficulties related to defining mezzanine financing and its complexity makes it a financial instrument not often used in the shipping industry.

5.5. Leasing

Many shipping companies use leasing to finance their assets. Leasing can either be financial (capital) or operating. Financial leases are shown on the balance sheet, while operating leases generally do not appear. One reason is the length of the lease. Assets are leased for a longer time period when classified as financial lease compared to operating lease, and is therefore more suitable for defining the lease of vessels. However, the use of operational lease does occur.

[9] ICAP is a large voice and electronic interdealer broker and provider of post trade risk and information services. It is active in the wholesale markets in interest rates, credit, commodities, foreign exchange, emerging markets, equities and equity derivatives (ICAP).

Leasing includes risk related to revenues, operations and the residual value. The legal owner, named lessor, is left with most of the risk in an operating lease. With the use of financial lease, which is common in shipping, the company leasing an asset (lessee) is responsible for the operation. The leasing alternative gives, in many countries, tax benefits to the lessor. Companies with high profit, but without suitable investment opportunities within their own industry, can invest in a vessel. They will then receive both the tax relief from purchasing a vessel and income from leasing it to a ship-owner.

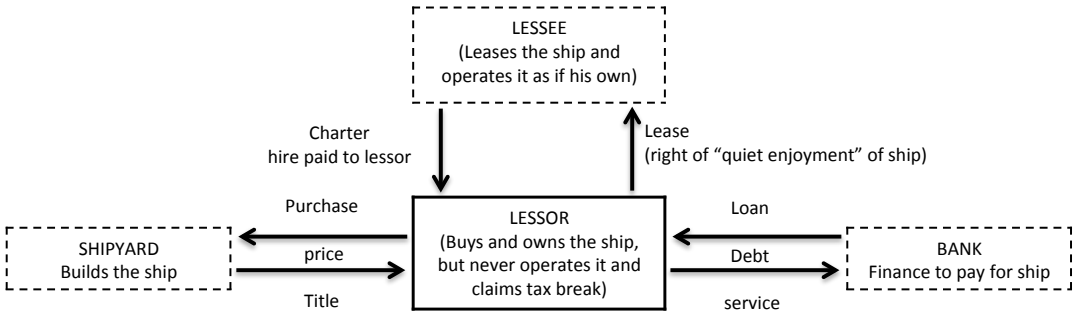


Figure 3: **Typical lease finance model** (Stopford, 2009). The figure illustrates the relations between the lessee, lessor, shipyard and the bank in a leasing process.

There are several advantages with leasing. Ship-owners are provided with longer maturity (15-25 years) than received from commercial banks (Stopford, 2009) and the cost of capital is reduced to tax benefits. The extent of the tax benefits is included in the charter back agreement. Leasing also includes some drawbacks. Often, the lessor has little or no interest in the vessel except as an investment and has to rely on the lessee fulfilling the leasing agreement. In addition, the leasing contract is often a long-term transaction, making it sometimes more complicated to lease rather than own the vessel.

6. What affects the choice of funding?

The most efficient way of funding a company or an investment depends on multiple factors. I.e. funding is about raising and manage disposable capital, based on a business strategy and the financial situation. Actions like expansion, reinvestment, speculation and defending a market position might require different types of capital. In general, funding is divided into two main categories, debt and equity. Both include sub categories, and it exist many different hybrids. The many alternatives make it interesting to look at some factors affecting the choice.

6.1. Asset play

The shipping industry moves, as written earlier, in cycles. The high level of homogeneity and competition in the industry influence the value and thereby the price of the vessels. E.g. the value of a vessel can be reduced due to a downturn in the market, keeping the quality constant. Many owners attempt to take advantage of this when it comes to buying and selling. Investments in new vessels, either in the new-building- or second-hand market, are done when the price and value of vessels are looked upon as low. When the market recovers, these investments are sold. This speculation in the buying and selling of assets is called asset play and is an opposite to the long term industrial investor (Birkeland d.y. and Eide, 2000). Asset play focuses on timing the business transactions, and has less focus on the profit from operations compared to a long-term investment.

To be able to buy and sell when the market is at the bottom and at top, some expectations about capital structure exists. With a too high level of debt, a market decline creates difficulties to access new capital and invest right before a recovery is expected to take place. In addition, conventional sources of capital often have no or little interest of being exposed to shipping during these cyclic downturns. In the middle of the 1980s, the shipping market was at the bottom of a cycle. To get access

to capital, new and untraditional methods were used, like constructing self-liquidating ship funds (Stopford, 2009). The first was established in 1984 and gave a return equal to four times the investment. Similar funds were created and as the market recovered more capital was invested. Increased activity gave higher prices and lower profits as the cycle moved towards a peak.

Asset playing is, according to Goulielmos (2009), safer than operating in the freight market. Goulielmos (2009) estimates the ratio to be three to one, as the profit from one good sale is equal to the profit from three years of operating a vessel.

6.2. Owning or leasing

Whether to own or lease is often a case when it comes to investments in shipping. Owning means the company must have large amount of capital available to buy, in addition to be responsible for the cost of maintenance and operation. Leasing, either as bareboat or time charter gives the opportunity to dispose a vessel without purchasing it. A lessee also avoids tying up capital in assets. The eight nontax incentives to lease an asset found by Smith and Wakeman (1985) can be used in the shipping market. Vessels, i.e. the assets, are for example not specialized to individual firms and the expected period of use might be less than the assets lifetime. The ideal period to use a vessel is relative short when market cycles last approximately eight years (Stopford, 2009) and the lifetime of vessels can be somewhere between 25 and 30 years.

Choosing between the two alternatives might also be affected by the company's market view and strategy. An example is Frontline, which leases a vast majority of its vessels from Shipfinance on time charter basis. This gives Frontline fixed operational costs. In return, Shipfinance receives a fixed return and tax benefits from the leasing. Knightsbridge Tankers is another example of a company choosing to lease. They did not own any vessels between 2000 and 2004. Others, like Nordic American Tanker Shipping and Euroseas, own all their vessels. Owning vessels, often with a long expected lifetime, makes it possible to increase the level of debt. Companies can

therefore be tempted to increase the level by using existing and acquired vessels as collateral. Ship-owners who operate their assets in the time charter- or bare boat market secure their income, and thereby reduce some of the uncertainty and volatility well known in the industry.

6.3. Market conditions

The market cycles affects the choice of funding. Capital theory suggests the use of equity in good times when companies are overvalued and debt in depressions when values are underestimated. Difficult times have historically also been the source of new financial alternatives, like self-liquidating ship funds.

Market conditions are influenced by variables like the oil prices, interest rates and the supply and demand in the world economy. High activity in the world economy increases the demand for transportation of goods, and freight rates raise. The revenues raise as the activity and thereby the freight rates pick up, which makes it easier to access new capital. In the end, the situation overheats as high activity results in the construction and entering of too many new vessels. The participants, in their eager to increase profits, create this downturn. This illustrates how the market cycles, described by Stopford (2009) can be formed.

6.4. Newbuilding market and second-hand market

It has historically been a close correlation between the peaks in the freight rates and the peaks in the ordering of new vessels (Stopford, 2009). As market conditions improve, the demand for vessels increases. This raise the question whether to build a new vessel or buy one that already exists. Both prices raise and fall depending on the demand. E.g. in difficult times, the price of a second-hand vessel can be close to the scrapping price. It will increase as the market recovers. This also affects the price on newbuilding, as the growth makes the two alternatives more comparable. However, it

is important to notice that a newbuilding will not arrive in the market immediately as there is a time lag between ordering and delivery. A lag means that today's freight rates only partial influence the price of a new vessel. The other important factor is the prices in the second-hand market. These prices are not based on the historical costs of building vessels, but on the opportunity to earn a profit today (Goulielmos, 1974, PhD thesis, referred to by Goulielmos, 2009). The lag creates a risk of investing in an upturn with delivery after the market has started to go down. A five-year old vessel is, according to Stopford (2009), valuated by the Sales and Purchase market[10] four to six times its annual income when the freight rate for a one-year time charter is high.

Goulielmos (2009), states that Greek ship-owners historically have preferred to purchase second-hand vessels. Buying a vessel in one or the other market indicate a certain market view. I.e. a company will not order a vessel if it believes delivery will be in a market downturn. On the other side, investing in a new vessel is most likely an investment in an asset with longer maturity.

A newbuilding does not normally require the entire investment paid up front, as often required in the second-hand market. The settlement of a newbuilding is normally divided into five equal payments; the first paid when the contract is signed and the last when the vessel is delivered. A vessel bought in the second hand market is often financed by two payments. 10% of the value is paid when the contract is signed and the remaining 90% when it is delivered (Fearnleys).

6.5. Risk

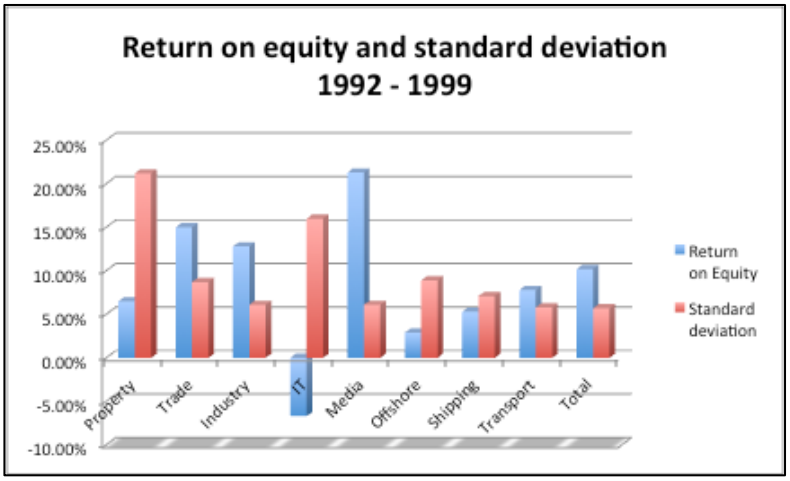
Operating in the shipping industry involves a certain level of risk, as the industry is known for its volatility. This affects the funding, as participants seldom get a high credit rating from the credit agencies. It would be expected that, given the level of uncertainty, shipping companies had chosen ways of funding with the purpose of reducing the risk. Instead, the industry is known for the willingness to take risk and

[10] The Sale and Purchase market is the name of the market in which the second-hand vessels are bought and sold.

thinking "*this time it is different*". The result is the well-known market cycles, repeating again and again, often triggered by the same problems. However, developing a countercyclical capital structure gives the ability to invest in downturns and thereby increase earnings compared to competitors (Goedhart, Koller and Rehm, 2006).

Problems related to how the companies are financed can be defined as internal factors, since the management can affect the structure and thereby the risk. External factors like economical and political stability creates risk not possible to control. Unstable political situations, like the conflicts in the Middle East during the 1970s, tend to increase the demand for tonnage. The closing of the Suez Canal forced all vessels going between east and west to proceed around Africa, a voyage taking significantly more time. This created the large increase in the world seaborne trade measured in tonne miles, shown above in graph 1. Financial downturns make it difficult to finance companies, as it gets more severe to borrow and raise capital.

The fluctuations create a low average return gained at a high level of risk. Many have tried to succeed, but not everyone has managed to make a fortune like John Fredriksen. This diversified outcome is known as the shipping return paradox (Stopford, 2009). Graph 7 compares the return of equity between 1992 and 1999 for shipping companies registered at Oslo Stock Exchange with other business segments (Birkeland d.y. and Eide, 2000). The average rate of return of the eight sectors is 8.11%, which means shipping has a return below both the average and the total market. Further, the standard deviation frequency in the shipping sector is low compared to some of the other sectors. This is related to the low rate of return in the shipping segment.



Graph 7: **Return on equity and standard deviation between 1992 and 1999** (Birkeland d.y. and Eide, 2000). The graph is a comparison of different business sectors at Oslo Stock Exchange.

7. Financial- and market data

During the history, financing has been done differently. New ways have been created as the competition and market conditions have changed. This master thesis examines both dry bulk companies and tanker companies in order to find out how the financing has changed during the last ten years. In addition, freight rates, interest rate for 10-year US treasury securities and oil prices are studied.

7.1. Time frame

The thesis uses data from year 2000 until 2010. This time frame gave the opportunity to observe both a raise and decline in the shipping market, as well as the world economy, since it includes the financial crisis.

7.2. Company data

In this thesis, I have studied 11 dry bulk companies and 13 tanker companies. These operate in different markets, but are at the same time quite similar. This provided the opportunity to compare the two samples. The company data is collected from both annual reports and Datastream. Annual reports have, among other things, been used to do random checks and to control the data. They were retrieved from both NYSE Euronext and the companies' webpages.

7.2.1. Beta

Datastream was used to collect the annual historical beta for each of the 24 companies. Beta measures the volatility of a company compared to the market volatility and is a commonly used benchmark. This makes it possible to study how the volatilities change as freight rates fluctuates.

7.3. Crude oil prices

Weekly and annual spot prices for both Brent- and WTI crude oil have been studied. In the analysis, only one has been used, since they had a correlation coefficient equal to 0.9971. This coefficient is based on the weekly spot prices. Brent has been chosen as the reference, as it is used to price approximately two-thirds of the crude oil traded internationally (Neste Oil). Spot prices were found at the U.S. Energy Information Administration webpage. Fluctuations in the crude oil price are important, as crude oil is the main cargo carried by the tanker fleet and probably the most important input factor when operating a vessel.

7.4. Financial market

To compare the shipping industry with the financial market, a representative index has to be selected. The companies studied are mainly traded on NASDAQ, NYSE and OSE. Oslo Shipping Index (OSLSHX), an index consisting of 24 companies operating in the shipping sector, is chosen to represent the development in the market. The index values are retrieved from Oslo Stock Exchange.

7.5. Freight rates

The freight rate dataset contains 12 different dry bulk voyages and 16 different tanker voyages (Appendix D). Dry bulk freight rates are stated as USD/day and USD/ton, while tank freight rates are given in WS. The rates are based on the Fearnleys Weekly report. Annual freight rates are set to be the last reported weekly rate each year.

7.6. Interest rate

The weekly reported yield on 10-year US treasury securities quoted on investment basis, have been used as a benchmark to compare interest rates with changes in the freight rates and share prices. This interest rate was retrieved from the U.S. Federal Reserve.

8. Analysing the data

The collection and processing of the data, combined with the study of capital structure theory, formed some expectations. Among other things, it would be natural to assume that the volatile shipping industry would have a risk adverse capital structure.

8.1. Hypotheses

The first three hypotheses are based on the capital structure theory and other theory presented in this master thesis, while the remaining hypotheses are based on personal expectations about the shipping industry.

Hypothesis 1:
Rauh and Sufi (2010) shows that firms with high market-to-book value tend to use less debt than those with high asset tangibility. Can this be found in shipping?

Hypothesis 2:
Can the shipping market explain the debt-equity ratio? This ratio is predicted to change as the freight rates fluctuate. The level of equity is expected to increase when the market raise and revenues increase, as companies prefer to use internal capital (Myers, 1984). In other words, the debt-equity ratio and the freight rates should be substitutes when a company follow the pecking order. Assuming this capital structure, the debt-equity ratio and stock price should be substitutes.

Hypothesis 3:
The use of financial leases will decrease and owning will increase as the market moves towards a peak. Leasing and debt will, as found by Ang and Peterson (1984), be complementary.

Hypothesis 4:
Historical beta can be explained by fluctuations in the shipping market, as a firm's volatility depends on the volatility of the market it operates in.

Hypothesis 5:

Freight rates influence the fluctuations in the companies' stock prices and thereby affect the financial market, i.e. the OSLSHX.

Hypothesis 6:

Interest rate, given as the yield on 10 year US treasury securities, affects the freight rates negatively and thereby the stock prices. This creates an expectation to find higher freight rates when the world economy performs well and the interest rate is low.

Hypothesis 7:

Return on equity and the return on invested capital are affected by beta, the debt-equity ratio and freight rates. The return will increase as the freight markets improve.

