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Dissertation/Thesis

# "EVALUATING FINANCIAL PERFORMANCE OF THE GLOBAL SHIPPING INDUSTRY THROUGH OPERATING BUSINESS EFFICIENCY: A COMPARATIVE ANALYSIS BETWEEN DRY BULK AND TANKER SHIPPING SECTOR"

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*Wonders are many on earth, and the greatest of these*
*Is man, who rides the ocean and takes his way*
*Through the deeps, through wind-swept valleys of perilous seas*
*That surge and sway.*
(The chorus in Sophocles'Antigone, 422 BC, trans. R.C. Jebb)

# Abstract

The purpose of this diploma thesis is to examine the financial performance of the shipping companies focusing on dry bulk and tanker sectors. For this analysis, the "three biggest players" from each market are examined in order to facilitate the benchmarking analysis. To evaluate their financial performance, Key Performance Indicators were used focusing on operational activities. Based on those KPIs, relevant benchmarks were created for each sector and a comparative analysis between those two followed.

The shipping industry has always been characterized by great risk and uncertainty. During the past decades, several external factors- such as Covid-19 pandemic, geopolitical disputes, etc.- have affected the freight markets and, as a result, also the financial performance of shipping companies. For this reason, the fuzzy methods were considered as more suitable in order to deal with this vagueness. More specifically, the non-asymptotic fuzzy estimators' method has been applied in several operation-related financial indicators and ratios of each sector's leader during a specific time frame.

This findings from this analysis can be utilized by either those companies, their competitors, potential investors or other stakeholders and even future market entrants to evaluate the risk and financial yield from such investment.

**Keywords**
Shipping industry, financial performance analysis, fuzzy logic, fuzzy methods

# Περίληψη

Σκοπός της παρούσας διπλωματικής εργασίας είναι να εξετάσει τις χρηματοοικονομικές επιδόσεις των ναυτιλιακών εταιρειών που επικεντρώνονται στους τομείς του ξηρού και υγρού χύδην φορτίου. Για την ανάλυση αυτή εξετάζονται οι «τρεις μεγαλύτεροι παίκτες» από κάθε αγορά προκειμένου να διευκολυνθεί η συγκριτική αξιολόγηση. Για την αξιολόγηση των χρηματοοικονομικών τους επιδόσεων χρησιμοποιήθηκαν βασικοί δείκτες απόδοσης που αφορούν κυρίως τις λειτουργικές δραστηριότητες. Με βάση τους εν λόγω δείκτες απόδοσης, δημιουργήθηκαν σχετικοί δείκτες αναφοράς για κάθε τομέα και ακολούθησε συγκριτική ανάλυση μεταξύ αυτών των δύο.

Ο ναυτιλιακός κλάδος χαρακτηριζόταν πάντοτε από μεγάλο κίνδυνο και υψηλό ποσοστό αβεβαιότητας. Κατά τη διάρκεια των τελευταίων δεκαετιών, διάφοροι εξωτερικοί παράγοντες - όπως η πανδημία Covid-19, οι διάφορες γεωπολιτικές διαμάχες κ.λπ.- επηρέασαν τις ναυλαγορές και, κατά συνέπεια, και τις οικονομικές επιδόσεις των ναυτιλιακών εταιρειών. Για το λόγο αυτό, οι fuzzy μέθοδοι θεωρήθηκαν καταλληλότερες για την αντιμετώπιση αυτής της ασάφειας. Πιο συγκεκριμένα, η μέθοδος Non Asymptotic Fuzzy Estimators εφαρμόστηκε πάνω σε διάφορα χρηματοοικονομικά στοιχεία και αριθμοδείκτες που σχετίζονται με τη λειτουργία κάθε ηγέτη του κλάδου κατά τη διάρκεια μιας συγκεκριμένης χρονικής περιόδου.

Τα ευρήματα της ανάλυσης αυτής μπορούν να αξιοποιηθούν είτε από τις εν λόγω εταιρείες, είτε από τους ανταγωνιστές τους, είτε από δυνητικούς επενδυτές ή λοιπούς ενδιαφερόμενους φορείς, ακόμη και από μελλοντικές νεοεισερχόμενες εταιρείες για την αξιολόγηση του κινδύνου και της χρηματοοικονομικής απόδοσης που θα τους επιφέρει η επένδυση αυτή.

**Λέξεις – Κλειδιά**

Ναυτιλιακή βιομηχανία, Ανάλυση χρηματοοικονομικής επίδοσης, Fuzzy λογική και μέθοδοι

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# Abbreviations

CFO: Cash Flow from Operations
DWT: Deadweight Tonnage
FIS: Fuzzy Inference System
KPIs: Key Performance Indicators
NAFEs: Non-Asymptotic Fuzzy Estimators
SIC: Standard Industrial Classification
TTM: Trailing Twelve Month
ULCC: Ultra Large Crude Carrier
UNCTAD: United Nations Conference on Trade and Development
VLCC: Very Large Crude Carrier

# 1. Introduction

Maritime transport serves as the foundation of global trade, facilitating the movement of over 80% of goods by volume and more than 70% by value across international waters (World Bank Group, 2023). In 2023, the volume of maritime trade was 12,292 million tons, marking a 2.4% growth rate after a reduction in 2022. Additionally, total ton-miles rose to 62,037 billion, reflecting a 4.2% year-over-year increase, as presented in the below graph (UNCTAD, 2024). Therefore, the shipping industry and efficient sea transportation are vital for both global and local economies (Chrysafis, Papadopoulou and Theotokas, 2023).

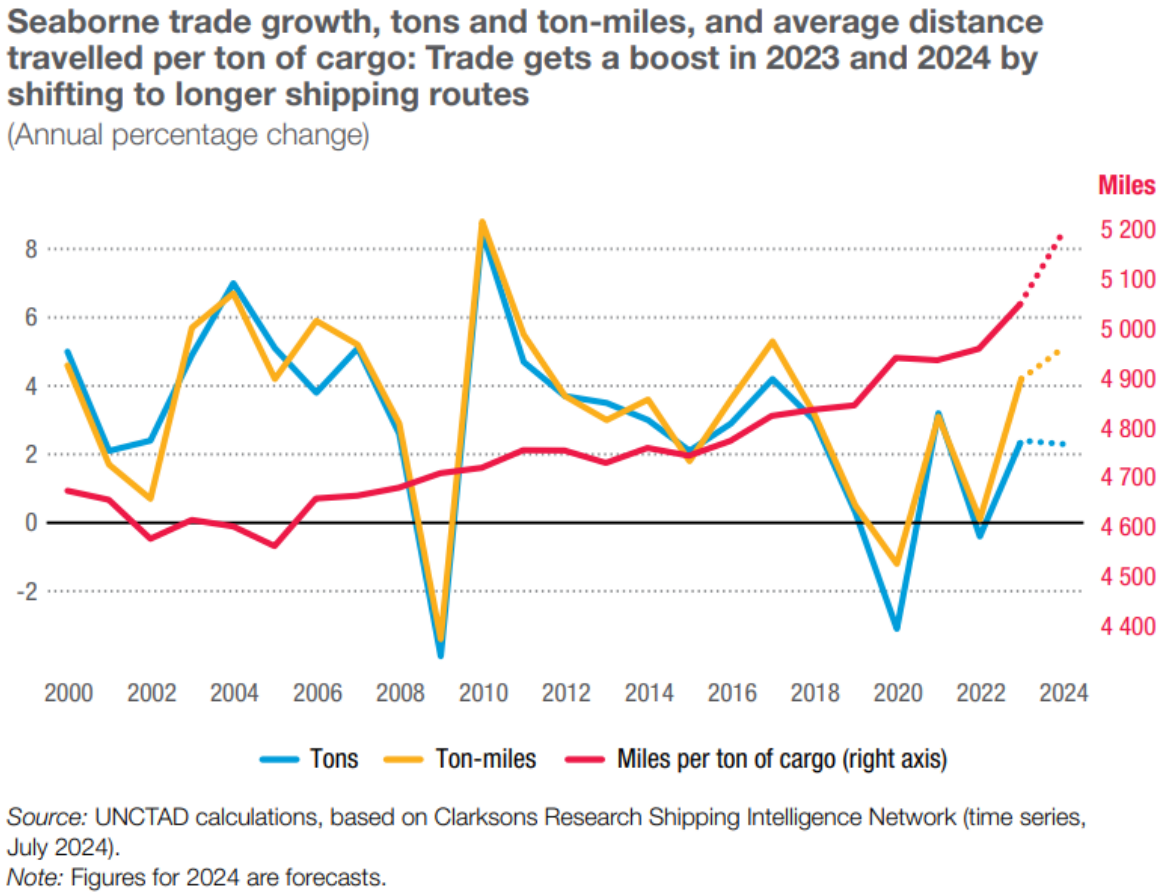


Figure 1: Seaborne trade growth, tons/ ton-miles and average distance travelled per cargo ton (UNCTAD, 2024)

However, the shipping sector has always been facing multiple challenges and is affected by numerous external factors such as global economic conditions, geopolitical risks, supply and demand for goods, new regulations, indices and commodities etc., all of which create high levels of uncertainty. In recent years, uncertainty has been increasing due to escalating geopolitical tensions, including the wars between Ukraine and Russia on one hand, and Irael against Palestine, along with the broader Middle East crisis, on the other. These conflicts have caused multiple disruptions to the global seaborne trade, primarily affecting tanker and dry bulk shipments (Sirimanne et al., 2023). The most notable one being the Houthi attacks at the Red Sea, Suez Canal where they have seized and attacked hundreds of vessels causing major delays as well as route changes resulting in substantial economic costs. Moreover, the newly elected President of the United States, Donald Trump is threatening various countries and has already imposed multiple tariffs on China and Canada, indirectly impacting major trade routes.

Although the condition of shipping markets has random behaviour, it is generally characterized by cyclical patterns: shipping cycles, either long-term or short-term, and each short cycle consists of four main stages with variable duration in each case. Firstly, the shipping market is in "*Through*", then signs of "*Recovery*" start appear until it reaches a certain "*Peak*" which eventually is followed by "*Collapse*" of the market as illustrated in Figure 2. However, shipping cycles vary in both duration and intensity. For instance, there have been historical cases where the recovery stage was not strong enough and in combination with overly confident market sentiment, this often led to excessive investments resulting in oversupply and a return to the "Through" stage (Stopford, 2009).

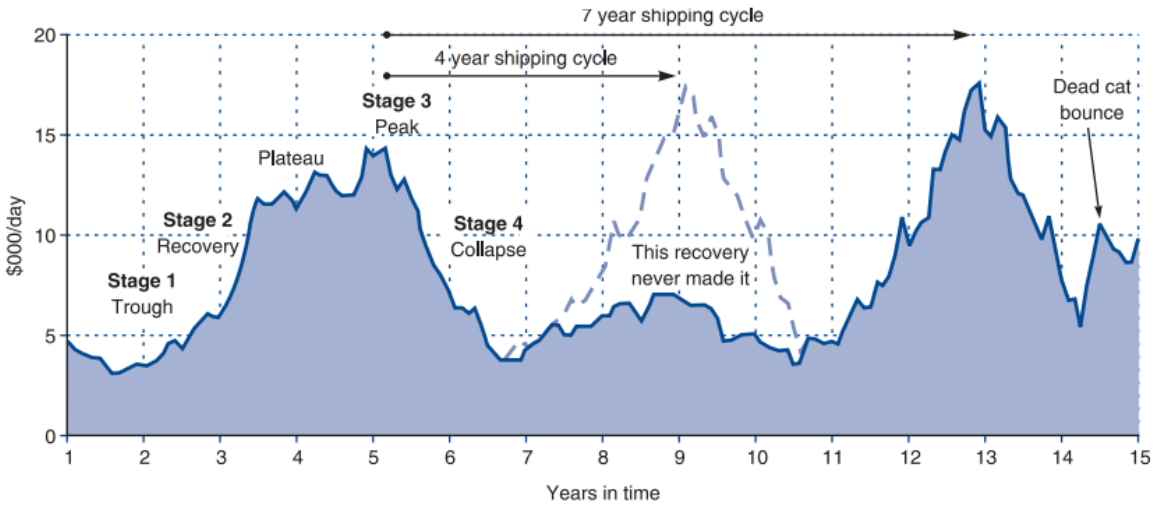


Figure 2: Main stages in a typical shipping market cycle (Stopford, 2009)

Considering all the above, financial markets- and consequently shipping industry- suffer from fluctuations which can often be very sharp resulting in frequent uncertainty and vagueness (Chrysafis and Papadopoulos, 2008). So, to better evaluate the financial performance of the leading shipping companies both in tanker and dry bulk shipping sector and to make a comparison between the two sectors, fuzzy estimation techniques will be used, which are perfect for sectors with high uncertainty. The inspiration for this thesis has been the article "*Measuring financial performance through operating business efficiency in the global cruise industry: A fuzzy benchmarking study on the big three*" by Chrysafis, Papadopoulou and Theotokas from which the proposed methodology has been used.

Fuzzy logic has been applied in several industries, such as engineering, marketing, economics and even medicine. In existing literature, fuzzy logic has been established as an effective tool also in the financial sector as, with the assistance of this method, vague, incomplete and even imprecise data can be handled. (Sanchez-Roger, Oliver-Alfonso and Sanchís-Pedregosa, 2019). However, little focus has been made on the shipping industry and the purpose of this diploma thesis is to cover this gap. More specifically, the focus will be made on two major sub-sectors, the tanker and the dry bulk shipping markets. Each market's financial health will be analyzed and a comparative analysis between the two will follow. The purpose of this analysis is to set benchmarks in order to assist the shipping

companies in improving their operational performance while being resilient to dynamically changing externalities.