Hypothesis 8:

Freight rates in the tanker segment affects freight rates in the dry bulk market, and the other way around. The tanker market can be divided into crude oil and refined products, as written in chapter 2.4.1. As the tanker and dry bulk segments are expected to influence each other, the crude oil- and refined products segments will do the same.

Hypothesis 9:

Brent crude oil spot price is expected to affect the freight rates, the return on equity, the return on invested capital and the stock price.

8.2. Statistical methods

In order to test the hypotheses stated above, two types of statistical methods were used.

8.2.1. Correlation

The simple regression method was first chosen to analyse the data. Equation 10 calculates the correlation coefficients. They are used to describe the linear relation between the different types of data collected.

$$Correl(x,y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2 \sum(y-\bar{y})^2}}$$

Equation 10: **The correlation formula**.

8.2.2. Regression

Simple correlation is not a strong empirical analysis. Therefore, multiple regression models were generated to perform more significant testing. Equation 11 illustrates the general multiple regression formula, where y is the dependent variable, x is the independent variables[11], β the coefficients, k the number of independent variables and ε the error variable. This thesis uses dummy variables in the multiple regressions. A dummy variable makes it possible to narrow down the amount of equations needed. Minitab, a statistical computer software, was used to create the models. The program determines which of the input variables to use and removes those with a too high correlation.

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k + \varepsilon$$

Equation 11: **The multiple regression equation** (Keller, 2005).

When the regression models are created, the P-values are used to determine whether or not to accept the equations and each variable. A P-value less than 0.05 indicates a significant relationship between the independent variable and the regression model.

[11] An independent variable is a variable use to explain the variable to be forecasted.

The coefficient of determination (R-Sq) measures the strength of the linear relationship in a regression model. It indicates the percentage of variation in y possible to explain by the independent variables. The F-value measures the level of variation in y explained by the regression model. I.e. a large F value means most of the variation is described by the equation.

A regression model can be valid and fit, even though none of the independent variables are significant. This can be explained by performing individual t-tests of the coefficients of correlation between the dependent variable and the independent variables. The individual variables correlate with each other and are linear related to y. Collinearity in a multiple regression affects the t-test and makes none of the independent variables linearly related to the dependent variable (Keller, 2005).

9. Results

Analysing financial and market related data from the past 10 years, gave some interesting observations. Dividing the data into dry bulk- and tank, made it possible to compare both companies and segments. The results will be presented first as a summary of the nine hypotheses, before they are divided into the eight variables used.

9.1. Summary of the results

The results from studying the dry bulk and tanker companies are located in table 9. During the analysis, it proved difficult to find the same solutions for all the companies in each hypothesis.

Summary of the results	
Hypothesis	Result
1	Tendency found among companies.
2	Weak tendecy found among companies.
3	Weak tendency found among companies.
4	Tendency found among dry bulk companies, but not among tanker companies.
5	Weak tendency found among companies.
6	Weak tendency found among freight rates.
7	Weak tendency found among companies.
8	Weak but positive correlation between dry bulk- and tanker freight rates. Strong positive correlation between crude- and refined products freight rates.
9	Tendecy to affect the freight rates and stockprice, but not debt-equity, ROI and ROCE.

Table 9: **Summary of results**.

9.2. Variables

9.2.1. Market-to-book value, debt-total-asset ratio and the level of debt

Rauh and Sufi (2010) proved that companies with high market-to-book value tend to have less debt than those with high asset tangibility. In order to resolve if this is the case in shipping as well, the correlation between the market-to-book value and debt-total asset ratio for each company were found (Appendix E, table 20). A multiple regression analysis, based on the same input, was then performed. The debt-total asset ratio is calculated by equation 12. Total book values are used, as the market value of the assets are not easy to determine and are highly volatile.

$$Debt - total\ asset\ ratio = \frac{Total\ book\ value\ of\ debt}{Total\ book\ value\ of\ assets}$$

Equation 12: **The debt-total asset ratio**.

The correlation between the market-to-book value and the debt-total asset ratio was then compared to the level of asset tangibility in each of the 11 dry bulk- and 13 tanker firms (Appendix E, Table 21). This is found by dividing the value of the tangible assets with the book value of the firm. The balance sheet item called "property, plant and equipment" by Datastream, is chosen to measure the tangible assets. From this, the hypothesis regarding the effect of market-to-book value and asset tangibility on the level of debt (Rauh and Sufi, 2010) can be found among the companies analysed. In other words, it is possible to see some decreases in the debt-total-asset ratio as the market-to-book value increases.

A multiple regression model (Appendix F), with the market-to-book value, asset tangibility and the companies as variables, can solve the same hypothesis. Each company is set to have a dummy variable, named by its stock ticker (Appendix C). Table 10 shows the coefficients, standard error and P-values from the model.

Hypothesis 1 Coefficients, standard error, P-value, market debt-equity ratio, market-to-book value and asset tangibility						
Predictor	Coefficients	Standard error	P-value	Average market debt-equity ratio	Average market-to-book value	Average asset tangibility
Constant	0.29296	0.03212	0.000			
MarketBook	-0.001003	0.001096	0.361			
AssetTangibility	0.112344	0.007703	0.000			
Dummy variables						
BLE	0.00864	0.03587	0.810	2.851	1.216	1.845
DNORD	-0.21155	0.04403	0.000	25.959	9.453	15.621
DSX	-0.00848	0.04338	0.845	0.156	1.278	-2.993
DRYS	-0.20943	0.03678	0.000	1.443	0.145	0.205
ESEA	-0.18570	0.04714	0.000	0.587	0.716	1.386
EXM	-0.04918	0.03615	0.175	1.446	1.261	1.464
2601	-0.08659	0.03736	0.022	0.744	1.327	1.066
FREE	-0.06433	0.04436	0.149	0.347	8.819	2.413
GOGL	0.02146	0.04933	0.664	0.223	26.356	2.888
JIN	-0.05481	0.03665	0.137	2.737	0.606	1.642
WILS	-0.02263	0.04345	0.603	1.409	1.304	2.971
CCOR B	-0.12861	0.03639	0.001	1.543	0.634	1.232
DHT	-0.00998	0.04424	0.822	1.008	3.022	3.237
EURN	-0.00248	0.04122	0.952	1.152	1.272	2.001
FRO	-0.03527	0.04133	0.395	2.877	2.056	3.642
GMR	-0.08657	0.03737	0.022	1.483	1.270	2.095
500620	-0.05086	0.03615	0.161	1.184	0.955	1.449
VLCCF	-0.10729	0.03627	0.004	0.421	1.472	1.368
NAT	-0.28286	0.03662	0.000	0.214	1.197	1.099
OSG	-0.05793	0.03609	0.110	1.094	0.905	1.502
SFL	0.35187	0.04243	0.000	1.621	2.302	1.951
TK	-0.05342	0.03583	0.138	2.055	0.855	2.165
TRMD	-0.01074	0.03845	0.780	6.296	0.763	1.674
S	0.0740856	P-value	0.000			
R-Sq	85.10%	F-value	39.19			
R-Sq(adj)	83.00%					

Table 10: **Coefficient, standard error and P-value for the variables in the DebtLevel regression model. The table also includes the market debt-equity ratio, market-to-book value and asset tangibility.**

Table 10 shows that the R-sq. is 85.1%, which gives a high coefficient of determination. The P-value of the model is 0.000 and the F-value is 39.19. This F-value is clearly above the rejection region (Appendix F). It shows that most of the variation in DebtLevel, i.e. y, is explained by the regression model. A majority of the dummy variables have high P-values, which indicate the insignificance of these coefficients. The significant variables, with P-values below 0.05[12], tend to have higher levels of debt than the others. NAT is the only exception, as this firm prefer to use equity. The MarketBook variable has a P-value of 0.361, leaving only AssetTangibility as a significant factor. Minitab has removed TNP due too high correlation with other variables. A multiple regression model with two other categories of dummy variables, segment and year, gives F-values, P-values and R-Sq.

[12] I have chosen to include NAT among the significant variables, as the company has a P-value equal to 0.056.

below those found above. This model does also give MarketBook a high P-value and AssetTangibility a P-value of 0.000. Neither the segment dummies nor the annual dummies get significant P-values. The first multiple regression model does therefore give the best answer to hypothesis 1. It suggests the tendency stated in the hypothesis can be found among the companies.

Commodity shipping is an industry with focus on asset management (Wijnolst and Wergeland, 2008) and a majority of the companies studied can be put in this category. This means the level of tangible assets are high for all companies, making it more difficult to prove the difference found by Rauh and Sufi (2010). A large spread found between the correlation coefficients illustrates the situation.

9.2.2. Debt-equity ratio

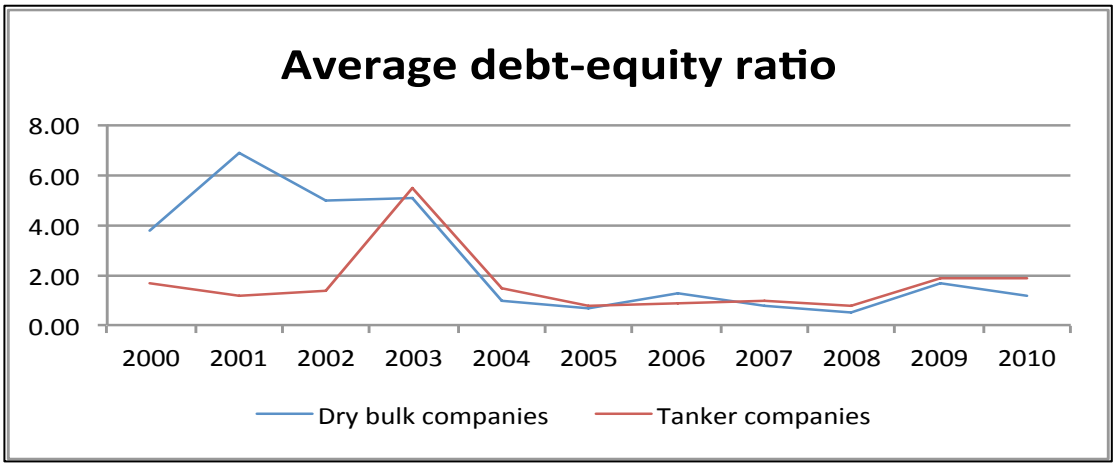
Debt-equity ratio can be found by dividing debt with equity, as shown by equation 13. The average debt-equity ratios for the selected companies, calculated separately for the dry bulk and tanker segments and then in total, are found in table 11. This shows that the tanker companies use more debt than those operating in the dry-bulk industry, when book values of equity form the basis of the calculation. Market values of equity, witch is used in correlations and regression models in this thesis, give the opposite answer. The difference might be explained by the many variables influencing a shipping company's market value of equity, e.g. the market cycles and the world's economy. Graph 8 illustrates the fluctuations from year to year in the market ratio. The level of debt can probably be explained by the high level of asset tangibility in shipping, and thereby the possibilities to offer collateral.

$$Debt - equity\ ratio = \frac{Total\ book\ value\ of\ debt}{Total\ value\ of\ equity}$$

Equation 13: **The debt-equity ratio**.

Average debt-equity ratio 2000-2010 Datastream		
	Book ratio	Market ratio
Dry bulk companies	0.98	2.66
Tanker companies	1.36	1.74
Total	**1.19**	**3.01**

Table 11: **The average debt-equity ratios between 2000 and 2010** (Datastream). The table indicates that the average dry bulk book value of debt compared to book value of equity is below the average tanker ratio. However, the tanker ratio is above the dry bulk ratio if market value of equity is used.



Graph 8: **Fluctuations in the average market debt-equity ratios** (Datastream). The graph shows that the dry bulk companies experienced the highest ratio until 2003. From 2003, the two ratios highly correlated. The debt-equity ratio for Dampskibsselskabet NORDEN in year 2000 is removed due to a significant larger value than the other companies.

Assuming that internal capital is preferred before external capital gives the expectation that market debt-equity ratio should correlate negative with the share price. This cannot be confirmed by studying the correlation for each of the firms (Appendix E, table 22). Both the dry bulk and tanker firms have positive and negative coefficients. The positive coefficients were slightly more significant than the negative coefficients, indicating a marginally positive relation between the debt-equity ratio and market-book ratio. An increase in the amount of data should be considered, in order to try finding a result with less spread among the coefficients.

The volatility in the freight rates might affect the debt-equity ratio as higher freight rates generate more equity and thereby a decrease in the ratio, assuming a constant level of debt. This influence does probably have a lag, as it might take time before a change in the freight rates is visible in the ratio. Calculating the correlations between

the ratios and freight rates (Appendix E table 23 and 24), give a large spread between the coefficients and approximately 60% are negative. This might be explained by the different financial and operational strategies among the companies. Some use a high level of leverage, while others rely solely on equity. A company defined as a tanker company might correlate different with crude oil freight rates and refined products freight rates, as vessels rarely switch between crude- and refined cargoes.

As the correlations did not give a clear answer to whether reject or accept the relationship between the debt-equity ratios, freight rates and stock prices, a multiple correlation equation was created (Appendix F). This model uses two types of dummy variables, a segment dummy and a company dummy. The stock price is measured as the market-to-book ratio to avoid affections from the amount of outstanding stocks.

Table 12 lists the variables used in the equation. Minitab has removed the independent variables and the dummy variables with high correlations. This made it possible to determine if the individual companies and segments can be explained. R-Sq. has a value of 96.5%, F is equal to 99.36 and P equal to 0.000, which makes the model valid. This indicates an acceptance of hypothesis 2. The independent variables, except the StockPrice and the five freight rates, have P-values below 0.000[13]. However, as only four of the dummy variables have significant P-values, other variables must affect the ratio. Frank and Goyal (2001, referred to by Myers, 2002) and Barclay and Smith (2005) might explain the spread. They found that financial behaviour is more complicated than predicted by the pecking order. E.g. the debt-equity ratio might be explained by variables like a company's market view, which is difficult to measure.

[13] I have chosen to include the MarketBook variable among the significant variables, as it has a P-value equal to 0.055.

Hypothesis 2 Coefficients, standard error and P-value				
Predictor		Coefficients	Standard error	P-value
Constant		1.5881	0.5119	0.002
MarketBook		0.008321	0.004298	0.055
AssetTangibility		0.87606	0.03547	0.000
StockPrice		-0.0004876	0.0007626	0.524
Owned		-1.9014	0.3390	0.000
TCT Cont/Far East (172' dwt)		0.00000724	0.00001458	0.621
Tubarao/R.dam (iron ore)		-0.0715	0.1193	0.550
Richards Bay/R.dam		0.01771	0.01455	0.226
Transatlantic RV		0.00000693	0.00001967	0.725
UKC-Med/States		-0.000637	0.001045	0.543
Caribs/USNH		0.000350	0.001160	0.763
Dummy variables				
	DryBulk	0.0840	0.1509	0.579
	BLE	0.4675	0.1490	0.002
	DNORD	-0.2519	0.2531	0.322
	DSX	-0.0650	0.1619	0.689
	DRYS	-0.0067	0.1740	0.970
	ESEA	-0.1744	0.1949	0.373
	EXM	0.0158	0.1436	0.913
	FREE	-0.1910	0.1898	0.316
	GOGL	-0.4927	0.2337	0.037
	CCOR B	-0.0693	0.1375	0.615
	DHT	0.0428	0.1544	0.782
	EURN	-0.1232	0.1427	0.390
	FRO	0.2152	0.1667	0.200
	GMR	0.0383	0.1294	0.767
	VLCCF	-0.1294	0.1401	0.358
	NAT	-0.3128	0.1432	0.031
	OSG	0.0660	0.1308	0.615
	SFL	1.6305	0.3233	0.000
	TK	-0.0607	0.1331	0.649
	TRMD	0.1164	0.1332	0.384
S	0.25544	P-value		0.000
R-Sq	96.50%	F-value		99.36
R-Sq(adj)	95.50%			

Table 12: **Coefficient, standard error and P-value for the variables in the D/E regression model**.

9.2.3. Financial leases versus owning

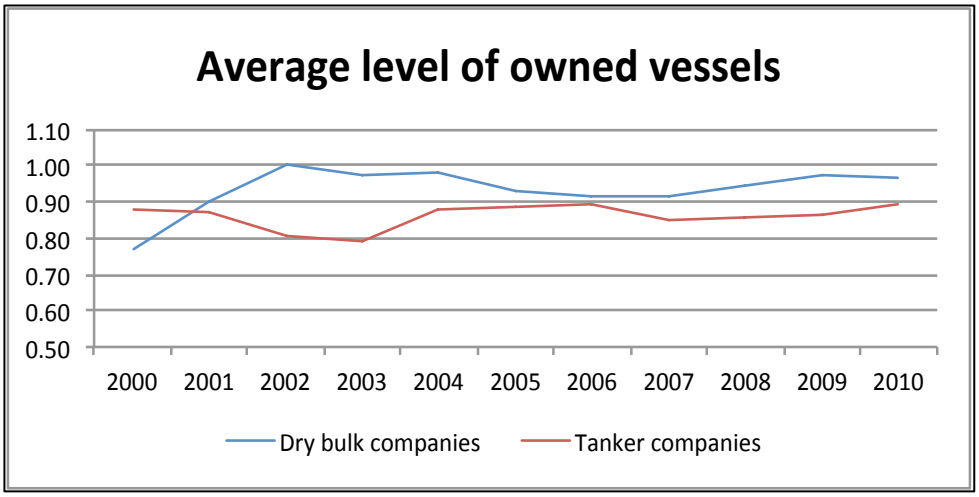
The purpose of testing for difference in the use of leasing and owning is to see if this is related to the market conditions or just other factors like business strategies. Equation 14 was used to calculate the percentage of owned vessels. The values of owned vessels and capital leases are found on the consolidated balance sheet in the companies' annual reports.

$$Owned\ vessels\ in\ percent = \frac{Value\ of\ owned\ vessels}{Value\ of\ owned + value\ of\ capital\ leases}$$

Equation 14: **The percentage of owned vessels in a shipping company**.

Going through the data shows that only two dry bulk companies reported financial leasing of vessels on their balance sheets, while four of the tanker companies did the same. The dry bulk market has experienced a decrease in the level of leasing between 2000 and 2010, whereas the level of leasing in the tanker market has been fairly

stable. Comparing an average of these results with annual freight rates (Appendix E, table 25) gave a very low and insignificant positive correlation for most dry bulk voyages. Tanker companies had a more significant correlation with the crude oil rates. However, these correlations were negative, which indicates a decrease in the use of leasing when crude rates increase. Refined products freight rates had a low, but positive correlation with the owned vessels ratio.



Graph 9 – **The average level of owned vessels between 2000 and 2010** (Annual reports). An increase in the level of owned vessels indicates a decrease in the leasing. The average level of owned vessels for dry bulk and tanker companies during the period were 0.94 and 0.86.

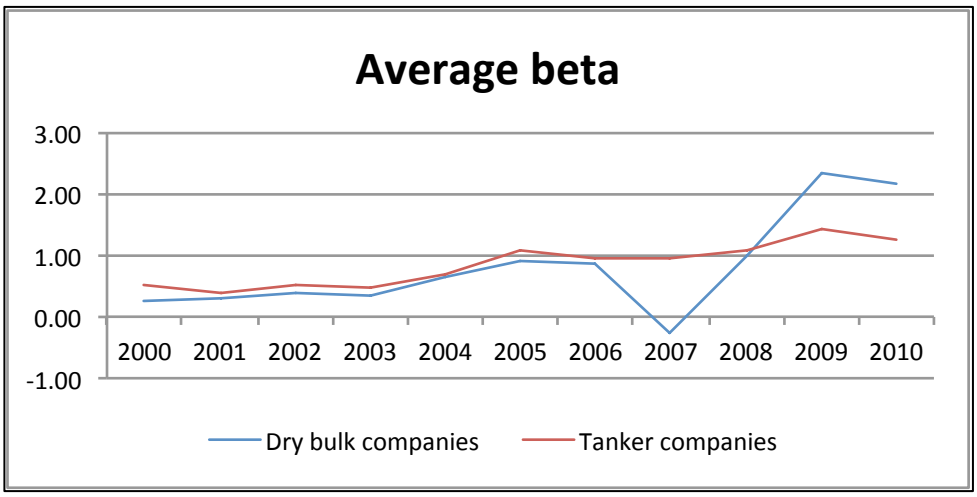
The multiple regression model DebtEquity includes Owned as an independent variable. This equation shows that the variable has a P-value of 0.000 and a negative coefficient. In other words, the negative coefficient indicates that the debt-equity ratio and leasing have a positive relationship. This is consistent with Ang and Peterson (1984). They found a positive relationship between debt and leasing, which was supported by Smith and Wakeman (1985). Performing a regression with the level of owned vessels as the dependent variable, and freight rates and the level of debt as independent variables supports this result. In fact, this model finds that the companies having significant P-values are the companies reporting the use of financial leasing on their balance sheet. Overseas Shipholding Group is the exception, as it reports the use of financial leasing and has a high P-value.

9.2.4. Beta

Calculating the correlation between the annual historical beta and the freight rates indicates, as expected, that beta for most of the companies decrease when the rates increase. In other words, approximately 74% of the coefficients are negative (Appendix E, table 26 and 27).

The average annual betas for the dry bulk and tanker companies, shown by graph 10, have a correlation coefficient equal to 0.77. This is influenced by Euroseas large negative beta in 2007. Excluding this beta from the dataset increases the coefficient to 0.91.

Finding annual average betas for the dry bulk- and tanker segments give betas equal to 0.96 and 0.91. The average beta representing all 24 firms is then 0.93. These betas, with values less than 1, indicate that the shipping market has a lower volatility than the stock market. This finding is consistent with the finding from an empirical study of common risk factors in the container-, dry bulk and tanker segments performed by Drobetz, Schilling and Tegtmeier (2010).



Graph 10: **Fluctuations in the average beta** (Datastream). The negative average beta for dry bulk in 2007 is due to Euroseas large negative beta that year. If this single observation were put aside, the two segments would have almost similar betas until 2008.

A regression model was then used to control these findings (Appendix F). Minitab removed, as with the previous regressions, some of the variables. The variables

remaining, and their values, are found in table 13. This regression also tests the relationship between beta and the market-to-book ratio.

Hypothesis 4 Coefficients, standard error and P-value				
Predictor		Coefficients	Standard error	P-value
Constant		-0.508	1.173	0.665
MarketBook		0.0616	0.1234	0.619
D/E		-0.01568	0.02675	0.559
TCT Cont/far east (172' dwt)		-0.00010333	0.00004915	0.037
Tubarao/R.dam (iron ore)		0.7236	0.3980	0.071
Richards Bay/R.dam		-0.05939	0.04903	0.228
Transatlantic RV		-0.00007408	0.00006625	0.265
UKC-Med/States		-0.009559	0.003467	0.007
Caribs/USNH		0.010321	0.003849	0.008
Dummy variables				
	DryBulk	-1.1533	0.6047	0.058
	BLE	1.0815	0.5662	0.058
	DNORD	1.2997	0.6734	0.056
	DSX	1.3028	0.6492	0.047
	DRYS	2.9206	0.6771	0.000
	ESEA	-1.5239	0.7104	0.034
	EXM	1.3674	0.5708	0.018
	2601	1.4699	0.5860	0.013
	FREE	1.4744	0.6999	0.037
	GOGL	1.6613	0.7635	0.031
	JIN	1.3115	0.5718	0.023
	CCOR B	-0.1969	0.5431	0.718
	DHT	-0.4344	0.6138	0.480
	EURN	-0.4838	0.6053	0.426
	FRO	0.1204	0.6104	0.844
	GMR	0.0553	0.5185	0.915
	500620	-0.0526	0.5114	0.918
	VLCCF	-0.0456	0.5186	0.930
	NAT	-0.4529	0.5715	0.429
	OSG	0.1629	0.5105	0.750
	SFL	0.2240	0.6169	0.717
	TK	-0.1079	0.5080	0.832
	TRMD	0.2751	0.5315	0.606
S	1.02454	P-value		0.000
R-Sq	39.50%	F-value		2.99
R-Sq(adj)	26.30%			

Table 13: **Coefficient, standard error and P-value for the variables in the Beta regression model.**

The regression has a R-Sq. equal to 39.5%, indicating less than half of the variation in beta can be explained by the independent variables. This gives a weak linear relationship. The F-value is 2.99, which is not far outside the rejection region (Appendix F). With a P-value of 0.000, the model might be used to describe the relation between beta, the debt-equity ratio, the freight rates and the market-to-book ratio. Studying the individual P-values disclose that most dry bulk companies have significant values, while the tanker values are above 0.05. The MarketBook and debt-equity variables have P-values of 0.691 and 0.559. They can therefore not be used to explain beta. Four[14] of the six freight rates included have significant P-value, and can thereby be capable of explaining the model. In other words, beta seems to be affected

[14] Tubarao/R.dam is included among the significant variables, as it has a P-value just above 0.05.

by the revenue generated from freight rates. It is interesting to observe how the regression can describe dry bulk betas and not tanker betas.

9.2.5. Freight rates

Comparing the freight rates to fluctuations in the companies stocks (Appendix E, table 28 and 29), i.e. the stock prices, indicate whether they affect each other or not. The majority of the tanker freight rates have a correlation between 0 and 0.5, while most of the dry bulk rates have correlation coefficients above 0.7. This means the dry bulk market and the companies' stock prices will follow each other more closely. In other words, an increase in the stock prices follows from an increase in the freight rates. Comparing the rates to OSLSHX (Appendix E, table 30), i.e. comparing the freight rates to a stock index, gives correlation coefficients below those fund between rates and the share prices.

How freight rates influence the stock prices might be explained by multiple regression (Appendix F). This model does also include the influence from OSLSHX and the Brent crude oil spot price. Table 14 illustrates the values of the variables. The remaining freight voyages, companies and segment are removed by Minitab due to correlation with other variables. Creating a model gives a R-Sq. value of 75.3%, a F-value of 11.75 and a P-value of 0.000. The R-Sq. value indicates that approximately tree quarters of the variation can be explained by the independent variables. OSLSHX and Brent, with P-values of 0.056[15] and 0.021 do affect the stock prices. However, the OSLSHX have a negative coefficient. To control this, the regression was then performed without the Brent variable and then without the OSLSHX variable. This gave the same types of coefficients, but the P-values were reduced. The fact that many of the companies used in this thesis are not listed on OSL might explain the negative coefficient. Different types of sipping companies are included in this index, which can contribute to the negative correlation between the index and the stock prices. E.g. companies like Aker Philadelphia Shipyard and Wilh. Wilhelmsen Holding do not operate in the dry bulk or tanker segments, and might fluctuate without affecting the companies used in this thesis.

[15] OSLSHX is assumed to be significant, as it has a P-value just above 0.05.

The vast majority of the companies do have p-values above 0.05. In other words, the model can be used to explain the variation, but factors not included explain a significant part of the dependent variable. The freight rates correlates, as found in the other regressions used in this thesis. This is visible trough the elimination of many voyages when the regression equation is generated by Minitab. A similar result is found when two matrixes, calculating the correlation between dry bulk- and tanker rates and crude oil- and refined products rates are created (Appendix E, table 36 and 37).

Hypothesis 5 Coefficients, standard error and P-value			
Predictor	Coefficients	Standard error	P-value
Constant	1.04	66.62	0.988
OSLSHX	-0.5961	0.3082	0.056
Brent	0.9485	0.4036	0.021
TCT Cont/far east (172' dwt)	0.0007464	0.0009871	0.451
Tubarao/R.dam (iron ore)	-3.032	5.132	0.556
UKC-Med/States	0.10045	0.07139	0.162
Dummy variables			
DryBulk	-2.42	26.79	0.928
BLE	-6.93	26.79	0.796
DNORD	228.09	26.79	0.000
DSX	-4.86	27.91	0.862
DRYS	3.12	27.91	0.911
ESEA	-17.65	29.68	0.553
EXM	-1.90	26.79	0.944
2601	12.57	26.79	0.640
FREE	-4.79	27.91	0.864
GOGL	-7.60	26.79	0.777
JIN	7.60	26.79	0.777
CCOR B	10.47	25.48	0.682
DHT	-13.96	26.79	0.603
EURN	-2.08	25.48	0.935
FRO	12.12	25.48	0.635
GMR	-1.73	25.48	0.946
500620	239.66	25.48	0.000
VLCCF	0.26	25.48	0.992
NAT	11.46	25.48	0.654
OSG	31.86	25.48	0.214
SFL	-2.54	25.48	0.921
TK	15.34	25.48	0.548
TRMD	0.91	25.48	0.972
S	44.1324	P-value	0.000
R-Sq	75.30%	F-value	11.75
R-Sq(adj)	68.90%		

Table 14: **Coefficient, standard error and P-value for the variables in the StockPrice regression model.**

The correlations between tanker freight rates and the yield on 10-year U.S. treasury securities are mixed, but the majority is weakly positive. Calculating the dry bulk correlations (Appendix E table 31) give mixed, but weak coefficients. Both segments should go through further examination in order to determine whether to accept or reject the hypothesis. The multiple regression model named FreightRate measures the

relationship between weekly reported spot freight rates, interest rates, and Brent spot prices (Appendix F). This generated a model with R-Sq. equal to 60.1%, a F-value of 730.72 and a P-value of 0.000, which means the model is valid. Both the crude oil- and interest variable have P-values of 0.000, which illustrates the influence on the spot freight rates. All variables used can be found in table 15. The table illustrates the fact that the regression model explains some freight rates better than others.

Hypothesis 6 Coefficients, standard error and P-value			
Predictor	Coefficients	Standard	P-value
Constant	-14340.2	946.8	0.000
InterestRate	70154.0	14492.0	0.000
Brent	212.388	4.681	0.000
Dummy variables			
DryBulk	4521.0	13434.0	0.736
TCT Cont/far east (172' dwt)	59825.0	13458.0	0.000
Tubarao/R.dam (iron ore)	-4323.0	13458.0	0.748
Richards Bay/R.dam	-4318.0	13458.0	0.748
Transatlantic RV	22342.0	13458.0	0.097
TCT Cont/F.east	26107.0	13458.0	0.052
TCT F.East/Cont	16896.0	13458.0	0.209
TCT F.East RV	20030.0	13458.0	0.137
Murmansk/Ara	-7718.0	13468.0	0.567
Murmansk/L.pool	-7717.0	13468.0	0.567
Atlantic RV	18078.0	13458.0	0.179
Pacific RV	15554.0	13458.0	0.248
TCT Cont/ F.East (Handysize)	22265.0	13458.0	0.098
Meg/WEST	240.9	812.6	0.767
MEG/JPN	276.4	811.9	0.733
MEG/SPORE	-1250.4	870.6	0.151
WAF/USG	279.3	811.9	0.731
WAF/USAC	315.4	811.9	0.698
Sidi Kerir/W Med	-787.5	855.9	0.358
NAF/EUROMED	344.8	811.9	0.671
UK/CONT	330.4	811.9	0.684
CARIBS/USG	370.7	811.9	0.648
MEG/Japan (75' dwt)	-4363.0	1073.0	0.000
MEG/Japan (55' dwt)	390.1	811.9	0.631
MEG/Japan (30' dwt)	443.6	811.9	0.585
Singapore/Japan (30' dwt)	421.2	811.9	0.604
Baltic T/A (60' dwt)	-4346.0	1073.0	0.000
UKC-Med/States (37' dwt)	414.2	811.9	0.610
S	13419.40	P-value	0.000
R-Sq	60.10%	F-value	730.72
R-Sq(adj)	60.00%		

Table 15: **Coefficient, standard error and P-value for the variables in the FreightRate regression model.**

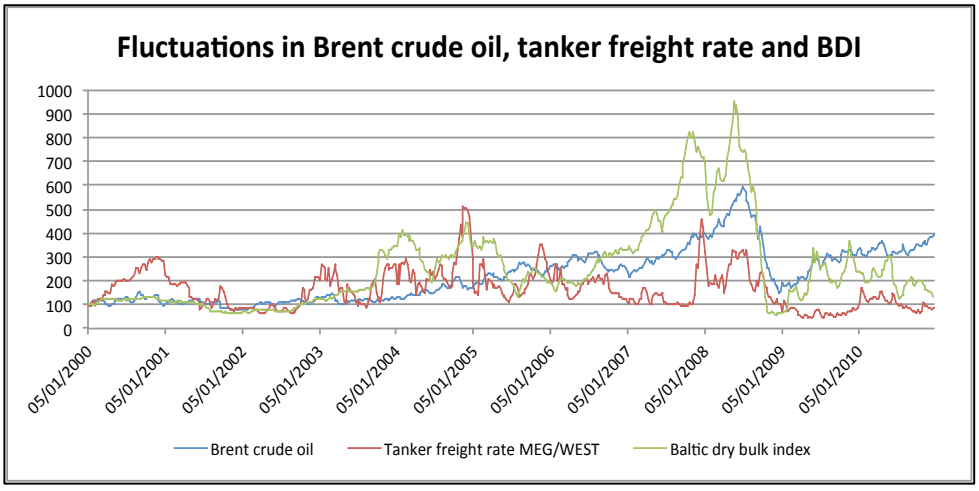
9.2.6. Brent crude oil

Fluctuations in the crude oil price are expected to be important, as crude oil is the main cargo for tanker vessels and the single most important input factor when operating a vessel. The fluctuation can be illustrated by graph 11, which shows the

development in the Brent spot price, freight rates on MEG/WEST and the BDI from 2000 until 2010.