# 2. Data collection

## 2.1 Companies selection

Specific criteria were considered in order to select the firms that will be used for the benchmarking. More specifically, the number of vessels in combination with the fleet's total capacity, measured in DWT, were the primary parameter in order to identify the top firms in each sector. Alternatively, the market capitalization of each company was taken into consideration as a secondary means of sorting. The term Market Capitalization refers to the overall worth of a company's outstanding shares and it can be calculated by multiplying the total number of shares with the market price of each share at the closing (Fitrah et al., 2022).

It is essential to note that only shipping companies that were listed on US stock exchange markets, mainly NYSE and NASDAQ, were assessed, provided that their respective SIC (Standard Industrial Classification) code concerns sea transportation. In this way, data collection was facilitated because those companies are required to publicly disclose their financial performance on a quarterly and yearly basis. Furthermore, all the companies under examination had homogeneous fleets, meaning that they had only either tankers or bulk carriers (with various ship sizes though), so no further sector sorting was required.

Multiple US listed companies were evaluated in order to identify the three largest shipping companies that own and operate tanker vessels and the three biggest ones that own dry bulk carriers. Indicatively, the seven largest publicly listed companies in each sector were evaluated in more detail in order to select the biggest three among them. A summary of the major players in terms of fleet size, total capacity and market capitalization can be found in the following two tables. The data were extracted from each firm's annual report issued for the latest accounting period of 2023. Concerning the stock prices, they were retrieved from

relevant historical data either directly from companies' websites or, alternatively, from Yahoo Finance. In Table 1 the data of the companies that own tanker vessels are shown.

The largest company is undoubtedly Frontline plc. with 76 tanker vessels with total capacity of over 15.8 million DWT. These 76 tankers consist of 33 VLCCs, 25 Suezmax and 18 Aframax/ LR2 Product carriers as of December 31, 2023. Additionally, company's market capitalization was approximately USD 4.5 billion calculated by multiplying its 222,622,889 outstanding shares on 31/12/2023 with stock price USD 20.05 at closing on 29/12/2023 (last trading day of 2023). Frontline was founded in 1985 and is now listed on both New York Stock Exchange and Oslo stock market.

The second biggest tanker shipping company is Euronav with 54 vessels, including 1 ULCC, 30 VLCCs, 20 Suezmax carriers, 3 FSO units (Floating, Storage and Offloading) with an aggregate capacity of 13.7 million DWT and Market Capitalization slightly over than USD 3.5 billion. On 1st of October 2024, Euronav changed name to CMB.TECH to reflect the take-over by Saverys Family. Nevertheless, since the company will continue tanker operations under the name "Euronav" and the period under examination is prior to this event, this thesis will not be affected. All information though was retrieved from the new site: cmb.tech as all data were transferred during this rebranding. Euronav is listed on NYSE and on Euronext Brussels. The company is headquartered in Antwerp, Belgium, and has offices across Asia and Europe.

Then, International Seaways Inc. on 31/12/2023 operated 73 vessels, of which 59 were owned & leased while 14 were chartered-in, resulting in a total capacity of 8.8 million DWT. Company's market capitalization on the same date was equal to USD 2,234,007,071 which is less than Scorpio Tankers (USD 3.2 billion). On the other hand, Scorpio Tankers has lower total capacity, of approximately 7.7 million DWT. However, Scorpio Tankers will be ultimately as the third company to be analyzed since International Seaways Inc. officially began trading on NYSE on December 1, 2016, following its spin-off from Overseas Shipholding Group (OSG) and therefore no data available from previous years.

Scorpio Tankers Inc.'s fleet, as of 31/12/2023, consisted of 110 wholly owned or leased financed product tankers (39 LR2, 57 MR and 14 Handymax). Although the fleet of Scorpio Tankers is way larger than Euronav's in terms of vessels' number, the total capacity of Euronav's fleet supersedes Scorpio's by approximately 6 million dwt due to having bigger vessels. Euronav's market capitalization is also greater than Scorpio's. Company trades at NYSE under the ticker "STNG".

| TANKER SHIP MANAGEMENT COMPANIES | | | | | |
|---|---|---|---|---|---|
| **Company Name** | **No of vessels** | **Total DWT** | **Oustanding shares** | **Stock Price** | **Market Capitalization** |
| Frontline | 76 | 15,851,850 | 222,622,889 | 20.05 | 4,463,588,924 |
| Euronav | 54 | 13,699,070 | 202,233,997 | 17.36 | 3,510,782,188 |
| International Seaways | 73 | 8,810,944 | 49,120,648 | 45.48 | 2,234,007,071 |
| Scorpio Tankers | 110 | 7,702,212 | 53,107,765 | 60.80 | 3,228,952,112 |
| DHT Holdings | 24 | 7,479,177 | 162,356,735 | 9.81 | 1,592,719,570 |
| Teekay Tankers | 43 | 6,097,500 | 34,093,108 | 49.97 | 1,703,632,607 |
| Nordic American Tankers | 20 | 3,145,345 | 208,796,444 | 4.2 | 876,945,065 |

Table 1: Biggest Tanker Shipping Companies for 2023 listed in US stock markets

The above three largest players of the oil tanker sector operate a combined capacity of 38,361,864 DWT, while the total world oil tanker capacity for 2023 was 652,850 thousand dwt as reported by UNCTAD data center. The subject companies thus cover approximately 5.88% of the entire fleet capacity which highlights the fragmented nature of the oil tanker shipping market. In Figure 3, the growth of global fleet's capacity of the last thirty years is presented, demonstrating a continuous upward trend. Relevant dataset was extracted from UNCTAD's statistical database. Additionally, for 2023 the total number of oil tankers was 12,309 vessels internationally.

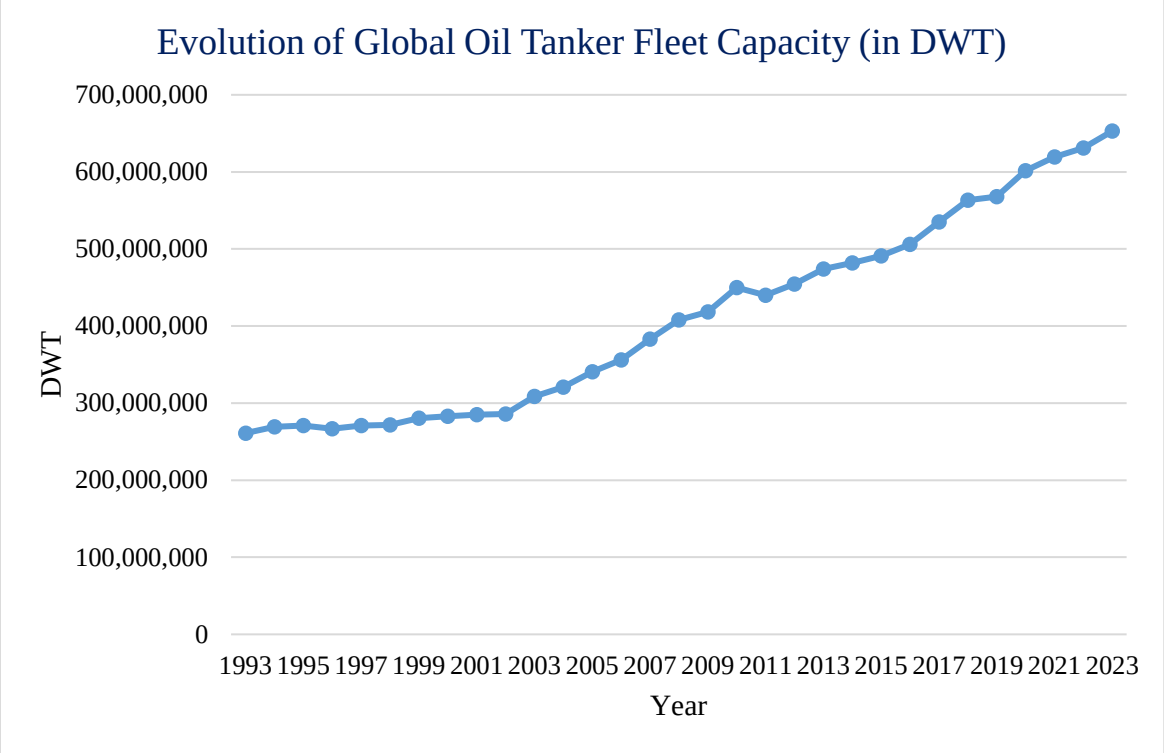


Figure 3: Evolution of Global Oil Tanker Fleet Capacity (in DWT)- Source: UNCTAD

Concerning shipping companies that own and operate dry bulk carriers, the categorization is more discrete as can be indicated in Table 2. More precisely, the largest company that owns dry bulk carriers is "Golden Ocean Group Limited" with total fleet of 91 vessels (19 Newcastlemax- Owned, 33 Capesize owned, 1 Capesize with operating lease, 7 Capesize with finance lease and 31 owned Panamax), attributing to aggregate capacity of approximately 13.85 million DWT (as of 20/03/2024- as stated in the annual report of 2023). Company's Market Capitalization as of 29/12/2023 was on about USD 1.95 billion. Golden Ocean is listed both on NASDAQ since 01/02/1998 and on OSE (Oslo Stock Exchange) since 04/01/2015 under the ticker 'GOGL'.

Star Bulk Carriers Corporation ranked second with a market capitalization USD 162 million less than Golden Ocean. At the end of the year 2023, Star Bulk had 119 ships of which 112 were owned by the company and 7 were chartered-in through long term Time Charters with

average fleet age 11.8 years. Company is listed on NASDAQ by the ticker 'SBLK' and has offices in Cyprus, Greece, Singapore and USA.

Lastly, the third biggest Dry bulk shipping company is Genco Shipping & Trading Limited with an overview of 46 dry bulk carriers, total capacity equal to 4,641,527 dwt and market capitalization USD 709,492,287- significantly lower than the previous two companies. An even greater difference is observed in the following companies: Safe Bulkers, Diana Shipping, Grindrod Shipping and Seanergy as indicated in the Table below. Genco's headquarters are located in the USA and has offices also in Copenhagen, Denmark and Singapore. Genco Shipping is trading on NYSE with the ticker 'GNK'.

| DRY CARGO SHIP MANAGEMENT COMPANIES | | | | | |
|---|---|---|---|---|---|
| **Company Name** | **No of vessels** | **Total DWT** | **Oustanding shares** | **Stock Price** | **Market Capitalization** |
| Golden Ocean | 91 | 13,849,387 | 199,628,293 | 9.76 | 1,948,372,140 |
| Star Bulk | 119 | 13,146,342 | 84,016,892 | 21.26 | 1,786,199,124 |
| Genco | 46 | 4,641,527 | 42,766,262 | 16.59 | 709,492,287 |
| Safe Bulkers | 47 | 4,719,600 | 111,607,828 | 3.93 | 438,618,764 |
| Diana Shipping | 40 | 4,400,000 | 101,877,142 | 2.97 | 302,575,112 |
| Grindrod | 24 | 1,200,000 | 19,685,590 | 9.01 | 177,367,166 |
| Seanergy | 17 | 3,054,820 | 18,442,688 | 7.83 | 144,406,247 |

Table 2: Biggest Dry Bulk Shipping Companies for 2023 listed in the US stock markets

The three largest dry bulk shipping companies, for the accounting period of 2023, operated in summary 31,637,256 deadweight tonnage, while internationally there were 974,452,000 DWT for the same year (13,182 dry bulk carriers). That can be translated as a 3.25% market share that the three major players own, reflecting a competitive sector without any monopolistic control from specific companies. Those worldwide values were retrieved again from UNCTAD statistics database and visualized in Figure 4. In addition, more steep growth was marked in the dry bulk segment in comparison to oil tankers fleet over the past three decades.

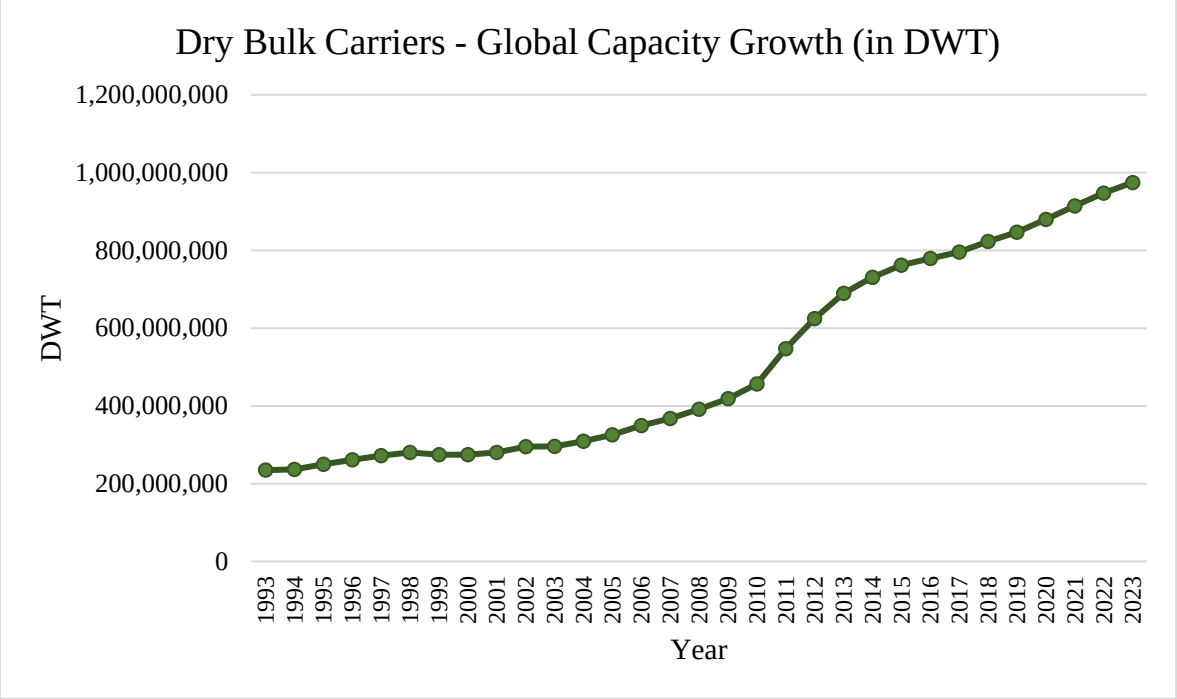


Figure 4: Dry Bulk Carriers- Global Capacity Growth (in DWT)- Source: UNCTAD

## 2.2 Data sources

For this thesis, secondary data have been utilized, and they were gathered from financial statements such as balance sheet, income statement and cash flow statement. Those statements were available in companies' quarterly and annual financial reports published either in each company's website or through the Securities and Exchange Commission's "SEC" EDGAR system which is an online database where companies file their periodic financial statements and other mandatory disclosures (Investopedia, 2024).

The period under examination starts from the year 2013 and ends the year 2023 resulting in a sample size n=44 (11 years with 4 quarters each) for each Key Performance Indicator as the data are gathered quarterly. Since the size is over 30, the Central Limit Theorem applies and so the values tend to follow the normal distribution curve as it will be explained in more detail in the next chapter. However, Montogomery and Runger, in 2010, suggested that the size of the sample should be at least 40 so that confidence intervals will be more reliable because Standard deviation of the population is replaced with sample's standard deviation

in Z- score calculation to add variability. Therefore, a larger size (44) was taken to obtain further credibility of the analysis.

Since the three leaders in each sector have been selected, the following financial indicators and operations-related KPIs for each company will be gathered from their publicly disclosed financial information as mentioned above. More specifically, the basic secondary financial information that was obtained for each company was Cash Flow from Operations (CFO), Current Liabilities, Debt, Total Assets, Net Income and Revenue.

Besides the point values of financial indicators derived from annual and quarterly financial statements, the Trailing Twelve Month (TTM) period has been calculated, meaning that each Quarter was also dynamically computed taking into account the values for twelve consecutive months. However, concerning indicators derived from Balance sheet, i.e. Current Liabilities, Debt and Total Assets, no TTM values were calculated because it would be incorrect as Balance sheet reflects the company's economic condition at a specific point in time just like a snapshot.

For some of the companies under examination, data was not publicly available for certain early years. In order to resolve this matter so that to ensure homogeneity and avoid issues during method applications, an optimum solution was to use the same value from the previous quarter to minimum affect the calculations of the lower and higher bounds. The issue was at Euronav's quarterly reports for most quarters from 2012 to 2014. Those values have been highlighted with light yellow color.

To ensure homogeneity in the entire dataset, all values are in the same currency- United States Dollars- since companies are listed on US stock markets and moreover most of the shipping companies and maritime sector in general, operate in USD to facilitate the necessary multiple international transactions.

Due to the considerable size of the detailed dataset, it will be displayed separately in Annex B. The numerical values, except for ratios and percentages, are presented in thousands USD for space reduction due to the large amounts. However, when inserted into the computational environment (MATLAB) they have been adjusted accordingly.

In the sample there were observed some outliers that will be also reflected in the fuzzy estimators- in a smaller degree though. However, it was considered important to be included in the analysis to express the realistic economic fluctuation of the shipping market. Those outliers were contained with the help of the conversion of those secondary data into fuzzy estimates.

# 3. Methodology

Firstly, in this particular chapter, the theorical background that contributed to the methodology of this thesis will be outlined and at the final sub-chapter the proposed methodology will be applied to the dataset.

## 3.1 Benchmarking

Financial Performance Benchmarks will be created using financial statements in order to assist the current players with evaluating their performance and whether their operations are fruitful. Additionally, the establishment of benchmarks is also essential to possible newcomers in order to be prepared for such substantial investment since a significant initial capital is required to obtain a vessel and to have enough Cash Flow to survive in through markets. (Chrysafis, Papadopoulou and Theotokas, 2023)

According to American Productivity and Quality Center (APQC): "*benchmarking is the process of measuring several business practices and metrics and comparing them with other entities, in order to understand if, how and where the organization needs to make changes to improve performance*". APQC categorizes different benchmarking methods in four types as follows:

a. *Performance benchmarking*: consists of collecting and analyzing quantitative data, such as KPIs, to evaluate and compare performance. Companies typically use this approach as a primary step to identify areas in need of improvement.
b. *Practice benchmarking*: focuses only on qualitative indicators (for example through process mapping) on how a specific task is performed by employees, processes or technological means.
c. *Internal benchmarking*: uses data from within the organization making comparisons between departments, branches in other regions, different product lines etc.
d. *External benchmarking*: takes the metrics from one organization and makes a comparison with the performance of one or more similar organizations concerning those same metrics. This type offers more benefits from Internal benchmarking as it takes into consideration both practice and performance.

So, for this paper External benchmarking together with Performance benchmarking will be utilized to interpret the findings of the research. With the establishment of benchmarks, as already mentioned, not only will the current industry stakeholders benefit but also future entrants as they are given the opportunity to better assess the market conditions or any possible entry barriers.

## 3.2 Normal Distribution and Confidence Intervals

Normal distribution, as introduced by Gauss, applies to continuous variables and thus is represented by a probability density function describing data that are symmetrically concentrated around a mean value.

Below, a few basic variables that will be used for the methodology will be mentioned. X denotes the continuous random variable, μ symbolizes the population mean and is equal to $\sum_{i=1}^{N} \frac{Xi}{N}$ where N is the number of the total population, $\bar{x}$ is the sample mean, s the sample's standard deviation and n the sample size, σ denotes the standard deviation of the population and can be found for the following equation:

$$\sqrt{\sum_{i=1}^{N}(Xi - \mu)^2/N}$$

$\sigma_{\bar{x}} = \sigma / \sqrt{n}$ represents the standard error of mean which will be further analyzed below as it is necessary for the application of confidence intervals (it is one of the possible ways to calculate confidence intervals). It is obvious that, while the sample size increases, the possible error of the mean decreases.

In accordance with the Central Limit Theorem, the sample distribution tends to approximate a normal distribution as the size of the sample increases even when the population's distribution is asymmetric or not completely symmetrical. Actually, for sample sizes greater than 30 observations the sampling distribution closely resembles a normal distribution irrespective of the population's initial distribution shape (Chalikias, 2017).

With the application of the above theorem, confidence intervals can be estimated by using the area as already known from the normal distribution in order to provide a range of values where the unknown mean value of the population is estimated to be contained (Chalikias, 2017). More precisely, the term 'confidence intervals' refers to the estimation of statistical uncertainty linked to population parameter estimates based on sample data. (Smithson, 2003). In that case, the following confidence intervals are more often selected, setting the ranges in which the population mean will lie, defined as margins of error:

- 68.2% confidence that the mean will be in the range: $\bar{x} - \sigma / \sqrt{n} < \mu < \bar{x} + \sigma / \sqrt{n}$
- 95%: $\bar{x} - 1.96\ \sigma_{\bar{x}} < \mu < \bar{x} + 1.96\ \sigma_{\bar{x}}$
- 99.7%: $\bar{x} - 3\ \sigma_{\bar{x}} < \mu < \bar{x} + 3\sigma_{\bar{x}}$

As observed from the above areas, the lower confidence percentage, the higher the estimation accuracy (Šimundić, 2008).

Usually, this confidence interval is preferred, which corresponds to the commonly used threshold for statistical significance (Šimundić, 2008). For better understanding it has been visualized through MATLAB computing platform, in Figure 5. The shaded region between Z = -1.96 and Z = +1.96 represents the interval within which 95% of sample means are expected to fall, assuming a population with mean $\mu = 0$ and standard deviation $\sigma = 1$ as applied in the standardized normal distribution.

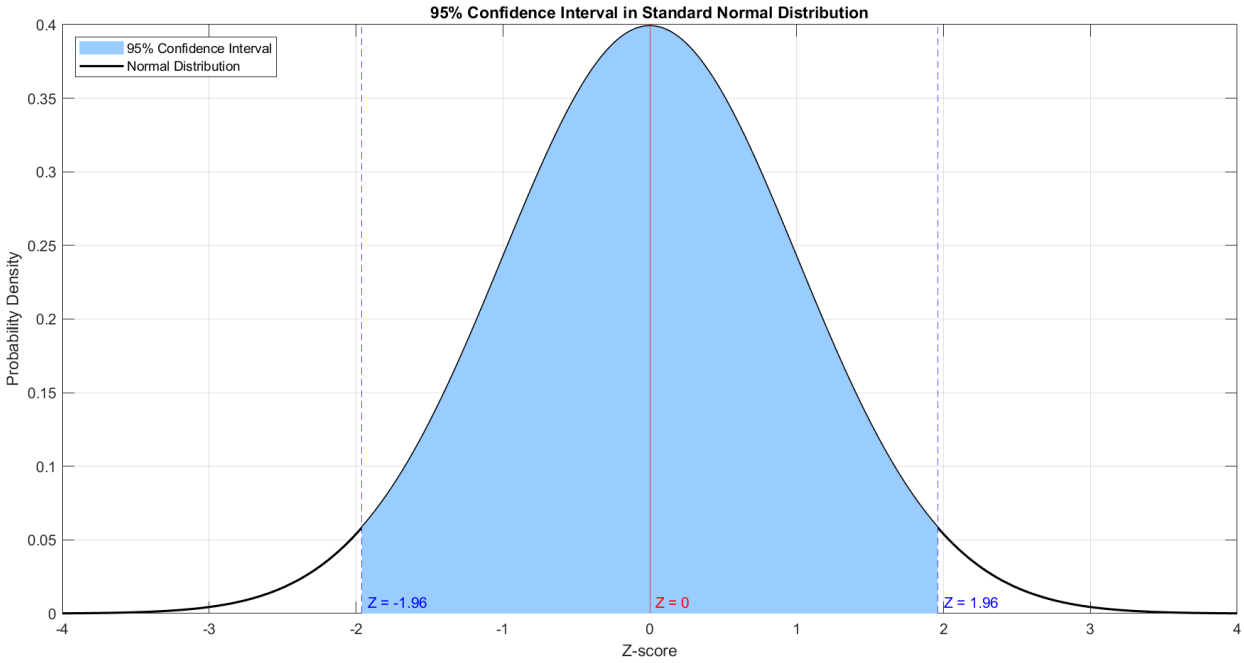


Figure 5: 95% Confidence Interval in a Standard Normal distribution

A point estimate is derived from sample observations and is used to make an estimation about the value of an unknown parameter in the population (Corporate Finance Institute, 2024). So, arithmetic mean acts as a point estimate (Šimundić, 2008).

The probability that the interval includes the actual value of the mean is represented by 1-α, called level of confidence and α the possibility of error or significance level (Tuitoek, 2024).

This error 'α' is distributed in both two ends of the distribution, so half (α/2) goes to the left tail (lower bound) and another half to the right tail (upper bound). Then Z-score is symbolized $Z_{\alpha/2}$ and $Z_{1-\alpha/2}$ respectively (Chalikias, 2017).

## 3.3 Fuzzy method

First of all, the fundamentals that compose the fuzzy methodology will be introduced in the following sub-chapters.

### 3.3.1 Fuzzy logic

Fuzzy logic relies on vague or imprecise terms to produce logical outcomes just like humans make decisions. Fuzzy logic incorporates the human way of thinking based on experience and turns it into code in the form of rules so that computers can understand it and it can be used for any decision-making process. Fuzzy rules enable the development of complex decision-making systems through Fuzzy Inference Systems that are challenging to represent using other modeling methods.

Taking all the above into account, fuzzy logic is a beneficial method that can be applied in the field of finance and even be used in a wide range of applications. (Sanchez-Roger, Oliver-Alfonso and Sanchís-Pedregosa, 2019).

Fuzzy logic can be successfully used in economics because economic phenomena are based on human logic which is linked to uncertainty that cannot be expressed by classical models and mathematics. The same applies to predictions on economic conditions that are usually expressed by the analysts in linguistic terms (Klir and Yuan, 1995).

Fuzzy sets are the foundation of fuzzy logic as will be explained in detail hereunder.

### 3.3.2 Fuzzy sets

As analyzed above, the term "fuzzy" is suitable for describing a mathematical framework in which the variables under examination lack clearly defined boundaries (Venkat, Kushal and Sangam, 2017).

According to Zadeh, who first introduced the Fuzzy Sets Theory in 1965, "*a fuzzy set is a class of objects with a continuum of grades of Membership*". This means that, a statement is not binary- absolutely truth (equal to 1) or absolutely false (equal to 0) as it is stated in traditional- Boolean- logic. Each element in a fuzzy set is attributed to a grade of

membership that can take values from 0 to 1 depending on what extent this element matches the set: [0,1]. So, every set is expressed by one membership function $\mu_A(x)$ representing infinite membership grades in the closed interval [0,1], hence $\mu_A(x) \in [0,1]$. So, $\mu_A$ quantifies the degree of belonginess of x to A. The closer to one is the result of the membership function, the higher the membership grade (Klir and Yuan, 1995).

The classical sets, also called crisp sets, are a special category of fuzzy sets that take only two values as explained above, one or zero represented by the below characteristic function:

Crisp set: $X_A(x) = \begin{cases} 1, \forall\, x \in A \\ 0, \forall\, x \notin A \end{cases}$

With fuzzy sets, patterns can be classified because one pattern or gesture is possible to have partial membership in multiple different classes. In this way, the gradual transition among classes is facilitated.