The development in the oil price can be compared with the freight rates, the return on equity and the stock prices. Dry bulk freight rates have high correlations with the Brent crude oil price, while tanker freight rates have low correlations (Appendix E, table 38). Positive correlations are also found when stock prices and the oil price are compared, but the spread is smaller (Appendix E, table 39). It is possible to conclude, with a majority of positive coefficients, that freight rates and stock prices tend to move in the same direction as the Brent crude spot price.

The different regression analysis performed, including those used to control the results, indicate that the price on Brent crude oil affects the freight rates and stock prices, but not the debt-equity ratio, ROI and ROIC.



Graph 11: **Fluctuations in Brent crude oil spot price, tanker freight rate and BDI in per cent** (Fearnleys and U.S. Energy Information Administration). The graph uses the first observations in 2000 as a basis to illustrate the development. These observations are set to be 100 and the development is measured in per cent. MEG/WEST and Brent crude oil have a weak correlation coefficient equal to 0.082, while BDI and Brent crude oil have a coefficient equal to 0.698. The correlation coefficient between BDI and MEG/WEST is 0.345.

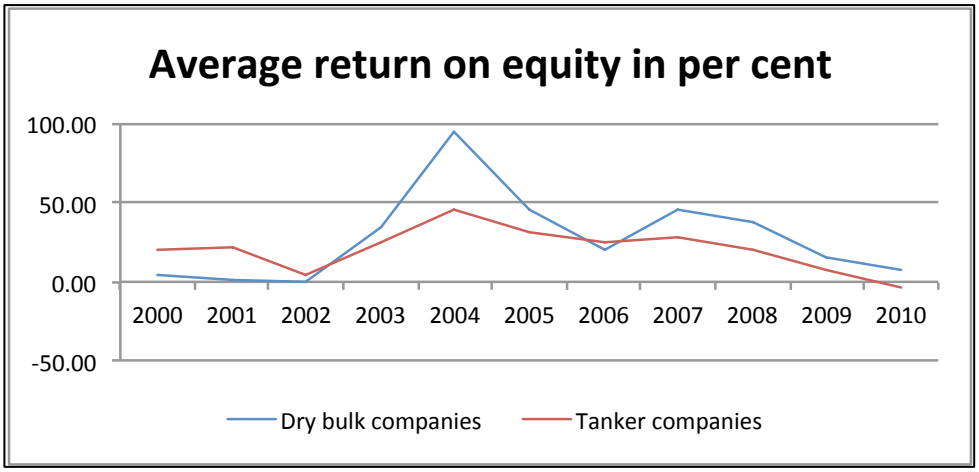
9.2.7. Return on equity

Return on equity (ROE) measures the rate of return for the owner of a company. This benchmark can be written as equation 15.

$$ROE = \frac{Net\ income\ after\ tax}{Shareholder\ equity}$$

Equation 15: **The return on equity**.

Fluctuations in the return on equity can be illustrated by graph 12 as an annual average of ROE. The dry bulk- and tanker companies' average returns have a correlation coefficient equal to 79%. Calculating an average rate of return for the entire period, as done in table 16, shows that dry bulk companies generated the highest rate of return.



Graph 12: **Fluctuations in the average return on equity** (Datastream). The dry bulk- and tanker companies had from 2000 until 2010 a correlation between their return on equity equal to 79%.

Average return on equity 2000-2010	
Datastream	
Dry bulk companies	32.14
Tanker companies	20.77
Total	**25.75**

Table 16: **Average return on equity between 2000 and 2010** (Datastream). The table shows that, in average, the dry bulk companies have generated a higher rate of return than the tanker companies.

By finding the correlation between freight rates and return on equity, the companies' equity and the development in the shipping market could be compared. This would indicate how close they have moved the last decade. From Appendix E table 32 and 33, showing the correlation coefficients between freight rates and the return on equity, both positive and negative correlations are found. 67% of the dry bulk coefficients

are positive, but a majority have values below 0.3. This makes it possible to find a weak relation between the dry bulk rates and the return on equity, but the low values require a closer analysis in order to determine whether or not to accept the hypothesis. The tanker companies have a higher percentage of positive correlations, making it possible to see a clearer relation between the fluctuations in the tanker freight rates and the return on equity.

The correlations between the return on equity and the Brent crude oil spot price have a diversified spread, making it difficult to state a relationship (Appendix E, table 40). Both the dry bulk- and tanker companies' return on equity behave independently as the Brent spot price fluctuates. In order to determine whether or not a to accept this hypothesis, a regression analysis should be performed.

A multiple regression (Appendix F), with segment and company as dummies, gives high P-values to beta, the debt-equity ratio and the Brent spot price. These findings indicate that beta, Brent and the debt-equity cannot be used to explain the return of equity. The relation between ROE and the debt-equity ratio in this model is also found if they change positions and if ROE is added as an independent variable in the DebtEquity regression model. A negative coefficient might be explained by the pecking order and its prediction of a negative relation between profitability and leverage (Fama and French, 2002). Minitab has, as with the other regressions, removed variables with high correlations. Of the 28 voyages involved in this analysis, five did not have a high correlation and were included. Three of the five had significant P-values and affects the outcome. Studying the dummy variables show mostly insignificant P-values, which implies that these companies cannot be explained by the model. Values of R-Sq., F and P, found in table 17, indicate that the regression model is valid. However, the part of hypothesis 7 related to ROE might not be completely confirmed, due to the spread in the P-values.

Hypothesis 7 - ROE Coefficients, standard error and P-value			
Predictor	Coefficients	Standard error	P-value
Constant	24.34	18.11	0.181
Beta	-0.644	1.910	0.737
D/E	-0.2089	0.4873	0.669
Brent	-0.1255	0.1204	0.299
TCT Cont/Far East (172' dwt)	-0.0000487	0.0004557	0.915
Tubarao/R.dam (iron ore)	-3.608	2.097	0.088
Richard Bay/R.dam	3.040	1.077	0.005
UKC-Med/States	-0.26291	0.09080	0.004
Caribs/USNH	0.28571	0.08221	0.001
Dummy variables			
DryBulk	-2.18	13.34	0.871
BLE	4.96	12.53	0.693
DNORD	28.08	12.75	0.029
DSX	2.09	14.24	0.883
DRYS	-3.04	15.03	0.840
ESEA	-9.26	15.24	0.545
EXM	11.64	12.63	0.358
2601	-12.62	12.93	0.331
FREE	-12.86	15.14	0.397
GOGL	78.54	14.30	0.000
JIN	12.52	12.79	0.329
CCOR B	-12.88	11.62	0.269
DHT	4.30	14.19	0.762
EURN	-3.06	14.08	0.828
FRO	40.13	12.45	0.002
GMR	-13.40	11.21	0.234
500620	8.98	11.01	0.416
VLCCF	2.11	11.05	0.849
NAT	-5.43	12.09	0.654
OSG	-5.54	11.02	0.616
SFL	11.24	12.42	0.367
TK	-8.84	10.99	0.422
TRMD	11.54	11.67	0.325
S	22.1810	P-value	0.000
R-Sq	53.50%	F-value	5.30
R-Sq(adj)	43.40%		

Table 17: **Coefficient, standard error and P-value for the variables in the ROE regression model.**

9.2.8. Return on invested capital

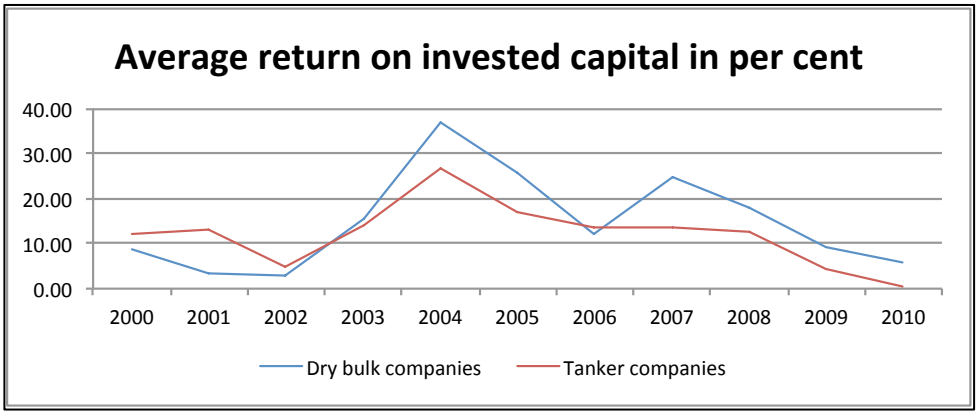
Return on invested capital measures how available capital is invested. It can be calculated by equation 16.

$$ROIC = \frac{Net\ income\ after\ tax}{Invested\ capital}$$

$$= \frac{After\ tax\ operating\ income}{Total\ assets - excess\ cash - non\ interest\ bearing\ current\ liabilities}$$

Equation 16: **The return on invested capital**.

The return on invested capital from 2000 and 2010 is illustrated by graph 13. During this period, the two segments had a correlation in ROIC equal to 81%. The main differences are to be found around 2001, 2004 and 2007. In average, as calculated in table 18, the dry bulk- and tanker segment had ROIC equal to 17.13% and 12.44%.



Graph 13: **Fluctuations in the average return on equity** (Datastream). The dry bulk- and tanker companies had from 2000 until 2010 a correlation between their return on invested capital equal to 81%.

Average return on invested capital 2000-2010	
Datastream	
Dry bulk companies	17.13
Tanker companies	12.44
Total	**14.48**

Table 18: **Average return on invested capital between 2000 and 2010** (Datastream). The table shows that, in average, the dry bulk companies have generated a higher rate of return than the tanker companies.

Finding the correlations between ROIC and the dry bulk freight rates, indicate the development in return compared to these rates. As shown in Appendix E table 34, the values of the coefficients fluctuate. Half of the observations are to be found between -0.2 and 0.2 and approximately 50% of all coefficients are positive. Doing the same with the tanker freight rates gives 73% positive coefficients (Appendix E table 35), with 52% above 0.3. These are more significant than those found among the dry bulk companies. However, both segments should be examined more closely in order to try increasing the significance. Correlation coefficients between Brent crude oil spot prices and the return on invested capital have, as the correlation between Brent and ROE, a large spread (Appendix E table 41). This makes it difficult to prove a relation.

The ROIC regression model (Appendix F) indicates the same tendency found in the ROE regression. With quite similar R-Sq.-values, F-values and P-values, ROIC and ROE seem to be affected by the same independent variables. This result is also

visible if ROIC is added as an independent variable in the DebtEquity regression model, and if the debt-equity ratio and ROIC switch positions in the ROIC model. The correlations found between the return on equity and return on invested capital support these results. A negative D/E coefficient in the ROIC regression model imply a negative relation between the return on invested capital and the debt-equity ratio, which can be explained by the pecking order theory (Fama and French, 2002).

Hypothesis 7 - ROIC Coefficients, standard error and P-value			
Predictor	Coefficients	Standard error	P-value
Constant	11.834	7.973	0.140
Beta	-0.6220	0.8737	0.478
D/E	-0.3332	0.2144	0.122
Brent	-0.05058	0.05380	0.349
TCT Cont/Far East (172' dwt)	0.0000804	0.0002039	0.694
Tubarao/R.dam (iron ore)	-1.7620	0.9291	0.060
Richard Bay/R.dam	1.0505	0.4863	0.033
UKC-Med/States	-0.13036	0.03986	0.001
Caribs/USNH	0.16260	0.03625	0.000
Dummy variables			
DryBulk	-1.528	5.863	0.795
BLE	4.779	5.630	0.397
DNORD	26.230	5.606	0.000
DSX	6.893	6.628	0.300
DRYS	0.623	6.634	0.925
ESEA	-3.395	7.450	0.649
EXM	9.220	5.555	0.099
2601	-7.069	5.690	0.216
FREE	-5.066	6.655	0.448
GOGL	21.865	6.652	0.001
JIN	8.140	5.626	0.150
CCOR B	-5.947	5.099	0.246
DHT	-0.621	6.834	0.928
EURN	-0.471	6.186	0.939
FRO	3.790	5.763	0.512
GMR	-3.057	4.922	0.536
500620	6.094	4.834	0.210
VLCCF	4.347	4.963	0.383
NAT	1.077	5.309	0.840
OSG	-1.933	4.835	0.690
SFL	0.652	5.452	0.905
TK	-2.208	4.823	0.648
TRMD	8.477	5.126	0.100
S	9.7345	P-value	0.000
R-Sq	55.70%	F-value	5.52
R-Sq(adj)	45.60%		

Table 19: **Coefficient, standard error and P-value for the variables in the ROIC regression model.**

9.3. Limitations

All companies did not have data for the entire period, as some were founded and/or went public during the decade. This, together with the most severe financial crisis since the late 1920s, might affect the analysis and give abnormal observations.

Many of the correlation coefficients found where either too weak or too widely spread to decide whether to accept or reject some of the hypotheses. The multiple regression models, with two dummy categories, were created with the purpose of giving more significant answers. One way to increase the results even more would be to expand the time frame and/or the amount of companies. The dummies used in the regression models can also create limitations, and different alternatives should be tested if the time frame and amount of companies are changed.

An important limitation in this thesis is the collecting of detailed information about financial structures, e.g. the detailed use of different types of debt and bonds, as this is not shown on the balance sheet. This made it difficult to examine the companies as originally planned.

10. Summary and conclusion

The purpose with this thesis was to study capital structure and relate it to the shipping industry. I have done this by examine both financial- and market data, in an attempt to see how the financing changes as the market fluctuates.

The results show that shipping companies do not have a clear solution to what is the best way of financing, given the market conditions. However, some common features can be found. Rauh and Sufi (2010) proved that companies with high market-to-book value tend to use less debt than those with high asset tangibility. This can be found for some of the companies, although not many enough to confirm the hypothesis. The D/E regression model indicates that financial behaviour is more complex than assumed by the pecking order. Both the dry bulk- and tanker companies seem to prefer owning vessels instead of leasing, but tanker companies' use leasing more frequently than dry bulk companies. The significant DebtLevel variable in the Owned regression model suggest that the positive relation between debt and leasing, described by Ang and Peterson (1984) and Smith and Wakeman (1985), might be found in shipping.

The use of debt, compared to equity, has been quite stable for tanker companies and decreased for dry bulk companies when data from 2000 is compared to 2010. Dry bulk experienced a peak in the debt-equity ratio in 2001, while the tanker market peaked in 2003. Both segments had a quite low and stable ratio from 2004. This might indicate a change among preferred capital.

ROE and ROIC are back to the levels they had in 2000. This is a result of both the shipping cycle and the problems in the financial markets.

It is difficult to predict the future in a volatile industry like shipping. With the expected increase in size of the existing fleet, calmer seas will probably not be reached for some time. This will also affect the financial alternatives, as few investors want to invest in a market with a troubled future.

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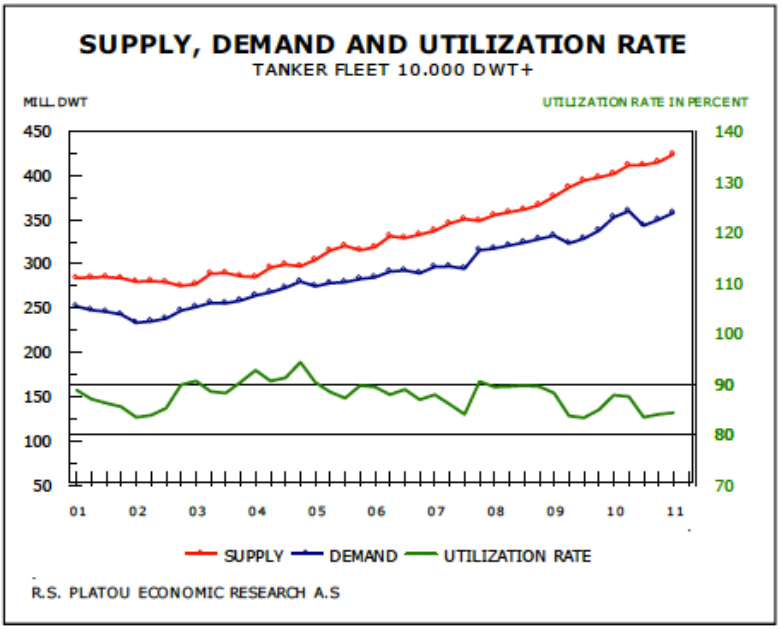
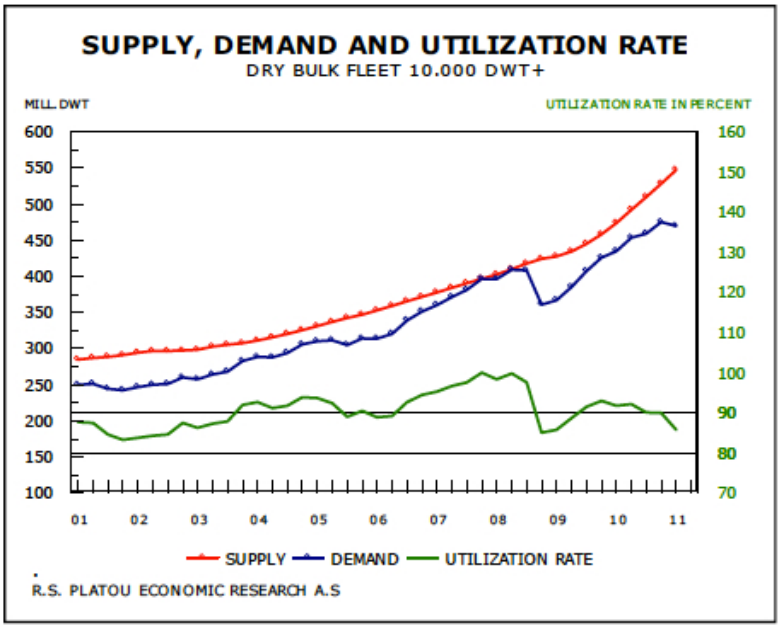
Appendix A – Abbreviations

Abbreviations	
Abbreviation	Explanation
BDI	Baltic Dry Index
Del	Delivery
Dwt	Dead weight tonnage
IPO	Initial public offering
LIBOR	London Interbank Offered Rate
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
OSE	Oslo Stock Exchange
OSLSHX	Oslo Shipping Index
ROE	Return on equity
ROIC	Return on invested capital
SEC	U.S. Security and Exchange Commission
Sold for demo.	Sold for demolition
SPO	Secondary public offering
TCE	Time charter equivalent
ULCC	Ultra large crude carrier
VLCC	Very large crude carrier
WS	World Scale
WTI	West Texas Intermediate

Appendix B – Supply, demand and utilization rates



Graph 14: **Supply, demand and utilization rates in the tanker market** (RS Platou Monthly report, April 2011).



Graph 15: **Supply, demand and utilization rates in the Dry bulk market** (RS Platou Monthly report, April 2011).

Appendix C – Shipping companies

Shipping companies				
Company	Ticker	Stock exchange	Segment	Website
Belships	BLE	OSE	Dry bulk	http://www.belships.com
Concordia Maritime	CCOR B	Stockholm	Tank	http://www.concordiamaritime.com/en/
Dampskibsselskabet NORDEN A/S	DNORD	NASDAQ OMX Copenhagen A/S	Dry bulk	http://www.ds-norden.com/
DHT Holdings Inc	DHT	NYSE	Tank	http://www.dhtholdings.com/
Diana Shipping	DSX	NYSE	Dry bulk	http://www.dianashippinginc.com/
Dryship Inc	DRYS	NASDAQ	Dry bulk	http://www.dryships.com
Euronav	EURN	NYSE Euronext Brussel	Tank	http://www.euronav.com
Euroseas	ESEA	NASDAQ	Dry bulk	http://www.euroseas.gr
Excel Maritime Carriers	EXM	NYSE	Dry bulk	http://www.excelmaritime.com
First Steamship	2601	TWSE	Dry bulk	http://www.firsteam.com.tw/en/
Freeseas	FREE	NASDAQ	Dry bulk	http://www.freeseas.gr
Frontline	FRO	NYSE/OSE	Tank	http://www.frontline.bm/
General Maritime Corporation	GMR	NYSE	Tank	http://www.generalmaritimecorp.com/
Golden Ocean	GOGL	OSE	Dry bulk	http://www.goldenocean.no
Great Eastern Shipping Company	500620	BSE/NSE	Tank	http://www.greatship.com
Jinhui Shipping and Transportation	JIN	OSE	Dry bulk	http://www.jinhuiship.com
Knightsbridge Tankers Limited	VLCCF	NASDAQ	Tank	http://www.knightsbridgetankers.com/
Nordic American Tanker Shipping	NAT	NYSE	Tank	http://www.nat.bm/
Overseas Shipholding Group	OSG	NYSE	Tank	http://www.osg.com/
Ship Finance	SFL	NYSE	Tank	http://www.shipfinance.bm
TeeKay Corporation	TK	NYSE	Tank	http://www.teekay.com/
Torm	TRMD	NASDAQ	Tank	http://www.torm.com
Tsakos Energy Navigation	TNP/TEN	NYSE/BSX	Tank	http://www.tenn.gr/
Wilson ASA	WILS	OSE	Dry bulk	http://www.wilsonship.no

Appendix D – Common trade routes

Common trade routes	
Crude oil	
CARIBS/USG	Caribbean to US Gulf
MEG/JPN	Middle East Gulf to Japan
MEG/SPORE	Middle East Gulf to Singapore
MEG/WEST	Middle East Gulf to US Gulf, Canada and Europe
NAF/EUROMED	North Africa to Europe
Sidi Kerir/W MED	Sidi Kerir to West Mediterranean
UK/CONT	United Kingdom to European continent
WAF/USAC	West Africa to US Atlantic coast
WAF/USG	West Africa to US Gulf
Refined products	
Baltic T/A	Baltic Sea across the Atlantic
Caribs/USNH	Caribbean to United States north of Cape Hatteras (North Carolina)
MEG/Japan	Middle East Gulf to Japan
Singapore/Japan	Singapore to Japan
UK Med/States	United Kingdom, Mediterranean to United States
Dry bulk	
Atlantic RV	Atlantic Round Voyage
Murmansk / ARA	Murmansk to Antwerp, Rotterdam, Amsterdam
Murmansk / L.pool	Murmansk to Liverpool
Pacific RV	Pacific round-voyage
Richards Bay/R.dam	South Africa to Rotterdam
TCT Cont/Far East	Time charter trip European continent to Far East
TCT F. East	Time charter trip in Far East
TCT F. East RV	Time charter trip in Far East, Round Voyage
Transatlantic RV	Transatlantic round-voyage
Tubarao/R.dam	Brazil to Rotterdam

Common trade routes (Fearnleys weekly).

Correlation - Market-book value, Debt-total-asset ratio Datastream													
	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
Correlation	-0.17234	0.98884	-0.61003	0.79959	0.30312	0.05565	0.52255	0.27435	-0.47289	0.84114	0.58750	0.38757	0.40785
	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA		
Correlation	-0.59674	-0.47936	0.19396	0.59122	-0.73989	0.65543	0.13386	0.05108	0.82276	0.17826	-0.86636		

Table 20: **Hypothesis 1, Correlation between the market-book value and debt-total asset ratio** (Datastream).

Correlation - Market-book value, Property, plant and equipment/book value Datastream													
	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
Correlation	-0.38475	0.97190	-0.71057	0.98320	0.33839	-0.24519	0.08090	0.38748	-0.19189	0.41659	0.55337	0.47758	0.45343
	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA		
Correlation	-0.48718	-0.27084	0.73785	0.37970	-0.35169	0.60382	0.42989	0.78401	0.71808	0.30658	-0.86586		

Table 21 **Hypothesis 1, Correlation between the market-book value and property, plant and equipment/book value** (Datastream).

Correlation - Market debt-equity ratio, Market-to-book ratio Datastream													
	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
Correlation	-0.78125	-0.83858	-0.95211	-0.69493	-0.30256	-0.89058	-0.93279	-0.59434	-0.80717	-0.79221	-0.53285	-0.52964	-0.65964
	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA		
Correlation	-0.57907	-0.33610	-0.75353	-0.68186	-0.95625	-0.43450	-0.51676	-0.81133	-0.79431	-0.84811	-0.98086		

Table 22: **Hypothesis 2, Correlation between the market debt-equity ratio and the share price** (Datastream).

Correlation - Market debt-equity ratio, Dry bulk freight rates Datastream, Fearnleys											
Voyage/company	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA
TCT Cont/Far East (172' dwt)	-0.39237	-0.27286	-0.39876	0.05847	0.76808	-0.16391	0.15637	0.20040	0.32409	-0.16104	-0.35390
Tubarao/R.dam (Iron ore)	-0.38642	-0.26732	-0.36344	0.12097	0.77767	-0.12382	0.19749	0.23147	0.39574	-0.11800	-0.34464
Richards Bay/R.dam	-0.41478	-0.26922	-0.50345	-0.04925	0.68811	-0.25464	0.22103	0.01791	0.32580	-0.24204	-0.51758
Transatlantic RV	-0.39710	-0.29333	-0.21793	0.32599	0.80254	-0.02037	0.27158	0.35339	0.55818	-0.01664	-0.26775
TCT Cont/F.East	-0.42369	-0.32430	-0.19795	0.30851	0.83421	0.05232	0.22435	0.42025	0.50015	-0.04670	-0.17833
TCT F.East/Cont	-0.33508	-0.21145	-0.40609	0.05836	0.72929	-0.34905	0.30625	0.00166	0.43685	-0.07555	-0.53545
TCT F.East RV	-0.35554	-0.24062	-0.34188	0.18076	0.75098	-0.25883	0.29683	0.13452	0.48916	-0.01743	-0.45679
Murmansk/Ara	0.04063	0.05411	-0.22002	0.24397	0.84207	-0.07727	0.16468	0.32300	0.49046	0.10432	-0.24019
Murmansk/L.pool	0.09880	0.02811	-0.16676	0.28784	0.86165	-0.03026	0.16599	0.37215	0.51088	0.15426	-0.18487
Atlantic RV	-0.38593	-0.28556	-0.35410	0.11804	0.78991	0.03966	0.20199	0.27912	0.37740	-0.18914	-0.29105
Pacific RV	-0.42466	-0.29935	-0.33728	0.11602	0.76963	-0.23149	0.36959	0.03994	0.48992	-0.15644	-0.49065
TCT Cont/ F.East (Handysize)	-0.42283	-0.33110	-0.19321	0.28121	0.85259	0.06165	0.14822	0.45413	0.41665	-0.09047	-0.12243

Table 23: **Hypothesis 2, Correlation between the debt-equity ratio and the dry bulk freight rates** (Datastream and Fearnleys).

Correlation - Market debt-equity ratio, Tanker freight rates Datastream, Fearnleys												
Voyage/company	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
MEG/WEST	-0.26820	-0.55618	-0.41140	0.09327	-0.29860	0.20151	-0.12468	0.16812	-0.13445	-0.50123	-0.10524	0.26032	0.44854
MEG/JPN	-0.32101	-0.48268	-0.35266	0.05752	-0.26822	0.19738	-0.16560	0.13381	-0.15092	-0.46546	-0.12188	0.21576	0.38990
MEG/SPORE	-0.52964	-0.48684	-0.36268	0.03364	-0.25808	0.16236	-0.29242	-0.00541	-0.27075	-0.47245	-0.33588	0.23218	0.40034
WAF/USG	-0.28499	-0.60060	-0.42553	0.12574	-0.30230	0.10622	-0.13226	0.17859	-0.22049	-0.67046	-0.14472	0.32173	0.24768
WAF/USAC	-0.33714	-0.68876	-0.52548	0.50096	-0.11376	0.25442	0.04244	0.17367	-0.15058	-0.77894	-0.15499	0.61945	0.38793
Sidi Kerir/W Med	-0.61093	-0.54320	-0.19571	0.57141	-0.13453	0.24071	0.01728	0.48318	-0.15715	-0.36009	-0.26871	0.59529	0.64506
NAF/EUROMED	-0.45581	-0.94092	-0.51051	-0.09342	-0.69504	-0.06530	-0.18664	0.78904	-0.44686	-0.59558	-0.35597	0.13003	0.28862
UK/CONT	-0.53758	-0.87407	-0.55459	0.31676	-0.42703	0.06683	-0.18744	0.74800	-0.35725	-0.54778	-0.40754	0.44707	0.52547
CARIBS/USG	-0.40066	-0.82033	-0.91302	0.13503	-0.17377	-0.37037	-0.17401	-0.02179	-0.40946	-0.76147	-0.14354	0.25291	0.21027
MEG/Japan (75' dwt)	-0.53355	-0.90535	-0.49537	-0.47233	-0.13246	-0.54843	-0.32257	0.33315	-0.26172	0.04343	0.03831	-0.47040	0.25608
MEG/Japan (55' dwt)	0.13661	-0.90308	-0.28637	-0.33484	-0.68275	-0.00410	0.05108	0.48415	-0.21522	-0.63378	-0.12421	-0.12866	-0.07925
MEG/Japan (30' dwt)	-0.29198	-0.94395	-0.55094	-0.29699	-0.74241	-0.07378	-0.10634	0.74459	-0.38000	-0.64717	-0.25524	-0.01780	0.27396
Singapore/Japan (30' dwt)	0.06841	-0.92341	-0.48153	-0.38132	-0.75778	0.00433	0.00890	0.58538	-0.18793	-0.67891	-0.12533	-0.11843	0.06948
Baltic T/A (60' dwt)	-0.89734	-0.85894	-0.81506	-1.00000	-0.81542	-0.74073	-0.64998	0.90567	-0.76901	-0.68063	-0.89060	-0.75551	0.44732
UKC-Med/States (37' dwt)	0.11228	-0.77448	-0.47303	0.00431	-0.56754	0.16884	0.07202	0.52802	-0.02629	-0.61429	-0.08816	0.16731	0.14775
Caribs/USNH (38' dwt)	-0.85873	-0.75997	-0.44727	-0.01187	-0.43522	-0.23663	-0.00316	0.67879	-0.54807	-0.66600	-0.35841	0.18522	0.14303

Table 24: **Hypothesis 2, Correlation between the debt-equity ratio and the tanker freight rates** (Datastream and Fearnleys).