In continuation to the above, an introduction of the relevant basic mathematical notations of the fuzzy set theory follows.

The universe of discourse (information), denoted by 'X', is the universe of all available elements 'x' that a fuzzy set can take. Each individual element of the fuzzy set that also belong to universal set X is marked as 'x' ($x \in X$). On the contrary, the null set is defined as $\emptyset$ (Ross, 2004).

As Klir and Yuan stated, vague concepts that are expressed by human language can be represented via fuzzy sets. This representation differs considerably among different concepts and even in the same context. This results in membership functions having various shapes depending on interpretation, with the most common ones being the triangular (which will be also used in this thesis) and the trapezoid. An example is displayed in Figure 6 where each of these four fuzzy sets represents a group of real numbers that are close to two, but they have different graph shapes.

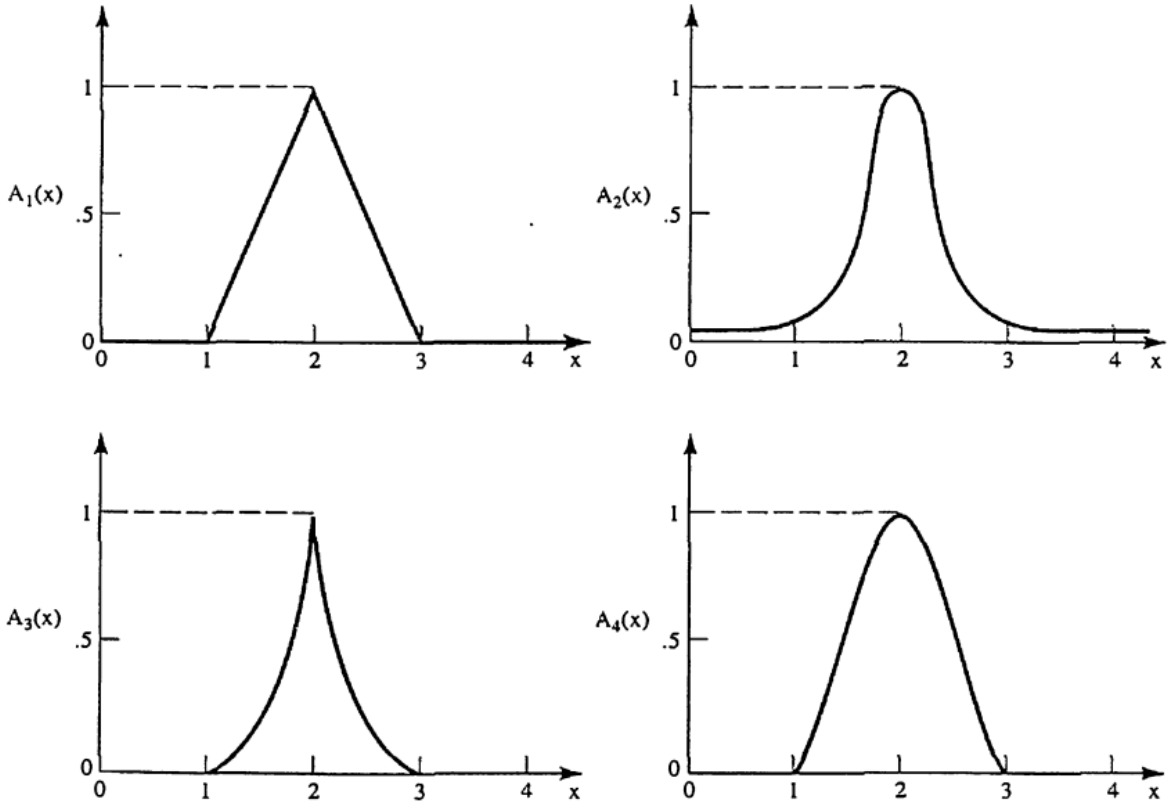


Figure 6: Examples of membership functions used in different contexts for characterizing fuzzy sets of real numbers close to 2 (Klir and Yuan, 1995)

Then, the definition of the α-cuts is provided, which is one of the most important concepts of fuzzy sets and it will be also used in the methodology of the current study.

Given a fuzzy set $\tilde{K}$ defined on universal set X and α in a number that belongs to the closed interval [0,1], the α-cut denoted by ${}^{\alpha}\tilde{K}$ is considered a crisp set containing all the element of the X whose membership grade in $\tilde{K}$ is greater than or equal to the specified value of α:

${}^{\alpha}\tilde{K} = \{x|K(x) \geq \alpha\}$, where K(x) is the membership grade of fuzzy set $\tilde{K}$ ($K(x) = \mu_K(x)$).

Similarly, the strong α-cut of fuzzy set $\tilde{K}$ (${}^{\alpha+}\tilde{K}$) is the crisp set that contains the elements in X whose membership grade in $\tilde{K}$ is strictly greater than the given value of α:

${}^{\alpha+}\tilde{K} = \{x|K(x) > \alpha\}$

Another important definition is the Support of a fuzzy set in universal set X, which is the crisp set that contains all the elements in the universal set with non-zero membership grades in K. This means that the support of a fuzzy set is basically its strong alpha cut (Klir and Yuan, 1995).

$S(K) = \{x|K(x) > 0\}$ or Supp(K) or ${}^{0+}\widetilde{K}$.

As the heigh of the fuzzy set is considered the highest membership grade (highest value) that is obtained by any element in that set: $h(K) = Sup_{x \in X} K(x)$. A fuzzy set is considered Normal when h(K) = 1 and subnormal when h(K) <1.

### 3.3.3 Fuzzy number

For a fuzzy set $\widetilde{K}$ on $\mathbb{R}$ to be considered a Fuzzy Number it must satisfy at least the below three properties:

i. $\widetilde{K}$ must be a normal fuzzy set, meaning that h(K) =1 as explained in the previous chapter.
ii. The α-cut of $\widetilde{K}$ (${}^{\alpha}\widetilde{K}$) must be a closed interval for every $\alpha \in [0,1]$. So, $\widetilde{K}$ must be a convex set and a consequence all α-cuts to be convex.
iii. The support of A, ${}^{0+}A$ must be bounded, i.e. have a Lower and an Upper Bound. This means that the membership function of $\widetilde{K}$ must be a piecewise continuous function. If an interval is chosen, then this interval should be able to be broken into an infinite number of sub-intervals.

It is important to consider the shape of the resulting fuzzy numbers.

### 3.3.4 Arithmetic Operations on Fuzzy sets

Let $\widetilde{K}$, $\widetilde{L}$ two fuzzy sets in the universal set X, with membership functions $f_{\widetilde{K}}$ and $f_{\widetilde{L}}$ accordingly.

Two fuzzy sets K, L can be equal (K=L), if and only if $f_{\widetilde{K}}(x) = f_{\widetilde{L}}(x)$ for all x elements of X (Zadeh, 1965).

The Union of $\widetilde{K}$ and $\widetilde{L}$ is symbolized as $\widetilde{K} \cup \widetilde{L} = \{x \mid x \in \widetilde{K} \text{ or } x \in \widetilde{L}\} = \text{Max}[f_{\widetilde{K}}(x), f_{\widetilde{L}}(x)]$ and includes all those elements contained in set $\widetilde{K}$ or $\widetilde{L}$ or both.

Intersection is denoted by $\widetilde{K} \cap \widetilde{L} = \{x \mid x \in \widetilde{K} \text{ and } x \in \widetilde{L}\} = \text{Min}[f_{\widetilde{K}}(x), f_{\widetilde{L}}(x)]$ which represents the elements residing both in $\widetilde{P}$ and L sets.

The complement of fuzzy set $\widetilde{K}$ ($\widetilde{P}' = \{x \mid x \notin \widetilde{K}, x \in X\} = 1 - \widetilde{K}$) includes only the elements in Universal set that are not contained in $\widetilde{P}$.

The difference between $\widetilde{K}$ and $\widetilde{L}$ is symbolized as $\widetilde{K} \mid \widetilde{L} = \{x \mid x \in \widetilde{K} \text{ and } x \notin \widetilde{L}\}$

As Zadeh also introduced, besides the operations of union and intersection, there are several other methods for combining fuzzy sets and establishing relationships between them.

Arithmetic operations on fuzzy numbers play a fundamental role in fuzzy set theory.

To begin with, let $\otimes$ denote any of the four arithmetic operations on closed intervals, addition (+), subtraction (−), multiplication (*) and division (/). Then the following property:

$[k_1, k_2] \otimes [l_1, l_2] = \{p * q | k_1 \leq p \leq k_2,\ l_1 \leq q \leq l_2\}$, is considered as a generic property for all arithmetic operation on closed intervals with the only exception in the division:

$[k_1, k_2] / [l_1, l_2]$ is not defined when $0 \in [l_1, l_2]$. In more detail, the arithmetic operations on closed intervals are as follows:

- $[k_1, k_2] + [l_1, l_2] = [k_1 + l_1, k_2 + l_2]$
- $[k_1, k_2] - [l_1, l_2] = [k_1 - l_2, k_2 - l_1]$
- $[k_1, k_2] * [l_1, l_2] = [\min(k_1l_1, k_1l_2, k_2l_1, k_2l_2), \max(k_1l_1, k_1l_2, k_2l_1, k_2l_2)]$, provided that $0 \notin [l_1, l_2]$

- $[k_1, k_2] / [l_1, l_2] = [k_1, k_2] * [(1/ l_1), (1/ l_2)] = [\min (k1/ l1, k_1/ l_2, k_2/ l_1, k_2/ l_2), \max (k_1/ l_1, k_1/ l_2, k_2/ l_1, k_2/ l_2)]$, provided that $0 \notin [l_1, l_2]$

### 3.3.5 Non-asymptotic fuzzy estimators method

The "Non-asymptotic fuzzy estimators' method" was introduced by Sfiris and Papadopoulos in 2014 and is based on confidence intervals. In particular, they suggested that NAFEs represent well-defined fuzzy numbers that retain the "statistically derived triangular" shape making them suitable for subtle fuzzy comparison. The shape of fuzzy estimators plays an important role and the suitable shape for each case can be calculated by False Alarm Rate Index.

In continuation to Buckley's method of fuzzy estimations, they proposed that:

Supposing there is a random sample: $X_1, X_2, \ldots, X_n$ with total size of n data and a distribution with confidence level parameter *'θ'* which is unknown and can be estimated from the above random sample. $[\theta_1(\alpha), \theta_2(\alpha)]$ denote the $(1 - \alpha)100\%$ confidence intervals for $\theta$. Taking into account that: $h(\alpha): (0,1] \rightarrow [\frac{\delta}{2}, 0.5]$, $\delta \in (0,1)$, a set of fuzzy estimators, named non-asymptotic fuzzy estimators, is constructed by the below superimposed intervals:

$^{\alpha}\tilde{\theta}_{\delta} = [\theta_1(2h(\alpha)), \theta_2(2h(\alpha))]$, $\alpha \in (0,1]$

It is necessary that $h(\alpha)$ is a continuous, monotonic increasing and onto function in order to create fuzzy estimators of a specific NAFE family.

They also proved that the above estimators are fuzzy numbers with triangular shape having compact support.

Moreover, Sfiris and Papadopoulos considered the below linear function with the aim of presenting non-asymptotic fuzzy estimators applicable for parameters estimation both for normal and exponential distributions:

$$h(\alpha) = \left(\frac{1-\delta}{2}\right)\alpha + \frac{\delta}{2}, \alpha\epsilon(0,1], \delta\epsilon(0,1)$$

This function determined how membership functions will be distributed in the fuzzy set.

Based on the above, and supposing $X_1$, $X_2$, $X_3$, …, $X_n$ to be a random set of data with each value characterized as $x_1$, $x_2$, $x_3$, …, $x_n$ and $\delta\epsilon(0,1)$, they proved that the below function is the membership function of x in δ.

$$\tilde{\mu}_{\delta}(x)\begin{cases}\frac{2}{1-\delta}\Phi\left(\frac{x-\bar{x}}{\sigma/\sqrt{n}}\right)-\frac{\delta}{1-\delta}, \bar{x}-\frac{\sigma}{\sqrt{n}}\Phi^{-1}\left(1-\frac{\delta}{2}\right)\leq x\leq\bar{x}\\ \frac{2}{1-\delta}\Phi\left(\frac{\bar{x}-x}{\sigma/\sqrt{n}}\right)-\frac{\delta}{1-\delta}, \bar{x}\leq x\leq\frac{\sigma}{\sqrt{n}}\Phi^{-1}\left(1-\frac{\delta}{2}\right)+\bar{x}\\ 0, in\ any\ other\ case\end{cases}$$

Where Φ symbolizes the cumulative probability function of the standard distribution.

The fuzzy set's α-cuts is the closed interval:

$^{\alpha}\tilde{\mu}_{\delta}=\left[\bar{x}-z_{h(\alpha)}\frac{\sigma}{\sqrt{n}},\bar{x}+z_{h(\alpha)}\frac{\sigma}{\sqrt{n}}\right]$, where $z_{h(\alpha)} = \Phi^{-1}(1 - h(\alpha))$, with $\Phi^{-1}$ being the inverse cumulative probability function of the standard distribution.

So, h(α) can modify the width of the confidence interval based on the chosen confidence level 'δ'.

## 3.4 Methodology Application

In this chapter the computational steps of the above methodology are explained.

For the methodology of this thesis, statistical analysis will be integrated with fuzzy set theory. Fuzzy estimators will be computed applying the theorems and propositions provided in section 3.3.5. In particular, the calculation steps of the above methodology are showcased in detail, while the evaluation of those results will be analyzed in the next chapter.