Correlation - Average owned vessels, Freight rates Annual reports, Fearnleys			
Tanker voyages	Correlation	Dry bulk voyages	Correlation
MEG/WEST	-0.39471	TCT Cont/Far East (172' dwt)	0.07088
MEG/JPN	-0.42631	Tubarao/R.dam (Iron ore)	0.07924
MEG/SPORE	-0.46335	Richards Bay/R.dam	0.04988
WAF/USG	-0.30815	Transatlantic RV	0.13140
WAF/USAC	-0.45727	TCT Cont/F.East	0.14889
Sidi Kerir/W Med	-0.29727	TCT F.East/Cont	0.05463
NAF/EUROMED	-0.05399	TCT F.East RV	0.09087
UK/CONT	-0.21556	Murmansk/Ara	-0.40201
CARIBS/USG	-0.07529	Murmansk/L.pool	-0.35948
MEG/Japan (75' dwt)	0.28179	Atlantic RV	0.03327
MEG/Japan (55' dwt)	0.16952	Pacific RV	0.08812
MEG/Japan (30' dwt)	0.02677	TCT Cont/ F.East (Handysize)	0.14255
Singapore/Japan (30' dwt)	0.17653		
Baltic T/A (60' dwt)	0.28363		
UKC-Med/States (37' dwt)	0.09344		
Caribs/USNH (38' dwt)	0.10069		

Table 25: **Hypothesis 3, Correlation between average owned vessels and freight rates** (Datastream and Fearnleys).

Correlation - Beta, Dry bulk freight rates Datastream, Fearnleys											
Voyage/company	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA
TCT Cont/Far East (172' dwt)	0.39448	0.11980	-0.08801	-0.35712	-0.96764	-0.09651	0.29682	-0.70874	-0.39915	-0.03764	-0.15101
Tubarao/R.dam (Iron ore)	0.40871	0.14609	-0.04897	-0.32321	-0.95038	-0.05729	0.32183	-0.67711	-0.36148	-0.00308	-0.11538
Richards Bay/R.dam	0.36986	0.07673	-0.26663	-0.52489	-0.98916	-0.18504	0.24175	-0.79493	-0.47128	-0.10254	-0.33030
Transatlantic RV	0.44625	0.21588	0.10893	-0.17428	-0.86335	0.05027	0.37463	-0.53927	-0.21538	0.08811	0.03478
TCT Cont/F.East	0.52241	0.30044	0.16561	-0.11399	-0.86961	0.13981	0.46493	-0.52710	-0.21809	0.17519	0.09706
TCT F.East/Cont	0.19426	-0.07798	-0.22725	-0.49820	-0.96381	-0.28987	0.07614	-0.72873	-0.34916	-0.22792	-0.29874
TCT F.East RV	0.25616	0.00017	-0.10442	-0.38324	-0.92557	-0.19954	0.15216	-0.65961	-0.30140	-0.14312	-0.17956
Murmansk/Ara	0.29774	-0.25145	0.08841	-0.19709	-0.89406	-0.22014	0.10083	-0.55581	-0.22190	-0.21881	0.01936
Murmansk/L.pool	0.32877	-0.20738	0.14988	-0.13658	-0.86846	-0.16249	0.13874	-0.50793	-0.17527	-0.17140	0.08118
Atlantic RV	0.53287	0.27470	-0.01136	-0.28216	-0.95106	0.06758	0.45643	-0.67015	-0.36690	0.15513	-0.07463
Pacific RV	0.36295	0.08428	-0.16521	-0.44372	-0.94402	-0.14713	0.22693	-0.67326	-0.28041	-0.05954	-0.23847
TCT Cont/ F.East (Handysize)	0.53851	0.30990	0.19184	-0.08251	-0.87871	0.14975	0.47255	-0.52783	-0.22851	0.18420	0.12804

Table 26: **Hypothesis 4, Correlation between beta and dry bulk freight rates** (Datastream and Fearnleys).

Correlation - Beta, Tanker freight rates Datastream, Fearnleys												
Voyage/company	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
MEG/WEST	0.05132	-0.58423	-0.44286	0.04125	-0.30768	-0.23587	-0.29100	-0.29421	-0.41755	-0.11934	-0.42442	-0.44686	-0.55802
MEG/JPN	0.12591	-0.61988	-0.38580	0.13574	-0.26549	-0.16235	-0.17040	-0.17145	-0.29647	-0.07224	-0.31574	-0.37113	-0.43642
MEG/SPORE	0.02019	-0.62091	-0.39129	0.03157	-0.28616	-0.33416	-0.30308	-0.28432	-0.50588	-0.07874	-0.47063	-0.38983	-0.45735
WAF/USG	0.06709	-0.65876	-0.55735	0.11800	-0.39002	-0.23482	-0.23063	-0.23129	-0.30669	0.08270	-0.36324	-0.46455	-0.56214
WAF/USAC	-0.19816	-0.55935	-0.62079	-0.12941	-0.38755	-0.46966	-0.42845	-0.42106	-0.47509	0.11041	-0.52683	-0.75946	-0.82527
Sidi Kerir/W Med	-0.44796	0.11257	-0.10505	-0.28177	-0.11767	-0.55644	-0.54570	-0.55785	-0.78701	0.26970	-0.66964	-0.86763	-0.83597
NAF/EUROMED	-0.40257	0.27824	-0.65240	-0.09576	-0.06364	-0.47159	-0.52953	-0.56020	-0.45127	-0.02025	-0.59367	-0.41307	-0.65890
UK/CONT	-0.44980	0.40803	-0.56565	-0.22874	-0.18066	-0.55324	-0.59297	-0.61226	-0.53646	-0.10636	-0.67059	-0.64577	-0.71904
CARIBS/USG	0.24383	-0.52995	-0.97919	0.19538	-0.83589	-0.19333	-0.18994	-0.15548	-0.13861	-0.68430	-0.28639	-0.29199	-0.60429
MEG/Japan (75' dwt)	0.76431	0.04220	-0.59673	0.80485	-0.32464	0.69664	0.65609	0.67060	0.64854	-0.88426	0.52733	0.44029	0.47963
MEG/Japan (55' dwt)	-0.39399	0.04012	-0.59624	-0.16237	0.09409	-0.35526	-0.50612	-0.52729	-0.49879	0.40774	-0.53128	-0.23746	-0.55553
MEG/Japan (30' dwt)	-0.34600	0.06261	-0.64864	-0.07687	-0.07940	-0.40333	-0.53017	-0.55144	-0.50560	-0.03507	-0.60256	-0.35553	-0.67539
Singapore/Japan (30' dwt)	-0.35148	0.17448	-0.62605	-0.18631	0.00804	-0.31526	-0.55046	-0.57057	-0.53525	0.16236	-0.57836	-0.26773	-0.58200
Baltic T/A (60' dwt)	-0.50694	0.27285	-0.66952	-0.24213	-0.46032	-0.74101	-0.98520	-0.93227	-0.79205	-0.69547	-0.94313	-0.36722	-0.62095
UKC-Med/States (37' dwt)	-0.41317	0.47401	-0.52649	-0.36429	-0.02206	-0.35120	-0.62989	-0.65039	-0.59228	0.14650	-0.62038	-0.44520	-0.61962
Caribs/USNH (38' dwt)	-0.39967	0.39607	-0.49163	0.01388	-0.17693	-0.43933	-0.39055	-0.38460	-0.33641	0.27254	-0.47395	-0.51271	-0.71248

Table 27: **Hypothesis 4, Correlation between beta and tanker freight rates** (Datastream and Fearnleys).

Correlation - Shareprice, Dry bulk freight rates Datastream, Fearnleys											
Voyage/company	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA
TCT Cont/Far East (172' dwt)	0.87976	0.88248	0.92353	0.91110	0.85966	0.87077	0.61087	0.74233	0.89399	0.87098	0.83437
Tubarao/R.dam (Iron ore)	0.86921	0.87234	0.90969	0.88897	0.84099	0.85415	0.61269	0.72441	0.88240	0.86234	0.79880
Richards Bay/R.dam	0.89534	0.84048	0.91559	0.92619	0.90965	0.87497	0.50411	0.82237	0.86343	0.84502	0.89282
Transatlantic RV	0.89705	0.88105	0.92309	0.89907	0.86979	0.86562	0.63309	0.73412	0.90876	0.88906	0.79515
TCT Cont/F.East	0.88039	0.89694	0.91274	0.87879	0.82022	0.83702	0.67897	0.65292	0.91759	0.89083	0.76072
TCT F.East/Cont	0.87035	0.75556	0.86061	0.87273	0.88669	0.83426	0.46218	0.79776	0.83945	0.80013	0.81650
TCT F.East RV	0.87404	0.81270	0.87993	0.87110	0.86022	0.83535	0.56213	0.74382	0.88006	0.84004	0.78303
Murmansk/Ara	0.79119	0.81239	0.85340	0.83901	0.76129	0.77720	0.49781	0.65741	0.84536	0.79657	0.74926
Murmansk/L.pool	0.78819	0.80978	0.84664	0.82858	0.74555	0.76727	0.51501	0.63594	0.84554	0.79581	0.72996
Atlantic RV	0.88106	0.93656	0.91375	0.88865	0.86022	0.85849	0.71502	0.71155	0.91814	0.92609	0.78423
Pacific RV	0.88608	0.85897	0.87062	0.87834	0.88005	0.86539	0.57787	0.79652	0.87201	0.88429	0.82153
TCT Cont/ F.East (Handysize)	0.85708	0.90322	0.87412	0.83367	0.74207	0.79963	0.70400	0.58397	0.89597	0.88641	0.70817

Table 28: **Hypothesis 5, Correlation between share prices and dry bulk freight rates** (Datastream and Fearnleys).

Correlation - Shareprice, Tanker freight rates Datastream, Fearnleys												
Voyage/company	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
MEG/WEST	0.19037	0.42181	0.60905	0.28130	0.49522	0.02734	0.43982	0.19116	0.29516	0.39426	0.35222	0.26679	0.25493
MEG/JPN	0.17757	0.33775	0.51880	0.34427	0.42987	0.13843	0.39700	0.22638	0.33800	0.39056	0.36879	0.25296	0.28539
MEG/SPORE	0.10120	0.35063	0.52863	0.32852	0.37445	0.05301	0.36953	0.13449	0.32045	0.39309	0.36106	0.22353	0.23135
WAF/USG	0.21238	0.35910	0.52895	0.34019	0.49280	0.10289	0.42430	0.24518	0.32954	0.34612	0.35999	0.25628	0.25999
WAF/USAC	0.22040	0.41289	0.56233	0.30631	0.50390	0.05358	0.42924	0.21983	0.31267	0.37432	0.35225	0.27885	0.25271
Sidi Kerir/W Med	0.15168	0.37460	0.53169	0.32546	0.41790	0.04645	0.37847	0.18539	0.31946	0.38194	0.36641	0.23687	0.21572
NAF/EUROMED	0.13152	0.40255	0.49439	0.14114	0.38181	-0.08845	0.33083	0.07454	0.16897	0.34613	0.23433	0.17956	0.12357
UK/CONT	0.10594	0.39945	0.49994	0.10699	0.36028	-0.09972	0.28320	0.01621	0.13977	0.40728	0.19549	0.19534	0.13011
CARIBS/USG	0.17362	0.42800	0.51643	0.18874	0.45789	-0.04524	0.35902	0.11491	0.21653	0.37945	0.26445	0.24382	0.18394
MEG/Japan (75' dwt)	0.08512	0.24650	0.50242	0.62765	0.35394	0.28886	0.49780	0.26086	0.48159	0.42321	0.23637	0.39705	0.48777
MEG/Japan (55' dwt)	0.18743	0.42317	0.59478	0.12601	0.48474	-0.19659	0.42016	0.08883	0.15362	0.32300	0.18154	0.26181	0.14881
MEG/Japan (30' dwt)	0.38081	0.60568	0.71328	0.28259	0.62126	-0.08020	0.54553	0.24392	0.34147	0.42351	0.39376	0.41868	0.25941
Singapore/Japan (30' dwt)	0.25710	0.58390	0.65048	0.05075	0.53934	-0.28621	0.42048	0.05621	0.11846	0.31869	0.20224	0.26346	0.07514
Baltic T/A (60' dwt)	0.24399	0.44129	0.64296	0.70615	0.54735	0.24398	0.66483	0.40486	0.62691	0.59838	0.33996	0.50217	0.56260
UKC-Med/States (37' dwt)	0.41872	0.68140	0.76644	0.28203	0.66144	-0.07248	0.56232	0.25660	0.35624	0.53971	0.41774	0.45007	0.28277
Caribs/USNH (38' dwt)	0.39310	0.64861	0.75931	0.33360	0.67173	-0.07758	0.59336	0.28265	0.40593	0.51525	0.44075	0.43111	0.26731

Table 29: **Hypothesis 5, Correlation between share prices and tanker freight rates** (Datastream and Fearnleys).

Correlation - Freight rates, OSLSHX Fearnleys, Oslo Stock Exchange			
Tanker voyages	Correlation	Dry bulk voyages	Correlation
MEG/WEST	0.50026	TCT Cont/Far East (172' dwt)	0.64298
MEG/JPN	0.45373	Tubarao/R.dam (Iron ore)	0.63368
MEG/SPORE	0.46169	Richards Bay/R.dam	0.74216
WAF/USG	0.42806	Transatlantic RV	0.65728
WAF/USAC	0.45869	TCT Cont/F.East	0.58390
Sidi Kerir/W Med	0.42666	TCT F.East/Cont	0.76338
NAF/EUROMED	0.41066	TCT F.East RV	0.70014
UK/CONT	0.44638	Murmansk/Ara	0.58670
CARIBS/USG	0.44120	Murmansk/L.pool	0.57475
MEG/Japan (75' dwt)	0.37530	Atlantic RV	0.62612
MEG/Japan (55' dwt)	0.41552	Pacific RV	0.75942
MEG/Japan (30' dwt)	0.55323	TCT Cont/ F.East (Handysize)	0.52024
Singapore/Japan (30' dwt)	0.48219		
Baltic T/A (60' dwt)	0.51376		
UKC-Med/States (37' dwt)	0.60996		
Caribs/USNH (38' dwt)	0.57907		

Table 30: **Hypothesis 5, Correlation between freight rates and OSLSHX** (Fearnleys and Oslo Stock Exchange).