First of all, the random sample $x_1$, $x_2$, $x_3$, …, $x_n$ is the data collected concerning each financial indicator/ ratios of the six companies for the period from 2013 to 2023. All those secondary data (except obviously from the ratios) have the same unit of measurement, which is USD, and they are presented in detail in Annex B, as already explained in chapter 2. Due to their

large amount, they are shown in thousands USD, but all the computations have been conducted with those figures as a whole.

After finding the membership function, the α-cuts from these fuzzy intervals will be computed in order to determine the lower and upper bounds of the performance benchmarks. Thus, interval-based estimates will be constructed from the financial indicators, instead of using single point estimates, hence defining continuous range of possible values to better cover the uncertainty. Alpha-cuts define confidence intervals at different levels, allowing risk-based decision-making.

So, the primary step was to calculate some basic statistical values necessary for the estimation of confidence intervals, i.e. Average value, Standard Deviation, sample size. This was achieved through Excel functions and the result concerning, for instance, the Cash Flow from Operation is presented in Table 3. Regarding Standard Deviation, the function STDEV.S (Sample Standard Deviation) was used instead of STDEV.P (Population Standard Deviation) since we only have a specific sample (year 2013-2023) of the entire historical values for each firm. In all indicators and ratios, it was observed that the Standard Deviation was extremely high, fully reflecting the uncertainty that all shipping companies are characterized by.

| **Cash Flow from Operations** | | | | | | |
|---|---|---|---|---|---|---|
| | **Frontline** | **Euronav** | **Scorpio** | **Golden** | **Star Bulk** | **Genco** |
| **Average** | 65,054,841 | 78,532,636 | 70,346,955 | 43,407,091 | 53,956,591 | 11,975,841 |
| **Standard Deviation** | 79,272,445 | 117,183,593 | 89,309,562 | 57,392,746 | 77,531,402 | 26,587,803 |
| **n** | 44 | 44 | 44 | 44 | 44 | 44 |

Table 3: Average and Standard Deviation of the Cash Flow from Operations for each shipping company (2013-2023)

Afterwards, those data were loaded into MATLAB, where the rest of the fuzzy estimation method was computed. The entire code used to generate the non-asymptotic fuzzy estimators for the CFO values can be found in Annex A. The same code applies also for the

fuzzy estimation of the rest ratios, simply by modifying some indicators' names, graphs' description and inserting different Excel Files with the same above-mentioned descriptive statistics. To sum up, this code generates α-cut intervals, membership functions, and fuzzy rankings, enabling a comparative analysis across multiple shipping companies. The fuzzy estimation was conducted simultaneously for all six companies, separating them per sector.

For the creation of the code in MATLAB the academic notes provided by Dr. Galanis G. and Dr. Kouloumpou D. in the context of the Master's degree course "*Statistical Analysis and Data Analysis*" were consulted along with the Documentation Library provided by MathWorks.

First of all, the above Table was loaded into MATLAB and the parameter δ was set to 0.05, corresponding to a 95% confidence interval: (1 – δ)100%= 95%. This percentage was chosen because, according to Šimundić (2008), in the academic literature, 95% is the most commonly used confidence interval. Then, the α-cut levels were also declared from 0 to 1 with 0.1 increase each time (alpha = 0:0.1:1).

Although $\alpha \in (0,1]$, the zero a-cut was calculated only in order to have a reference of the fuzzy numbers' support as it is the widest fuzzy interval hence providing the full fuzzy range where the membership function is positive. When α is equal to zero the maximum possible estimates are shown.

After setting δ and α, the excel file was read starting from the variable names (companies), followed by finding the average, standard deviation and sample size for each company defining the relevant variables: 'meanRow', 'stdRow' and 'nRow' (as pre-computed in Excel file).

Another important step was to set the function for h(α) and the $z_{h(\alpha)}$ as defined in 3.3.5.

Concerning, the inverse cumulative probability function ($\Phi^{-1}$) of the standard distribution in excel is symbolized as 'NORM.S.INV' in Excel and in MATLAB as 'norminv' according to the software's documentation and functions library. To also note-as already mentioned earlier- that for the MATLAB code all the functions were taken from the documentation and functions library publicly available on the official MathWorks site.

Then, the membership grade of each α-cut was calculated using the $\mu_{\delta}(x)$ function.

The outcomes from the methodology application for all the different indicators and ratios have been saved in '.csv' files in order to demonstrate the results in tables and explain the findings in detail in Chapter 4. Finally, a visualization took place in two different graphs, one collective graph with all six companies marked with different colour according to their sector and one plot with different subplots for each company.

# 4. Comparative Analysis between tanker and dry bulk shipping companies

According to Martin Stopford, financial performance is the key component that distinguishes survivors of the long and unknown recession periods from those who "drop out". In order to measure this performance correctly, relevant benchmarks have been created with the help of the above proposed methodology and the results are presented below.

Each KPI will be analyzed in detail in the following sub-chapters, however, a summary of the fuzzy benchmarks is shown in Tables 4 and 5 for tanker and dry bulk shipping companies accordingly. For the left tail of the benchmark formation, the minimum fuzzy estimator's α-cut for each KPI (smallest Lower Bound) was selected from the three players in each sector and likewise for the right tail the biggest Upper Bound.

| KPIs | Frontline | Euronav | Scorpio | Fuzzy Benchmarks |
|---|---|---|---|---|
| CFO (Quarterly-Millions) | [41.6318; 88.4780] | [43.9077; 113.1575] | [43.9582; 96.7358] | [41.6318; 113.1575] |
| CFO (TTM-Millions) | [164.6108; 315.3729] | [193.1291; 370.8766] | [167.9268; 342.7257] | [164.6108; 370.8766] |

| | | | | |
|---|---|---|---|---|
| CFO/Debt (TTM) | [0.11207; 0.18708] | [0.17215; 0.35561] | [0.13887; 0.46469] | [0.11207; 0.46469] |
| CFO/Revenue (TTM) | [0.18310; 0.28667] | [0.23364; 0.40802] | [0.21572; 0.33915] | [0.18310; 0.40802] |
| CFO/Current Liabilities (TTM) | [0.52965; 0.93152] | [0.41606; 1.00448] | [0.44304; 0.83649] | [0.41606; 1.00448] |
| CFO/Assets (TTM) | [0.04834; 0.08165] | [0.05586; 0.10487] | [0.03989; 0.07991] | [0.03989; 0.10487] |
| CFO/Net Income (Quarterly) | [-0.09554; 3.57852] | [-18.60426; 74.66850] | [-3.03764; 8.13596] | [-18.60426; 74.66850] |

Table 4: The α-cuts of non-asymptotic fuzzy estimators (NAFEs) for the financial KPIs from operating activities and the fuzzy benchmarks- Tanker shipping sector

| KPIs | Golden Ocean | Star Bulk | Genco | Fuzzy Benchmarks |
|---|---|---|---|---|
| CFO (Quarterly-Millions) | [26.4489; 60.3653] | [31.0479; 76.8652] | [4.1198; 19.8319] | [4.1198; 76.8652] |
| CFO (TTM-Millions) | [105.3444; 224.0709] | [118.5255; 290.8116] | [15.0439; 70.9516] | [15.0439; 290.8116] |
| CFO/Debt (TTM) | [0.11397; 0.20853] | [0.10493; 0.23696] | [0.09964; 0.37230] | [0.09964; 0.37230] |
| CFO/Revenue (TTM) | [0.18578; 0.31688] | [0.16106; 0.28511] | [-0.05493; 0.10888] | [-0.05493; 0.31688] |
| CFO/Current Liabilities (TTM) | [0.60181; 1.19301] | [0.40418; 1.01574] | [0.42438; 1.66589] | [0.40418; 1.66589] |

| | | | | |
|---|---|---|---|---|
| CFO/Assets (TTM) | [0.03942; 0.07317] | [0.04257; 0.08924] | [0.01658; 0.06154] | [0.01658; 0.08924] |
| CFO/Net Income (Quarterly) | [-0.958568672; 5.71855] | [-2.54373; 6.95805] | [-0.34597; 3.23198] | [-2.54373; 6.95805] |

Table 5: The α-cuts of non-asymptotic fuzzy estimators (NAFEs) for the financial KPIs from operating activities and the fuzzy benchmarks- Dry Bulk shipping sector

## 4.1 Cash Flow from Operations (CFO)

The cash flow of a company reflects the difference between cash received and cash paid out during a specific accounting period (Stopford, 2009).

Companies with weaker cash flow are the ones prone to drop out first during long-term recessions. On the other hand, companies that have obtained strong cash flow and maintained it during those circumstances have the ability to make smart investments. More specifically, they can take advantage of the low prices of secondhand vessels, buy ships in lower price, operate them during market's "Recovery" and then when the market is at "Peak" to sell them at the highest prices, earning a substantial amount of cash flow. The strategy is called "Asset Play" and this is the reason of the success of Greek shipowners (Theotokas, 2019).

Cash Flow from Operations that is derived from cash flow statements are a helpful tool for crisis management because it offers direct information concerning an organization's surplus or deficit in cash and/ or cash equivalents created from daily operations. It is thus considered as one of the most essential measures that indicate a firm's financial health because it is derived directly from the company's core operations without being influenced by investments or asset depreciation. So, it simply represents the cash generated by company's primary operations, meaning sea transportation of commercial goods (Chrysafis, Papadopoulou and Theotokas, 2023).

The detailed results from each company for all possible α-cuts from 0 to 1 with 0.1 increase are displayed in Tables 6 and 7- separately for each sector. The results are also visualized to enhance better comparison. As clearly seen from Figure 8, the tanker shipping industry generated more cash flows from operations than the dry bulk shipping industry during the period under examination.

Although in some quarters- as stated in the secondary data at Appendix B- some of the companies under examination generated negative operating cashflows during several quarters, all the fuzzy intervals during all the α-cuts for the interval (0,1] were positive. Concerning the shipping sector, the larger quarterly CFO fuzzy estimator is Euronav's in comparison to the other two and is equal to 113,157,539.19, followed by Scorpio Tankers (96,735,758.97) and last ranked Frontline (88,477,921.22)- despite being the largest tanker shipping company. Those values are attributed to each company's upper bound for α-cut equal to zero. As already mentioned in section 3.4, even though zero does not belong to (0,1], it has been computed as it identified the support of the fuzzy estimator and reflects the widest fuzzy interval. Consequently, Euronav's operating activities are found to be more productive than the rest two, leading to better cash flow. The smallest left tail is attributed to Frontline as expected, but Euronav and Scorpio Tankers had similar values, on about USD 43,9 million with Scorpio's being slightly larger by approximately 50 thousand.

As far as Dry Bulk shipping companies are concerned, Star Bulk Carriers had the most efficient operations having the greatest Upper Bound (76,865,235.13) which was placed as the fuzzy benchmark's right closed interval. Next was Golden Ocean and third Genco Shipping that had significant difference between the other two firms and really small bounds ([4.1198; 19.8319]) resulting to a fuzzy benchmark of high deviation. Prior to drawing any conclusions, it is important to take into account that Genco Shipping, as a firm is also a lot smaller in comparison to Golden Ocean and Star Bulk carriers. Therefore, it is logical to generate lower operation cash flows as they own and operate fewer ships.

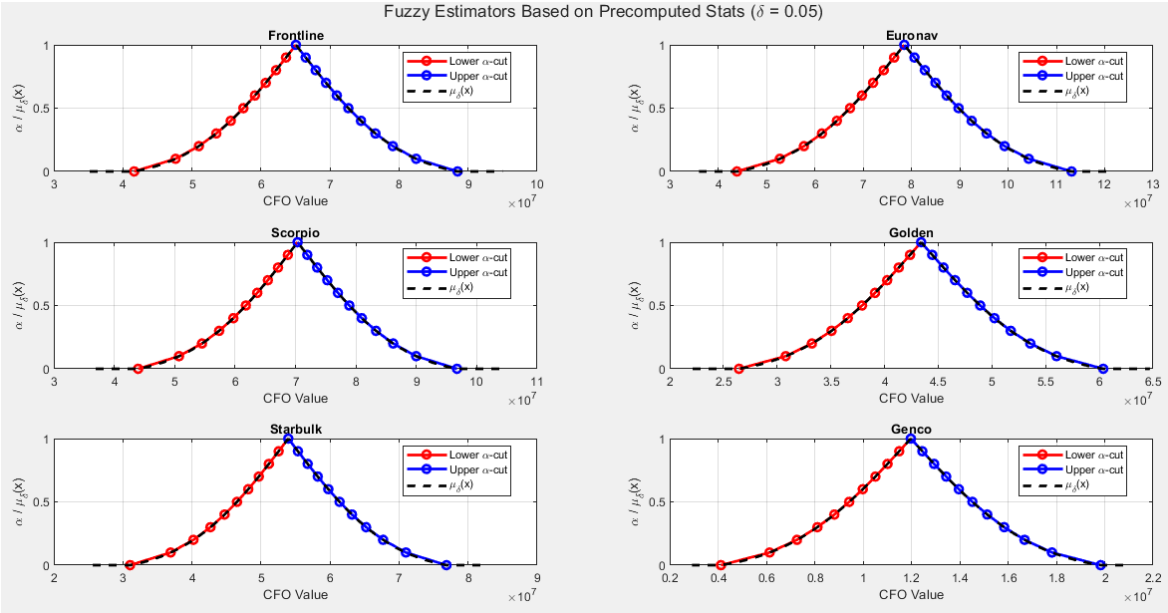


Figure 7: Fuzzy Representation of CFO Values for Leading Shipping Companies based on α-cuts

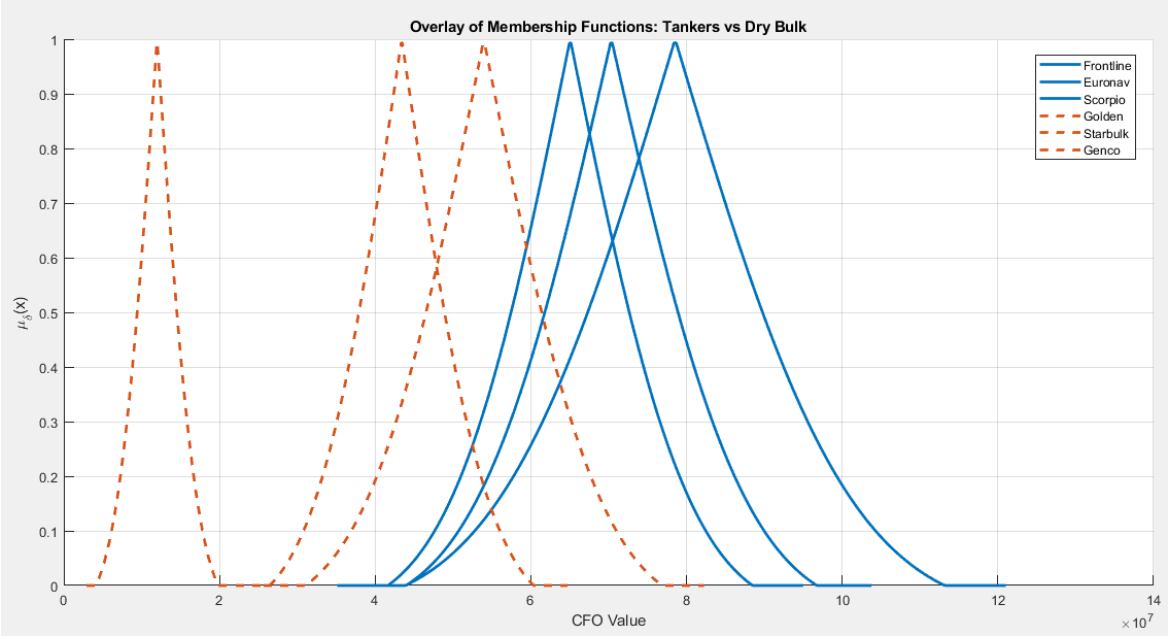


Figure 8: Fuzzy Membership Distributions of CFO: Tanker vs Dry Bulk Firms

| Tanker Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy CFO values for different alpha levels | | | | | | |
| a-cut | Frontline | | Euronav | | Scorpio Tankers | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 0 | 41,631,760.60 | 88,477,921.22 | 43,907,733.53 | 113,157,539.19 | 43,958,150.12 | 96,735,758.97 |
| 0.1 | 47,637,527.79 | 82,472,154.03 | 52,785,690.77 | 104,279,581.96 | 50,724,340.29 | 89,969,568.80 |
| 0.2 | 51,012,843.09 | 79,096,838.73 | 57,775,212.34 | 99,290,060.39 | 54,527,022.70 | 86,166,886.39 |
| 0.3 | 53,533,203.10 | 76,576,478.72 | 61,500,905.94 | 95,564,366.79 | 57,366,499.25 | 83,327,409.84 |
| 0.4 | 55,623,392.37 | 74,486,289.45 | 64,590,704.52 | 92,474,568.21 | 59,721,338.80 | 80,972,570.29 |
| 0.5 | 57,458,249.65 | 72,651,432.17 | 67,303,061.48 | 89,762,211.25 | 61,788,517.38 | 78,905,391.71 |
| 0.6 | 59,129,047.07 | 70,980,634.75 | 69,772,898.82 | 87,292,373.90 | 63,670,863.59 | 77,023,045.51 |
| 0.7 | 60,691,025.94 | 69,418,655.88 | 72,081,876.37 | 84,983,396.36 | 65,430,613.13 | 75,263,295.96 |
| 0.8 | 62,181,564.52 | 67,928,117.30 | 74,285,248.13 | 82,780,024.60 | 67,109,876.94 | 73,584,032.15 |
| 0.9 | 63,628,545.50 | 66,481,136.32 | 76,424,231.35 | 80,641,041.38 | 68,740,068.08 | 71,953,841.01 |
| 1 | 65,054,840.91 | 65,054,840.91 | 78,532,636.36 | 78,532,636.36 | 70,346,954.55 | 70,346,954.55 |

Table 6: Fuzzy α-Cut Boundaries of CFO Estimates in the Tanker Sector

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy CFO Values for different alpha levels | | | | | | |
| a-cut | Golden Ocean | | Star Bulk | | Genco | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 0 | 26,448,929.73 | 60,365,252.09 | 31,047,946.69 | 76,865,235.13 | 4,119,791.65 | 19,831,890.17 |
| 0.1 | 30,797,066.98 | 56,017,114.84 | 36,921,810.50 | 70,991,371.32 | 6,134,112.66 | 17,817,569.16 |
| 0.2 | 33,240,773.79 | 53,573,408.03 | 40,222,994.48 | 67,690,187.34 | 7,266,185.94 | 16,685,495.88 |
| 0.3 | 35,065,498.41 | 51,748,683.41 | 42,688,000.36 | 65,225,181.45 | 8,111,509.10 | 15,840,172.71 |
| 0.4 | 36,578,782.15 | 50,235,399.67 | 44,732,283.25 | 63,180,898.57 | 8,812,553.96 | 15,139,127.86 |
| 0.5 | 37,907,207.15 | 48,906,974.67 | 46,526,841.95 | 61,386,339.87 | 9,427,961.02 | 14,523,720.80 |
| 0.6 | 39,116,853.86 | 47,697,327.96 | 48,160,944.01 | 59,752,237.81 | 9,988,342.78 | 13,963,339.04 |
| 0.7 | 40,247,716.62 | 46,566,465.20 | 49,688,617.47 | 58,224,564.35 | 10,512,227.03 | 13,439,454.79 |
| 0.8 | 41,326,857.08 | 45,487,324.74 | 51,146,419.68 | 56,766,762.14 | 11,012,150.37 | 12,939,531.45 |
| 0.9 | 42,374,462.10 | 44,439,719.72 | 52,561,620.92 | 55,351,560.90 | 11,497,464.59 | 12,454,217.23 |
| 1 | 43,407,090.91 | 43,407,090.91 | 53,956,590.91 | 53,956,590.91 | 11,975,840.91 | 11,975,840.91 |

Table 7: Fuzzy α-Cut Boundaries of CFO Estimates in the Dry Bulk Sector

The Cash Flow from Operations Trailing Twelve Months (TTM) fuzzy metric was also computed with the goal to better analyze the sample in an annual format to reduce the influence by seasonality. Both the tanker shipping and dry bulk shipping markets are characterized by seasonality and especially the larger vessels. More precisely, the demand for certain goods or the supply of several raw materials are seasonal and since sea transportation is characterized by derived demand, there is also seasonality in the vessels' trading patterns. For example, the demand for heating oil and, as a result, for tankers is increased during winter, while the demand for asphalt, which is an oil product, is very high during summertime, hence the freight rates for bitumen carriers are boosted. Moreover, grains, which are one of the five major bulk cargoes, are seasonal too as they are harvested during the summer. Same applies for other agricultural products, such as corn, soya beans, oats etc. (Stopford, 2009). So, for the TTM CFO, the minimum fuzzy estimator of the tanker shipping sector was around USD 165 million (Frontline's left tail) and the maximum USD 370 million (Euronav's right tail). For the dry bulk shipping sector, the benchmark's fuzzy set was [15.0439; 290.8116] (in millions USD), again a lot lower than the one of tanker shipping companies. The same company ranking as quarterly CFO was observed.

| **Tanker Shipping Companies** | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO Intervals for different alpha levels | | | | | | |
| **a-cut** | **Frontline** | | **Euronav** | | **Scorpio Tankers** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 164,610,765.77 | 315,372,916.05 | 193,129,104.19 | 370,876,577.63 | 167,926,769.53 | 342,725,685.02 |
| **0.1** | 183,938,761.13 | 296,044,920.69 | 215,916,669.47 | 348,089,012.35 | 190,336,324.06 | 320,316,130.49 |
| **0.2** | 194,801,333.15 | 285,182,348.67 | 228,723,562.50 | 335,282,119.32 | 202,930,770.37 | 307,721,684.18 |
| **0.3** | 202,912,454.52 | 277,071,227.30 | 238,286,515.32 | 325,719,166.50 | 212,335,088.47 | 298,317,366.07 |
| **0.4** | 209,639,183.55 | 270,344,498.27 | 246,217,279.69 | 317,788,402.13 | 220,134,293.62 | 290,518,160.92 |
| **0.5** | 215,544,193.15 | 264,439,488.67 | 253,179,242.86 | 310,826,438.96 | 226,980,768.51 | 283,671,686.04 |
| **0.6** | 220,921,218.91 | 259,062,462.91 | 259,518,716.93 | 304,486,964.89 | 233,215,080.42 | 277,437,374.12 |
| **0.7** | 225,948,040.53 | 254,035,641.29 | 265,445,302.89 | 298,560,378.93 | 239,043,353.41 | 271,609,101.14 |
| **0.8** | 230,744,950.22 | 249,238,731.60 | 271,100,824.36 | 292,904,857.46 | 244,605,058.46 | 266,047,396.09 |
| **0.9** | 235,401,681.11 | 244,582,000.71 | 276,591,076.05 | 287,414,605.77 | 250,004,235.29 | 260,648,219.26 |
| **1** | 239,991,840.91 | 239,991,840.91 | 282,002,840.91 | 282,002,840.91 | 255,326,227.27 | 255,326,227.27 |

Table 8: Fuzzy α-Cut Boundaries of TTM CFO Estimates in the Tanker Sector

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO Intervals for different alpha levels | | | | | | |
| **a-cut** | **Golden Ocean** | | **Star Bulk** | | **Genco** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 105,344,384.46 | 224,070,933.73 | 118,525,509.04 | 290,811,581.87 | 15,043,887.93 | 70,951,566.61 |
| **0.1** | 120,565,354.64 | 208,849,963.55 | 140,612,912.34 | 268,724,178.56 | 22,211,359.03 | 63,784,095.52 |
| **0.2** | 129,119,727.79 | 200,295,590.39 | 153,026,305.69 | 256,310,785.22 | 26,239,566.27 | 59,755,888.28 |
| **0.3** | 135,507,308.82 | 193,908,009.36 | 162,295,430.90 | 247,041,660.01 | 29,247,443.02 | 56,748,011.52 |
| **0.4** | 140,804,668.43 | 188,610,649.75 | 169,982,517.64 | 239,354,573.26 | 31,741,940.51 | 54,253,514.03 |
| **0.5** | 145,454,916.60 | 183,960,401.58 | 176,730,570.21 | 232,606,520.70 | 33,931,716.79 | 52,063,737.76 |
| **0.6** | 149,689,372.74 | 179,725,945.44 | 182,875,260.03 | 226,461,830.87 | 35,925,698.88 | 50,069,755.67 |
| **0.7** | 153,648,039.98 | 175,767,278.20 | 188,619,747.99 | 220,717,342.92 | 37,789,813.50 | 48,205,641.05 |
| **0.8** | 157,425,649.51 | 171,989,668.67 | 194,101,500.08 | 215,235,590.83 | 39,568,669.03 | 46,426,785.51 |
| **0.9** | 161,092,866.96 | 168,322,451.22 | 199,423,060.40 | 209,914,030.51 | 41,295,541.55 | 44,699,912.99 |
| **1** | 164,707,659.09 | 164,707,659.09 | 204,668,545.45 | 204,668,545.45 | 42,997,727.27 | 42,997,727.27 |

Table 9: Fuzzy α-Cut Boundaries of TTM CFO Estimates in the Dry Bulk Sector

Between the two sectors- as it is obvious from Figure 9- the operational business transactions of the leading tanker shipping firms outperform the dry bulk shipping sector.