Correlation - Interest rate, Freight rates Fearnleys, U.S. Federal Reserve			
Tanker voyages	Correlation	Dry bulk voyages	Correlation
MEG/WEST	0.17997	TCT Cont/Far East (172' dwt)	-0.21613
MEG/JPN	0.09141	Tubarao/R.dam (Iron ore)	-0.21519
MEG/SPORE	0.26644	Richards Bay/R.dam	-0.13007
WAF/USG	0.09964	Transatlantic RV	-0.19994
WAF/USAC	0.14417	TCT Cont/F.East	-0.28772
Sidi Kerir/W Med	0.15015	TCT F.East/Cont	-0.04659
NAF/EUROMED	0.16071	TCT F.East RV	-0.14400
UK/CONT	0.23804	Murmansk/Ara	0.18419
CARIBS/USG	0.18129	Murmansk/L.pool	0.16567
MEG/Japan (75' dwt)	0.28638	Atlantic RV	-0.25804
MEG/Japan (55' dwt)	0.28326	Pacific RV	-0.13099
MEG/Japan (30' dwt)	0.28746	TCT Cont/ F.East (Handysize)	-0.34430
Singapore/Japan (30' dwt)	0.37695		
Baltic T/A (60' dwt)	0.40759		
UKC-Med/States (37' dwt)	0.26200		
Caribs/USNH (38' dwt)	0.38020		

Table 31: **Hypothesis 6, Correlation between freight rates and interest rate** (Fearnleys and U.S. Federal Reserve)

Correlation - Return on equity, Dry bulk freight rates Datastream, Fearnleys											
Voyage/company	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA
TCT Cont/Far East (172' dwt)	0.92292	0.08940	0.26639	0.46060	0.12461	0.27644	0.24827	-0.08853	0.03203	0.03771	-0.04292
Tubarao/R.dam (Iron ore)	0.91685	0.07014	0.25234	0.41774	0.09152	0.28451	0.26241	-0.10867	0.00116	0.00646	-0.08452
Richards Bay/R.dam	0.93161	0.14404	0.30596	0.50776	0.22609	0.25677	0.27945	-0.15687	0.10261	0.09216	0.05773
Transatlantic RV	0.90143	0.05012	0.24682	0.33328	0.04217	0.33443	0.23524	-0.14307	-0.11813	-0.03997	-0.18163
TCT Cont/F.East	0.89510	-0.00890	0.18549	0.31036	-0.05378	0.26310	0.28023	-0.08975	-0.10924	-0.02551	-0.27539
TCT F.East/Cont	0.87248	0.18329	0.36542	0.45327	0.32512	0.44918	0.15005	-0.27110	-0.02434	-0.02890	0.17881
TCT F.East RV	0.88102	0.13839	0.32963	0.41709	0.25633	0.44732	0.17375	-0.21750	-0.06598	-0.04228	0.08966
Murmansk/Ara	0.89801	0.00328	0.20560	0.24248	0.01147	0.28468	-0.20487	-0.16707	-0.12437	-0.38122	-0.27296
Murmansk/L.pool	0.87961	-0.00906	0.19690	0.20542	-0.02310	0.29377	-0.21400	-0.16802	-0.16076	-0.42180	-0.31946
Atlantic RV	0.87752	-0.09727	0.08151	0.33161	-0.07245	0.06553	0.31785	-0.07123	0.01575	0.03608	-0.29972
Pacific RV	0.91902	0.10087	0.29764	0.42044	0.25829	0.32037	0.20668	-0.30937	-0.09022	0.01158	-0.00092
TCT Cont/ F.East (Handysize)	0.89584	0.00120	0.19387	0.34659	-0.04765	0.21811	0.25524	-0.03651	-0.10392	0.00785	-0.29573

Table 32: **Hypothesis 7, Correlation between return on equity and dry bulk freight rates** (Datastream and Fearnleys).

Correlation - Return on equity, Tanker freight rates Datastream, Fearnleys												
Voyage/company	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
MEG/WEST	0.05865	0.46032	-0.13259	0.24099	0.31705	0.04325	0.62951	0.18817	0.14991	-0.10165	0.27094	0.71108	0.15891
MEG/JPN	-0.08465	0.42581	-0.16219	0.17270	0.20744	0.08418	0.54848	0.05872	0.04930	-0.18504	0.14580	0.64795	0.05412
MEG/SPORE	-0.05852	0.42904	-0.15543	0.18882	0.25283	0.06474	0.53286	0.13165	0.06937	0.05219	0.25438	0.72002	0.07763
WAF/USG	0.09806	0.57457	0.14890	0.32966	0.35879	0.19760	0.63793	0.31415	0.31670	-0.06300	0.24817	0.66566	0.38181
WAF/USAC	0.23747	0.57042	0.30188	0.01865	0.42484	0.06966	0.56810	0.57098	0.37410	0.06241	0.33111	0.70700	0.41182
Sidi Kerir/W Med	0.28803	-0.03381	-0.11762	0.22661	0.44502	-0.00295	0.48010	0.55186	0.38348	0.49567	0.69103	0.61686	0.39331
NAF/EUROMED	0.33551	0.81579	0.44660	0.43333	0.71503	0.40720	0.55209	0.59647	0.66786	-0.04965	0.52940	0.62030	0.69739
UK/CONT	0.23248	0.80609	0.41213	-0.03104	0.63631	0.25894	0.44024	0.69756	0.57001	0.16554	0.45198	0.56773	0.56733
CARIBS/USG	0.48461	0.95113	0.52646	0.69826	0.53071	0.30429	0.84941	0.63415	0.59977	0.29498	0.12448	0.68149	0.76626
MEG/Japan (75' dwt)	-0.35119	0.54605	-0.31861	0.49741	-0.28138	0.33861	0.28813	-0.50038	-0.21221	-0.24903	-0.57450	-0.17361	0.07817
MEG/Japan (55' dwt)	0.50991	0.54300	0.40655	0.47287	0.62022	0.19560	0.54070	0.46772	0.59734	-0.13174	0.67849	0.50250	0.61432
MEG/Japan (30' dwt)	0.44052	0.64086	0.30557	0.77784	0.69290	0.30900	0.67499	0.51325	0.62539	-0.10859	0.60554	0.67147	0.68028
Singapore/Japan (30' dwt)	0.47046	0.64812	0.44777	0.55580	0.64780	0.14646	0.58104	0.49627	0.55879	-0.14413	0.63119	0.47664	0.67645
Baltic T/A (60' dwt)	0.53267	0.80718	0.57260	-1.00000	0.52309	0.49850	0.54635	0.75822	0.71831	0.33077	0.29747	0.45576	0.93401
UKC-Med/States (37' dwt)	0.39357	0.79043	0.60063	0.00096	0.60414	-0.01072	0.37365	0.64229	0.47557	-0.04777	0.55274	0.32550	0.61360
Caribs/USNH (38' dwt)	0.52787	0.50520	0.57463	0.47978	0.57776	0.46562	0.58218	0.66354	0.74607	0.11278	0.53132	0.54297	0.82328

Table 33: **Hypothesis 7, Correlation between return on equity and tanker freight rates** (Datastream and Fearnleys).

Correlation - Return on invested capital, Dry bulk freight rates Datastream, Fearnleys											
Voyage/company	Belships	Dampskibsselskabet NORDEN A/S	Diana Shipping	Dryship Inc	Euroseas	Excel Maritime Carriers	First Steamship	Freeseas	Golden Ocean	Jinhui Shipping and Transportation	Wilson ASA
TCT Cont/Far East (172' dwt)	0.94232	0.01229	0.61194	0.55250	0.09390	0.26357	0.21446	-0.06384	-0.04015	0.03472	-0.16160
Tubarao/R.dam (Iron ore)	0.93315	-0.03223	0.58389	0.51004	0.05141	0.26328	0.22822	-0.09161	-0.06450	0.00248	-0.22531
Richards Bay/R.dam	0.94406	0.03907	0.62570	0.59594	0.15627	0.26726	0.24235	-0.09823	-0.03080	0.08671	-0.04189
Transatlantic RV	0.90295	-0.10862	0.54058	0.41663	-0.01530	0.30027	0.19806	-0.14694	-0.17205	-0.03744	-0.37949
TCT Cont/F.East	0.90816	-0.12414	0.49399	0.41741	-0.06839	0.22827	0.23914	-0.11471	-0.10642	-0.03070	-0.41622
TCT F.East/Cont	0.87215	0.02881	0.67031	0.48922	0.22462	0.42065	0.13133	-0.19972	-0.21353	-0.01559	-0.09196
TCT F.East RV	0.87915	-0.02688	0.64763	0.46431	0.14897	0.40604	0.15399	-0.16408	-0.24014	-0.02717	-0.17979
Murmansk/Ara	0.93000	-0.11335	0.52712	0.28616	-0.01361	0.17212	-0.20326	-0.17562	-0.14411	-0.35466	-0.37156
Murmansk/L.pool	0.91828	-0.12500	0.50827	0.24371	-0.03270	0.17226	-0.21422	-0.18962	-0.15491	-0.39314	-0.42411
Atlantic RV	0.92112	-0.16569	0.44653	0.46878	-0.10518	0.04659	0.28434	-0.07119	-0.00833	0.02028	-0.27551
Pacific RV	0.91732	-0.06355	0.61757	0.49174	0.14870	0.31086	0.18167	-0.25012	-0.25649	0.02635	-0.16513
TCT Cont/ F.East (Handysize)	0.92441	-0.07546	0.52333	0.45700	-0.03527	0.19906	0.21430	-0.06556	-0.08750	0.00706	-0.37734

Table 34: **Hypothesis 7, Correlation between return on invested capital and dry bulk freight rates** (Datastream and Fearnleys).

Correlation - Return on invested capital, Tanke freight rates Datastream, Fearnleys													
Voyage/company	Concordia Maritime	DHT Holdings Inc	Euronav	Frontline	General Maritime Corporation	Great Eastern Shipping Company	Knightsbridge Tankers Limited	Nordic American Tanker Shipping	Overseas Shipholding Group	Ship Finance	TeeKay Corporation	Torm	Tsakos Energy Navigation
MEG/WEST	0.04884	0.16618	-0.08248	-0.21053	0.28618	0.01060	0.61903	0.05177	0.16164	0.06315	0.15784	0.67576	0.14279
MEG/JPN	-0.07879	0.13360	-0.11367	-0.40299	0.16840	0.05831	0.53389	-0.06761	0.07225	-0.04681	0.00910	0.60418	0.05019
MEG/SPORE	-0.05795	0.14340	-0.10661	-0.35497	0.18203	0.04320	0.51892	-0.02117	0.08292	0.13859	0.15048	0.67060	0.06946
WAF/USG	0.08389	0.34142	0.19194	0.16332	0.39746	0.13837	0.61265	0.22294	0.33740	0.13401	0.17682	0.64270	0.37355
WAF/USAC	0.23840	0.44834	0.34341	0.14825	0.48116	-0.02165	0.55545	0.51706	0.39267	0.33844	0.25738	0.69589	0.36303
Sidi Kerir/W Med	0.27737	-0.21792	-0.08788	0.36120	0.56373	-0.14808	0.46460	0.45429	0.41775	0.69468	0.48769	0.64573	0.38838
NAF/EUROMED	0.37681	0.53258	0.46440	0.86148	0.82179	0.29766	0.50386	0.46838	0.71515	0.19989	0.43842	0.66746	0.73213
UK/CONT	0.25586	0.60035	0.42726	0.28750	0.73158	0.15252	0.39276	0.56552	0.60603	0.38795	0.35616	0.59188	0.54765
CARIBS/USG	0.44745	0.92717	0.56724	0.74857	0.55297	0.30978	0.83898	0.61040	0.54362	0.40335	0.33188	0.66140	0.63889
MEG/Japan (75' dwt)	-0.32398	0.30550	-0.28820	0.03029	-0.24784	0.42356	0.32041	-0.47682	-0.21145	-0.40542	-0.59622	-0.19401	0.05261
MEG/Japan (55' dwt)	0.50375	0.31369	0.42188	0.71304	0.78326	0.08364	0.49188	0.42049	0.63876	0.15249	0.61778	0.57420	0.70034
MEG/Japan (30' dwt)	0.46450	0.34314	0.33778	0.85186	0.80854	0.20862	0.64989	0.40536	0.66603	0.15609	0.51682	0.72609	0.72368
Singapore/Japan (30' dwt)	0.44887	0.46218	0.46853	0.75824	0.80657	0.05187	0.53835	0.42629	0.59140	0.12629	0.58938	0.53782	0.74614
Baltic T/A (60' dwt)	0.68302	0.88442	0.59330		0.78121	0.41294	0.49479	0.67482	0.80274	0.82546	0.68611	0.50556	0.97065
UKC-Med/States (37' dwt)	0.34616	0.91979	0.60474	0.83687	0.76095	-0.10041	0.32154	0.57731	0.49639	0.22096	0.54447	0.37029	0.64736
Caribs/USNH (38' dwt)	0.56130	0.75598	0.58356	0.97994	0.81052	0.30126	0.55219	0.67072	0.80198	0.40754	0.46937	0.62751	0.84116

Table 35: **Hypothesis 7, Correlation between return on invested capital and tanker freight rates** (Datastream and Fearnleys).

Correlation - Dry bulk freight rates, Tanker freight rates Fearnleys																
	MEG/WEST	MEG/JPN	MEG/SPORE	WAF/USG	WAF/USAC	Sidi Kerir/ W Med	NAF/ EUROMED	UK/CONT	CARIBS/USG	MEG/Japan (75' dwt)	MEG/Japan (55' dwt)	MEG/Japan (30' dwt)	Singapore/Japan (30' dwt)	Baltic T/A (60' dwt)	UKC-Med/States (37' dwt)	Caribs/USNH (38' dwt)
TCT Cont/Far East (172' dwt)	0.32967	0.38910	0.37018	0.35281	0.31361	0.34994	0.19377	0.18443	0.20901	0.42064	0.09532	0.22890	0.01696	0.49216	0.23938	0.28124
Tubarao/R.dam (Iron ore)	0.33078	0.39287	0.36756	0.36003	0.32029	0.34949	0.19199	0.19137	0.21276	0.44245	0.09908	0.22495	0.01442	0.50480	0.24284	0.28349
Richards Bay/R.dam	0.39645	0.43471	0.41984	0.41763	0.39231	0.42169	0.26957	0.26315	0.31141	0.51861	0.18102	0.32915	0.11960	0.60892	0.34753	0.39376
Transatlantic RV	0.29787	0.35877	0.33446	0.32535	0.29026	0.32574	0.17726	0.16547	0.17855	0.31782	0.04439	0.18424	-0.01847	0.42022	0.22889	0.26724
TCT Cont/F.East	0.27889	0.34551	0.32073	0.31241	0.26779	0.30995	0.15033	0.13702	0.16557	0.39742	0.02948	0.15808	-0.05374	0.45738	0.19150	0.22846
TCT F.East/Cont	0.37440	0.40793	0.38376	0.38181	0.36371	0.38275	0.26256	0.26326	0.29235	0.35987	0.13869	0.29563	0.11744	0.44312	0.32755	0.35947
TCT F.East RV	0.32942	0.38033	0.35347	0.35108	0.31902	0.35278	0.22069	0.21154	0.23752	0.34060	0.07630	0.22243	0.02975	0.40974	0.25195	0.28338
Murmansk/Ara	0.31345	0.34291	0.33790	0.29520	0.27155	0.30510	0.26159	0.29668	0.23740	0.40697	0.17540	0.21058	0.09064	0.46386	0.23670	0.23617
Murmansk/L.pool	0.30020	0.33256	0.32716	0.28302	0.25768	0.29122	0.24985	0.28669	0.22336	0.40361	0.16415	0.19508	0.07572	0.44962	0.21694	0.21650
Atlantic RV	0.22952	0.30020	0.26466	0.25053	0.21112	0.23424	0.09400	0.08928	0.12345	0.38177	-0.00033	0.13375	-0.08157	0.44794	0.14973	0.16875
Pacific RV	0.31536	0.36579	0.34371	0.33994	0.31071	0.34593	0.20370	0.19143	0.22670	0.41717	0.09894	0.26089	0.05518	0.48666	0.27865	0.31377
TCT Cont/ F.East (Handysize)	0.23632	0.31137	0.28414	0.26286	0.21088	0.25087	0.08693	0.07410	0.10316	0.35328	-0.01987	0.10404	-0.10988	0.38014	0.12604	0.15970

Table 36: **Hypothesis 8, Correlation between dry bulk freight rates and tanker freight rates** (Fearnleys).