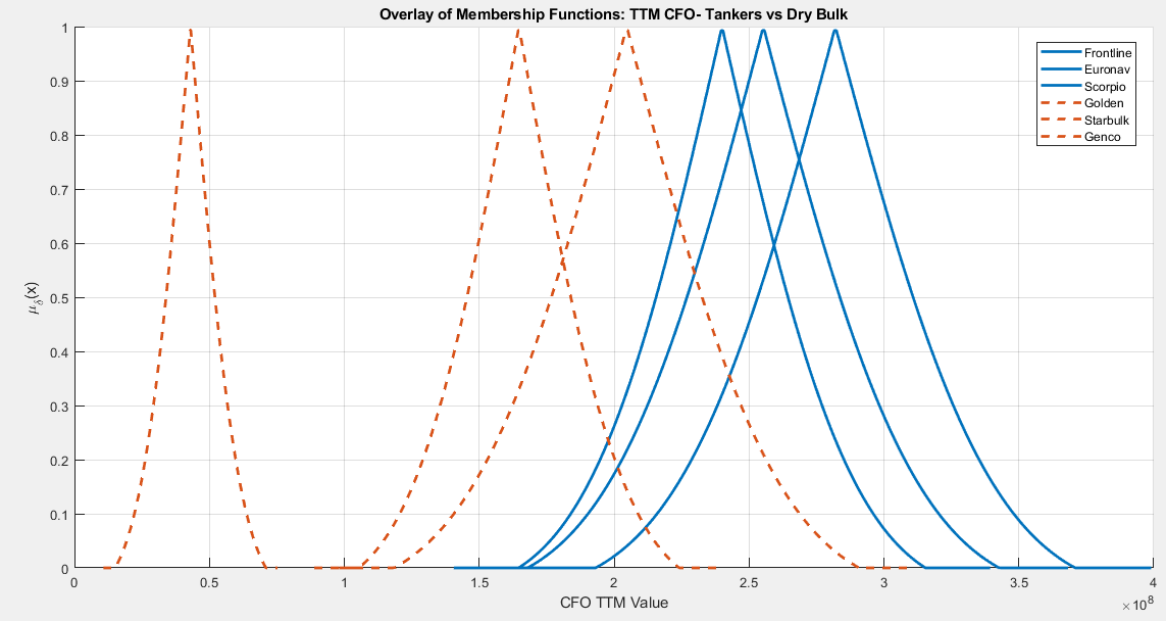


Figure 9: Overlay of TTM CFO Membership Functions

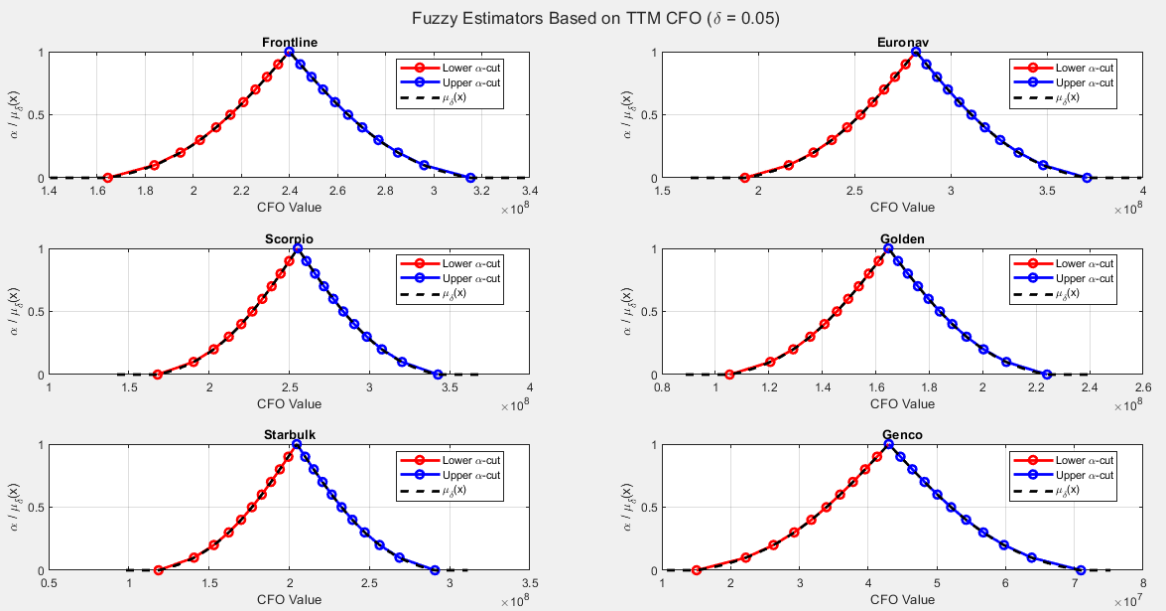


Figure 10: Fuzzy Estimators on TTM CFO based on 95% confidence interval

## 4.2 Cash Flow coverage ratio (CFO/ Debt)

Each ship's finance strategy is crucial because it defines the leverage levels, meaning the capital costs. If a large percentage of the ship's buying value comes from debt, then the company is burdened with regular capital repayments. On the other hand, if the ship is bought with private equity, then the ship-owning company has highly decreased cash flows.

The type of a vessel's financing method plays a crucial role in the cashflow because some methods, like debt, are not included in cash flow statement. (Stopford, 2009)

A firm's ability to provide a commercial return on assets can help her survive during recessions.

So, the liquidity ratio, calculated by the division of Cash Flows from Operations by Debt, is important to be analyzed because it represents the company's ability to repay her indebtedness through her cash flows gained from her operational activities. It also shows the entity's operating efficiency. Debt can be either short term or long term. The goal is to

achieve ratios greater than unity. However, all six companies under examination resulted estimates smaller than unity meaning there is the risk that further debt will be required in order to repay the ones expiring soon. Actually, the values of all six companies were quite close as can be reviewed from Figure 11. It is also observed that the fuzzy interval Genco Shipping, Scorpio Tankers and Euronav is much wider in comparison to the rest three. Those low values should alert the companies to restructure their business operations and financial strategies because the cash that they currently generate from their core operational activities is not enough to cover their capital repayments or their resources are not utilized to their full potential. This situation is normal for the entire shipping industry since the majority of the vessel's value is bought under debt due to the large amount of capital needed for a ship's acquisition. Nevertheless, the companies have to optimize their loan repayment capability under the given circumstances to improve this benchmark since multiple stakeholders are interested in this ration and especially the financial institutions.

| **Tanker Shipping Companies** | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Debt Intervals for different alpha levels | | | | | | |
| **a-cut** | **Frontline** | | **Euronav** | | **Scorpio Tankers** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.112071341 | 0.187077457 | 0.172152482 | 0.355612284 | 0.138874319 | 0.464691676 |
| **0.1** | 0.121687269 | 0.17746153 | 0.195672379 | 0.332092387 | 0.180644726 | 0.422921269 |
| **0.2** | 0.127091538 | 0.17205726 | 0.208890851 | 0.318873915 | 0.20412021 | 0.399445784 |
| **0.3** | 0.131126926 | 0.168021873 | 0.218761132 | 0.309003634 | 0.221649438 | 0.381916556 |
| **0.4** | 0.13447356 | 0.164675238 | 0.226946769 | 0.300817996 | 0.236186807 | 0.367379187 |
| **0.5** | 0.137411379 | 0.16173742 | 0.234132472 | 0.293632294 | 0.24894833 | 0.354617664 |
| **0.6** | 0.140086519 | 0.15906228 | 0.240675679 | 0.287089086 | 0.260568809 | 0.342997185 |
| **0.7** | 0.142587427 | 0.156561371 | 0.24679273 | 0.280972036 | 0.271432449 | 0.332133545 |
| **0.8** | 0.144973952 | 0.154174847 | 0.252630005 | 0.275134761 | 0.281799218 | 0.321766776 |
| **0.9** | 0.147290736 | 0.151858063 | 0.258296698 | 0.269468067 | 0.291863042 | 0.311702952 |
| **1** | 0.149574399 | 0.149574399 | 0.263882383 | 0.263882383 | 0.301782997 | 0.301782997 |

Table 10: α-Cut Intervals of TTM CFO/Debt Values for Tanker Shipping Companies

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Debt Intervals for different alpha levels | | | | | | |
| **a-cut** | **Golden Ocean** | | **Star Bulk** | | **Genco** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.113971233 | 0.208530602 | 0.10493664 | 0.236968763 | 0.099644374 | 0.372296104 |
| **0.1** | 0.126093924 | 0.19640791 | 0.12186341 | 0.220041993 | 0.134598846 | 0.337341632 |
| **0.2** | 0.132907027 | 0.189594808 | 0.131376464 | 0.210528939 | 0.154243691 | 0.317696787 |
| **0.3** | 0.137994395 | 0.18450744 | 0.138479895 | 0.203425508 | 0.168912567 | 0.303027911 |
| **0.4** | 0.142213459 | 0.180288375 | 0.144370925 | 0.197534478 | 0.181077784 | 0.290862694 |
| **0.5** | 0.145917134 | 0.176584701 | 0.149542322 | 0.192363081 | 0.191756931 | 0.280183548 |
| **0.6** | 0.149289653 | 0.173212182 | 0.15425133 | 0.187654073 | 0.201481224 | 0.270459254 |
| **0.7** | 0.15244252 | 0.170059314 | 0.158653641 | 0.183251762 | 0.210572177 | 0.261368301 |
| **0.8** | 0.155451185 | 0.16705065 | 0.162854604 | 0.179050799 | 0.219247337 | 0.252693142 |
| **0.9** | 0.158371928 | 0.164129907 | 0.166932803 | 0.1749726 | 0.227668984 | 0.244271494 |
| **1** | 0.161250917 | 0.161250917 | 0.170952702 | 0.170952702 | 0.235970239 | 0.235970239 |

Table 11: α-Cut Intervals of TTM CFO/Debt Values for Dry Bulk Shipping Companies

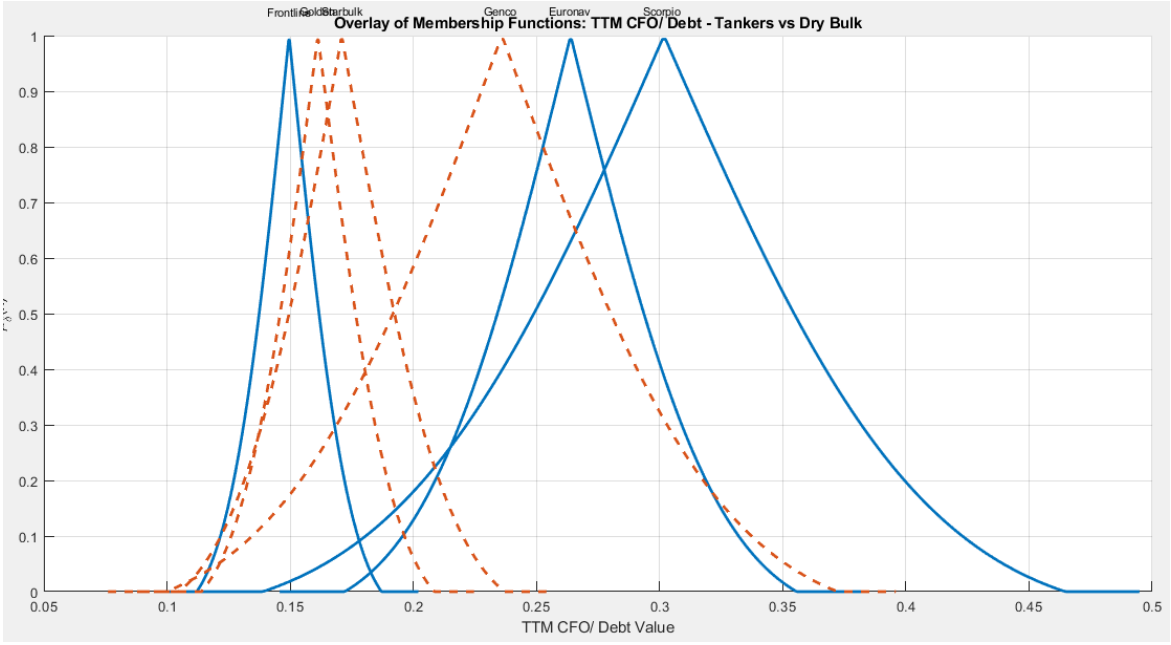


Figure 11: Fuzzy Membership Functions of TTM CFO/ Debt: Tanker vs Dry Bulk Firms

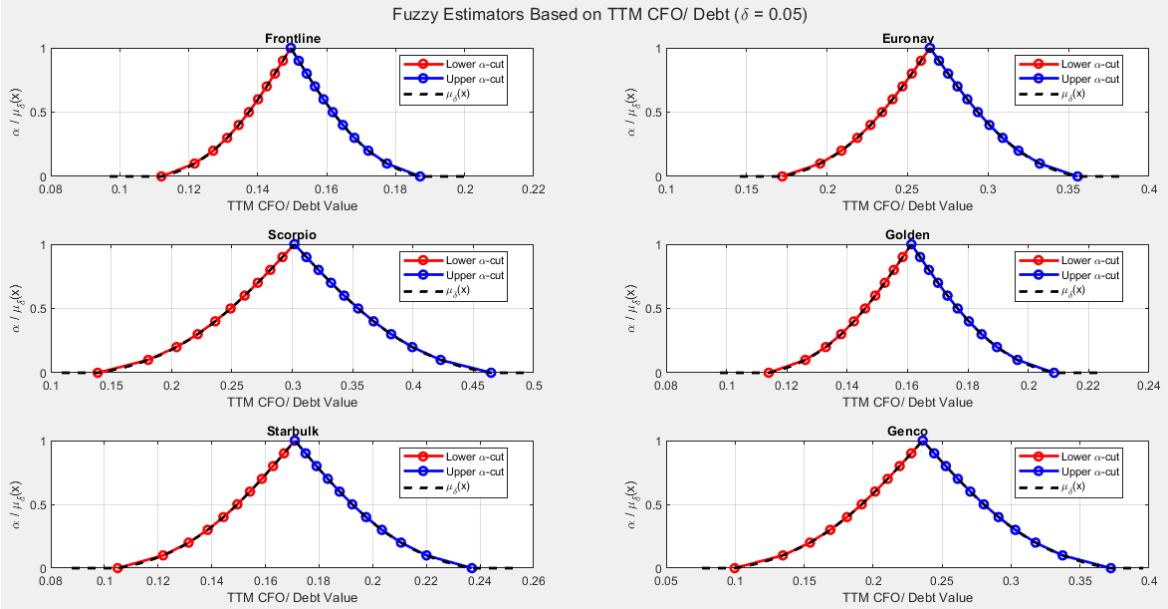


Figure 12: Fuzzy Estimators' Individual Membership Functions on TTM CFO/ Debt based on 95% confidence interval

## 4.3 Cash Flow margin ratio (CFO/ Revenue)

The Revenue of shipping companies mainly comes from vessels' successful trading. In general, shipowners cannot control the revenues because freight rates are mainly defined by demand and supply since shipping industry is characterized by derived demand. However, there are multiple other ways that they can optimize their revenues from every ship or even generate additional revenues- with the most common one being the sale of a vessel at a higher price than the one it was acquired. Some other indicative examples are to increase their fleet's cargo capacity, operate more environmentally friendly ships that are preferred by major charterers, minimize off hires, voyage optimization to reduce waiting times at port, increase cargo handling operations, utilize the vessel's deadweight tonnage as efficiently as possible and combine geographically closed voyage charters to decrease the voyages under ballast increasing the revenue. (Stopford, 2009)