Correlation - Crude oil freight rates, Refined products freight rates Fearnleys									
	MEG/WEST	MEG/JPN	MEG/SPORE	WAF/USG	WAF/USAC	Sidi Kerir/ W Med	NAF/ EUROMED	UK/CONT	CARIBS/USG
MEG/Japan (75' dwt)	0.65935	0.58146	0.58305	0.63894	0.66850	0.59354	0.50319	0.57897	0.61611
MEG/Japan (55' dwt)	0.68549	0.58501	0.60004	0.63849	0.65906	0.61026	0.60034	0.60243	0.64109
MEG/Japan (30' dwt)	0.68339	0.59762	0.60051	0.64182	0.66349	0.61961	0.59727	0.59326	0.63375
Singapore/Japan (30' dwt)	0.63998	0.52766	0.54246	0.58072	0.60873	0.56226	0.57207	0.58311	0.61376
Baltic T/A (60' dwt)	0.66197	0.58887	0.59570	0.65451	0.71096	0.65588	0.61602	0.67150	0.66560
UKC-Med/States (37' dwt)	0.65034	0.56384	0.56547	0.63181	0.65734	0.61814	0.61381	0.60895	0.64452
Caribs/USNH (38' dwt)	0.69002	0.59967	0.60341	0.66356	0.68272	0.63542	0.60232	0.62899	0.66541

Table 37: **Hypothesis 8, Correlation between crude oil freight rates and refined products freight rates** (Fearnleys).

Correlation - Brent crude oil spot price, Freight rates Fearnleys, U.S. Energy Information Administration			
Tanker voyages	Correlation	Dry bulk voyages	Correlation
MEG/WEST	0.08869	TCT Cont/Far East (172' dwt)	0.74774
MEG/JPN	0.19365	Tubarao/R.dam (Iron ore)	0.75025
MEG/SPORE	0.10979	Richards Bay/R.dam	0.67547
WAF/USG	0.16569	Transatlantic RV	0.71977
WAF/USAC	0.11810	TCT Cont/F.East	0.77552
Sidi Kerir/W Med	0.11720	TCT F.East/Cont	0.54584
NAF/EUROMED	-0.00857	TCT F.East RV	0.63864
UK/CONT	-0.02604	Murmansk/Ara	0.64653
CARIBS/USG	-0.00021	Murmansk/L.pool	0.65180
MEG/Japan (75' dwt)	0.49632	Atlantic RV	0.79812
MEG/Japan (55' dwt)	-0.07348	Pacific RV	0.71218
MEG/Japan (30' dwt)	0.02811	TCT Cont/ F.East (Handysize)	0.80777
Singapore/Japan (30' dwt)	-0.18504		
Baltic T/A (60' dwt)	0.48144		
UKC-Med/States (37' dwt)	0.03330		
Caribs/USNH (38' dwt)	0.04071		

Table 38: **Hypothesis 9, Correlation between Brent crude oil spot price and freight rates** (Fearnleys and U.S. Energy Information Administration).

Correlation - Brent crude oil spot price, Stock price Datastream, U.S. Energy Information Administration			
Tanker companies	Correlation	Dry bulk companies	Correlation
Concordia Maritime	0.38305	Belships	0.64082
DHT Holdings Inc	0.00423	Dampskibsselskabet NORDEN A/S	0.87409
Euronav	0.23801	Diana Shipping	0.66709
Frontline	0.86363	Dryship Inc	0.64438
General Maritime Corporation	0.21965	Euroseas	0.48595
Great Eastern Shipping Company	0.93351	Excel Maritime Carriers	0.64187
Knightsbridge Tankers Limited	0.38080	First Steamship	0.77907
Nordic American Tanker Shipping	0.66648	Freeseas	0.40715
Overseas Shipholding Group	0.75797	Golden Ocean	0.74684
Ship Finance	0.51532	Jinhui Shipping and Transportation	0.81684
TeeKay Corporation	0.57514	Wilson ASA	0.55488
Torm	0.58189		
Tsakos Energy Navigation	0.75275		

Table 39: **Hypothesis 9, Correlation between Brent crude oil spot price and stock prices** (Datastream and U.S. Energy Information Administration).

Correlation - Brent crude oil spot price, Return on equity Datastream, U.S. Energy Information Administration			
Tanker companies	Correlation	Dry bulk companies	Correlation
Concordia Maritime	-0.26894	Belships	0.26053
DHT Holdings Inc	0.56787	Dampskibsselskabet NORDEN A/S	-0.65632
Euronav	0.39955	Diana Shipping	-0.77372
Frontline	0.76741	Dryship Inc	-0.04029
General Maritime Corporation	-0.36472	Euroseas	-0.75446
Great Eastern Shipping Company	0.47143	Excel Maritime Carriers	-0.53721
Knightsbridge Tankers Limited	0.19130	First Steamship	0.85501
Nordic American Tanker Shipping	-0.42206	Freeseas	0.29312
Overseas Shipholding Group	-0.08664	Golden Ocean	0.64535
Ship Finance	-0.25228	Jinhui Shipping and Transportation	0.46525
TeeKay Corporation	-0.71745	Wilson ASA	-0.53756
Torm	-0.26036		
Tsakos Energy Navigation	0.22185		

Table 40: **Hypothesis 9, Correlation between Brent crude oil spot price and return on equity** (Datastream and U.S. Energy Information Administration).

Correlation - Brent crude oil spot price, Return on invested capital Datastream, U.S. Energy Information Administration			
Tanker companies	Correlation	Dry bulk companies	Correlation
Concordia Maritime	-0.24657	Belships	0.29204
DHT Holdings Inc	0.94177	Dampskibsselskabet NORDEN A/S	-0.50297
Euronav	0.40985	Diana Shipping	-0.76482
Frontline	0.41786	Dryship Inc	0.22078
General Maritime Corporation	-0.29677	Euroseas	-0.72133
Great Eastern Shipping Company	0.54889	Excel Maritime Carriers	-0.51820
Knightsbridge Tankers Limited	0.25720	First Steamship	0.79240
Nordic American Tanker Shipping	-0.26843	Freeseas	0.22795
Overseas Shipholding Group	-0.08838	Golden Ocean	0.92567
Ship Finance	-0.40500	Jinhui Shipping and Transportation	0.37065
TeeKay Corporation	-0.57529	Wilson ASA	0.02770
Torm	-0.27748		
Tsakos Energy Navigation	0.19929		

Table 41: **Hypothesis 9, Correlation between Brent crude oil spot price and return on invested capital** (Datastream and U.S. Energy Information Administration).

Appendix F – Regression models

Validation of regression models						
Hypothesis	Regression	α	k	n	$F_{(\alpha,k,n-k-1)}$	F
1	DebtLevel	0.05	25	171	1.57	39.19
2	D/E	0.05	30	109	1.56	99.36
4	Beta	0.05	31	142	1.53	2.99
5	StockPrice	0.05	28	108	1.58	11.75
6	FreightRate	0.05	30	14558	1.46	730.72
7	ROE	0.05	31	143	1.53	5.30
7	ROIC	0.05	31	136	1.54	5.52

Table 42: **Validation of the regression models**.

Hypothesis 1 – DebtLevel regression model:

```
DebtLevel = 0.293 - 0.00100 [MarketBook] + 0.112 [AssetTangibility] + 0.0086 [BLE]
          - 0.212 [DNORD] - 0.0085 [DSX] - 0.209 [DRYS] - 0.186 [ESEA] - 0.0492 [EXM]
          - 0.0866 [2601] - 0.0643 [FREE] + 0.0215 [GOGL] - 0.0548 [JIN]
          - 0.0226 [WILS] - 0.129 [CCOR B] - 0.0100 [DHT] - 0.0025 [EURN]
          - 0.0353 [FRO] - 0.0866 [GMR] - 0.0509 [500620] - 0.107 [VLCCF]
          - 0.283 [NAT] - 0.0579 [OSG] + 0.352 [SFL] - 0.0534 [TK] - 0.0107 [TRMD]

S = 0.0740856   R-Sq = 85.1%   R-Sq(adj) = 83.0%

Analysis of Variance
Source           DF       SS       MS      F      P
Regression       25  5.37781  0.21511  39.19  0.000
Residual Error  171  0.93856  0.00549
Total           196  6.31637
```

Hypothesis 2 – D/E regression model:

```
D/E = 1.59 + 0.00832 [MarketBook] + 0.876 [AssetTangibility] - 0.000488 [StockPrice]
    - 1.90 [Owned] + 0.000007 [TCT Cont/Far East (172' dwt)]
    - 0.071 [Tubarao/R.dam (iron ore)] + 0.0177 [Richard Bay/R.dam]
    + 0.000007 [Transatlantic RV] - 0.00064 [UKC-Med/States] + 0.00035 [Caribs/USNH]
    + 0.084 [DryBulk] + 0.468 [BLE] - 0.252 [DNORD] - 0.065 [DSX] - 0.007 [DRYS]
    - 0.174 [ESEA] + 0.016 [EXM] - 0.191 [FREE] - 0.493 [GOGL] - 0.069 [CCOR B]
    + 0.043 [DHT] - 0.123 [EURN] + 0.215 [FRO] + 0.038 [GMR] - 0.129 [VLCCF]
    - 0.313 [NAT] + 0.066 [OSG] + 1.63 [SFL] - 0.061 [TK] + 0.116 [TRMD]

S = 0.255438   R-Sq = 96.5%   R-Sq(adj) = 95.5%

Analysis of Variance
Source           DF        SS      MS      F      P
Regression       30  194.5001  6.4833  99.36  0.000
Residual Error  109    7.1121  0.0652
Total           139  201.6122
```

Hypothesis 4 – Beta regression model:

```
Beta = - 0.51 + 0.062 [D/E] - 0.0157 [MarketBook]
      - 0.000103 [TCT Cont/Far East (172' dwt)] + 0.724 [Tubarao/R.dam (iron ore)]
      - 0.0594 [Richard Bay/R.dam] - 0.000074 [Transatlantic RV]
      - 0.00956 [UKC-Med/States] + 0.0103 [Caribs/USNH] - 1.15 [DryBulk] + 1.08 [BLE]
      + 1.30 [DNORD] + 1.30 [DSX] + 2.92 [DRYS] - 1.52 [ESEA] + 1.37 [EXM]
      + 1.47 [2601] + 1.47 [FREE] + 1.66 [GOGL] + 1.31 [JIN] - 0.197 [CCOR B]
      - 0.434 [DHT] - 0.484 [EURN] + 0.120 [FRO] + 0.055 [GMR] - 0.053 [500620]
      - 0.046 [VLCCF] - 0.453 [NAT] + 0.163 [OSG] + 0.224 [SFL] - 0.108 [TK]
      + 0.275 [TRMD]

S = 1.02454   R-Sq = 39.5%   R-Sq(adj) = 26.3%

Analysis of Variance
Source           DF       SS     MS     F      P
Regression       31   97.365  3.141  2.99  0.000
Residual Error  142  149.053  1.050
Total           173  246.419
```

Hypothesis 5 – StockPrice regression model:

```
StockPrice = 1.0 - 0.596 [OSLSHX] + 0.948 [Brent]
           + 0.000746 [TCT Cont/Far East (172' dwt)]
           - 3.03 [Tubarao/R.dam (iron ore)] + 0.100 [UKC-Med/States]
           - 2.4 [DryBulk] - 6.9 [BLE] + 228 [DNORD] - 4.9 [DSX] + 3.1 [DRYS]
           - 17.6 [ESEA] - 1.9 [EXM] + 12.6 [2601] - 4.8 [FREE] - 7.6 [GOGL]
           + 7.6 [JIN] + 10.5 [CCOR B] - 14.0 [DHT] - 2.1 [EURN] + 12.1 [FRO]
           - 1.7 [GMR] + 240 [500620] + 0.3 [VLCCF] + 11.5 [NAT] + 31.9 [OSG]
           - 2.5 [SFL] + 15.3 [TK] + 0.9 [TRMD]

S = 44.1324   R-Sq = 75.3%   R-Sq(adj) = 68.9%

Analysis of Variance
Source           DF      SS     MS      F      P
Regression       28  640908  22890  11.75  0.000
Residual Error  108  210348   1948
Total           136  851257
```

Hypothesis 6 – FreightRate regression model:

```
FreightRate = - 14340 + 70154 [InterestRate] + 212 [Brent] + 4521 [DryBulk]
              + 59825 [TCT Cont/Far East (172' dwt)]
              - 4323 [Tubarao/R.dam (iron ore)] - 4318 [Richard Bay/R.dam]
              + 22342 [Transatlantic RV] + 26107 [TCT Cont/F.East]
              + 16896 [TCT F.East/Cont] + 20030 [TCT F.East RV] - 7718 [Murmansk/ARA]
              - 7717 [Murmansk/L.Pool] + 18078 [Atlantic RV] + 15554 [Pacific RV]
              + 22265 [TCT Cont/F.East (Handysize)] + 241 [MEG/WEST] + 276 [MEG/JPN]
              - 1250 [MEG/SPORE] + 279 WAF/USG] + 315 [WAF/USAC]
              - 788 [Sidi Kerir/W Med] + 345 [NAF/EUROMED] + 330 [UK/CONT]
              + 371 [CARIBS/USG] - 4363 [MEG/Japan (75' dwt)]
              + 390 [MEG/Japan (55' dwt)]+ 444 [MEG/Japan (30' dwt)]
              + 421 [Singapore/Japan] - 4346 [Baltic T/A] + 414 [UKC-Med/States]

S = 13419.4   R-Sq = 60.1%   R-Sq(adj) = 60.0%

Analysis of Variance
Source             DF           SS           MS       F      P
Regression         30  3.94766E+12  1.31589E+11  730.72  0.000
Residual Error  14558  2.62162E+12    180081122
Total           14588  6.56928E+12
```

Hypothesis 7 – ROE and ROIC regression models:

```
ROE = 24.3 - 0.64 [Beta] - 0.209 [D/E] - 0.125 [Brent]
    - 0.000049 [TCT Cont/Far East (172' dwt)] - 3.61 [Tubarao/R.dam (iron ore)]
    + 3.04 [Richard Bay/R.dam] - 0.263 [UKC-Med/States] + 0.286 [Caribs/USNH]
    - 2.2 [DryBulk] + 5.0 [BLE] + 28.1 [DNORD] + 2.1 [DSX] - 3.0 [DRYS] - 9.3 [ESEA]
    + 11.6 [EXM] - 12.6 [2601] - 12.9 [FREE] + 78.5 [GOGL] + 12.5 [JIN]
    - 12.9 [CCOR B] + 4.3 [DHT] - 3.1 [EURN] + 40.1 [FRO] - 13.4 [GMR] + 9.0 [500620]
    + 2.1 [VLCCF] - 5.4 [NAT] - 5.5 [OSG] + 11.2 [SFL] - 8.8 [TK] + 11.5 [TRMD]

S = 22.1810   R-Sq = 53.5%   R-Sq(adj) = 43.4%

Analysis of Variance
Source           DF        SS      MS     F      P
Regression       31   80833.8  2607.5  5.30  0.000
Residual Error  143   70355.3   492.0
Total           174  151189.1


ROIC = 11.8 - 0.622 [Beta] - 0.333 [D/E] - 0.0506 [Brent]
      + 0.000080 [TCT Cont/Far East (172' dwt)] - 1.76 [Tubarao/R.dam (iron ore)]
      + 1.05 [Richard Bay/R.dam] - 0.130 [UKC-Med/States] + 0.163 [Caribs/USNH]
      - 1.53 [DryBulk] + 4.78 [BLE] + 26.2 [DNORD] + 6.89 [DSX] + 0.62 [DRYS]
      - 3.40 [ESEA] + 9.22 [EXM] - 7.07 [2601] - 5.07 [FREE] + 21.9 [GOGL]
      + 8.14 [JIN] - 5.95 [CCOR B] - 0.62 [DHT] - 0.47 [EURN] + 3.79 [FRO]
      - 3.06 [GMR] + 6.09 [500620] + 4.35 [VLCCF] + 1.08 [NAT] - 1.93 [OSG]
      + 0.65 [SFL] - 2.21 [TK] + 8.48 [TRMD]

S = 9.73446   R-Sq = 55.7%   R-Sq(adj) = 45.6%

Analysis of Variance
Source           DF        SS      MS     F      P
Regression       31  16209.35  522.88  5.52  0.000
Residual Error  136  12887.32   94.76
Total           167  29096.66
```