This KPI is a profitability ratio, depicting how companies transform revenue into operating cash flow. Again, the α-cuts of the fuzzy estimates are all lower than one and the left tail of

the dry bulk fuzzy benchmark is negative (Genco's lower bound). This negative metric indicates that the company does not have the capability to cover its production costs and requires to take money from the reserves eventually leading to debt. The tanker sector's fuzzy estimators maximum value amounts to rounded 41% (maximum right tail attributed to Euronav's right tail) while the minimum value is more than 18% (Lower Bound of Frontline). The benchmarking process was concluded as minimum value roughly -0,06 (from Genco) and maximum 0.32 (from Golden Ocean). Those results indicate that the tanker shipping sector converts revenue into cash more effectively. After the freight market collapse in 2008 for all ship types, which resulted from the general economic market crash, the freight market was in trough for many of the following years with only a few signs of recovery which followed by another collapse due to Covid-19 pandemic affecting the ratio's value.

| **Tanker Shipping Companies** | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Revenue Bounds for different alpha levels | | | | | | |
| **a-cut** | **Frontline** | | **Euronav** | | **Scorpio Tankers** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.183098289 | 0.286673362 | 0.233641707 | 0.408016547 | 0.215718252 | 0.33914761 |
| **0.1** | 0.196376811 | 0.27339484 | 0.255996894 | 0.38566136 | 0.231542131 | 0.323323731 |
| **0.2** | 0.203839505 | 0.265932147 | 0.268560786 | 0.373097469 | 0.240435347 | 0.314430515 |
| **0.3** | 0.209411924 | 0.260359727 | 0.277942288 | 0.363715966 | 0.247075943 | 0.30778992 |
| **0.4** | 0.214033253 | 0.255738398 | 0.285722572 | 0.355935683 | 0.252583133 | 0.302282729 |
| **0.5** | 0.218090053 | 0.251681599 | 0.292552437 | 0.349105818 | 0.257417579 | 0.297448283 |
| **0.6** | 0.221784122 | 0.24798753 | 0.298771624 | 0.342886631 | 0.261819764 | 0.293046098 |
| **0.7** | 0.225237597 | 0.244534054 | 0.304585757 | 0.337072498 | 0.265935236 | 0.288930626 |
| **0.8** | 0.228533121 | 0.24123853 | 0.310133969 | 0.331524286 | 0.269862478 | 0.285003384 |
| **0.9** | 0.231732341 | 0.238039311 | 0.315520047 | 0.326138208 | 0.273674955 | 0.281190907 |
| **1** | 0.234885826 | 0.234885826 | 0.320829127 | 0.320829127 | 0.277432931 | 0.277432931 |

Table 12: Fuzzy Set Representation of TTM CFO/ Revenue Estimates for Frontline, Euronav, Scorpio Tankers

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Revenue Bounds for different alpha levels | | | | | | |
| **a-cut** | **Golden Ocean** | | **Star Bulk** | | **Genco** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.185779601 | 0.316878913 | 0.161064544 | 0.285105816 | -0.054932551 | 0.108876065 |
| **0.1** | 0.202586783 | 0.300071731 | 0.176966872 | 0.269203488 | -0.033931974 | 0.087875488 |
| **0.2** | 0.212032627 | 0.290625887 | 0.185904176 | 0.260266183 | -0.02212939 | 0.076072904 |
| **0.3** | 0.219085872 | 0.283572642 | 0.192577694 | 0.253592666 | -0.013316359 | 0.067259873 |
| **0.4** | 0.224935281 | 0.277723232 | 0.198112186 | 0.248058173 | -0.00600752 | 0.059951034 |
| **0.5** | 0.230070142 | 0.272588371 | 0.2029706 | 0.24319976 | 0.00040849 | 0.053535025 |
| **0.6** | 0.234745881 | 0.267912633 | 0.207394609 | 0.238775751 | 0.006250826 | 0.047692689 |
| **0.7** | 0.23911709 | 0.263541424 | 0.211530484 | 0.234639876 | 0.011712652 | 0.042230862 |
| **0.8** | 0.243288373 | 0.259370141 | 0.215477195 | 0.230693164 | 0.016924671 | 0.037018844 |
| **0.9** | 0.247337759 | 0.255320755 | 0.219308574 | 0.226861786 | 0.02198438 | 0.031959134 |
| **1** | 0.251329257 | 0.251329257 | 0.22308518 | 0.22308518 | 0.026971757 | 0.026971757 |

Table 13: Fuzzy Set Representation of TTM CFO/ Revenue Estimates for Golden Ocean, Star Bulk, and Genco

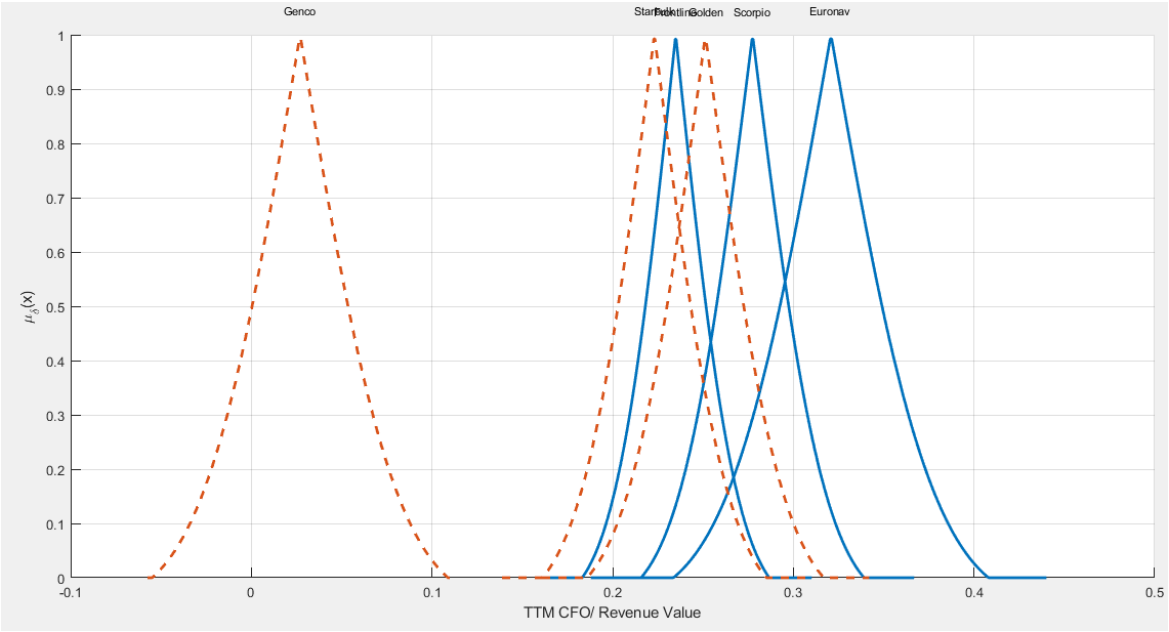


Figure 13: Fuzzy Membership Functions of TTM CFO/ Revenue: Tanker vs Dry Bulk Firms

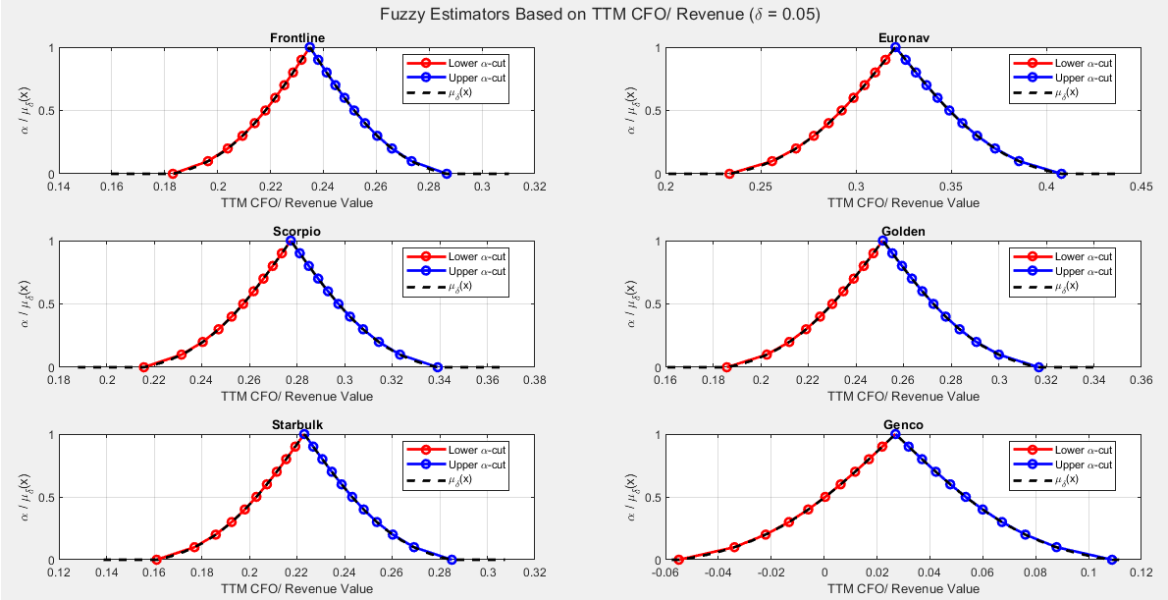


Figure 14: Fuzzy Estimators' Individual Membership Functions on TTM CFO/ Revenue based on 95% confidence interval

## 4.4 Current liabilities coverage ratio (CFO/ Current liabilities)

Current Liabilities are the obligations expected to be paid usually in less than a year period and most commonly have the form of outstanding invoices, short-term debt, current proportion of long-term debt, bonds and other financial commitments.

Again, a liquidity ratio will be examined by dividing Current liabilities from TTM CFO values to identify the ability of an entity to cover short-term obligations with cash raised from business operations. The target results should be greater than unity which is achieved by Euronav's Upper Bound fuzzy estimator's support and also for three major dry bulk shipping companies, right tails. This demonstrates that the dry bulk shipping companies for this period used more efficiently their available resources and were closing open liabilities more quickly. A temporary solution for the tanker shipping companies would be to reduce dividends to first repay their current liabilities.

| Tanker Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Current Liabilities Bounds for different alpha levels | | | | | | |
| a-cut | Frontline | | Euronav | | Scorpio Tankers | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 0 | 0.529648402 | 0.931520696 | 0.416058238 | 1.004474587 | 0.443037887 | 0.83648914 |
| 0.1 | 0.581169197 | 0.879999901 | 0.491494337 | 0.929038489 | 0.493479089 | 0.786047939 |
| 0.2 | 0.61012452 | 0.851044578 | 0.533890356 | 0.88664247 | 0.521827667 | 0.757699361 |
| 0.3 | 0.631745563 | 0.829423535 | 0.565547615 | 0.854985211 | 0.542995651 | 0.736531376 |
| 0.4 | 0.649676363 | 0.811492735 | 0.591801667 | 0.828731159 | 0.56055072 | 0.718976307 |
| 0.5 | 0.665416785 | 0.795752313 | 0.614848593 | 0.805684232 | 0.575961309 | 0.703565719 |
| 0.6 | 0.67974981 | 0.781419288 | 0.635834828 | 0.784697998 | 0.589993992 | 0.689533035 |
| 0.7 | 0.693149329 | 0.768019769 | 0.655454235 | 0.76507859 | 0.603112731 | 0.676414297 |
| 0.8 | 0.705935994 | 0.755233104 | 0.674176309 | 0.746356517 | 0.615631457 | 0.66389557 |
| 0.9 | 0.718348997 | 0.7428201 | 0.692351272 | 0.728181553 | 0.627784352 | 0.651742675 |
| 1 | 0.730584549 | 0.730584549 | 0.710266413 | 0.710266413 | 0.639763514 | 0.639763514 |

Table 14: α-Cut Intervals of TTM CFO/Current Liabilities Values for Tanker Shipping Companies

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Current Liabilities Bounds for different alpha levels | | | | | | |
| a-cut | Golden Ocean | | Star Bulk | | Genco | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 0 | 0.601807112 | 1.193008218 | 0.404179504 | 1.015738931 | 0.424377871 | 1.665894 |
| 0.1 | 0.677600222 | 1.117215108 | 0.48258259 | 0.937335845 | 0.583542608 | 1.506729263 |
| 0.2 | 0.720196886 | 1.074618445 | 0.526646092 | 0.893272343 | 0.672995155 | 1.417276716 |
| 0.3 | 0.752003967 | 1.042811364 | 0.559548466 | 0.860369969 | 0.739789692 | 1.350482179 |
| 0.4 | 0.778382269 | 1.016433061 | 0.58683512 | 0.833083315 | 0.795183851 | 1.29508802 |
| 0.5 | 0.801538269 | 0.993277062 | 0.610788508 | 0.809129927 | 0.843811207 | 1.246460664 |
| 0.6 | 0.822623823 | 0.972191507 | 0.632600155 | 0.78731828 | 0.888090651 | 1.20218122 |
| 0.7 | 0.842336082 | 0.952479248 | 0.652991215 | 0.76692722 | 0.929486188 | 1.160785684 |
| 0.8 | 0.86114676 | 0.93366857 | 0.672449649 | 0.747468786 | 0.968988415 | 1.121283456 |
| 0.9 | 0.879407739 | 0.915407591 | 0.691339455 | 0.72857898 | 1.00733628 | 1.082935592 |
| 1 | 0.897407665 | 0.897407665 | 0.709959217 | 0.709959217 | 1.045135936 | 1.045135936 |

Table 15: α-Cut Intervals of TTM CFO/Current Liabilities Values for Tanker Shipping Companies

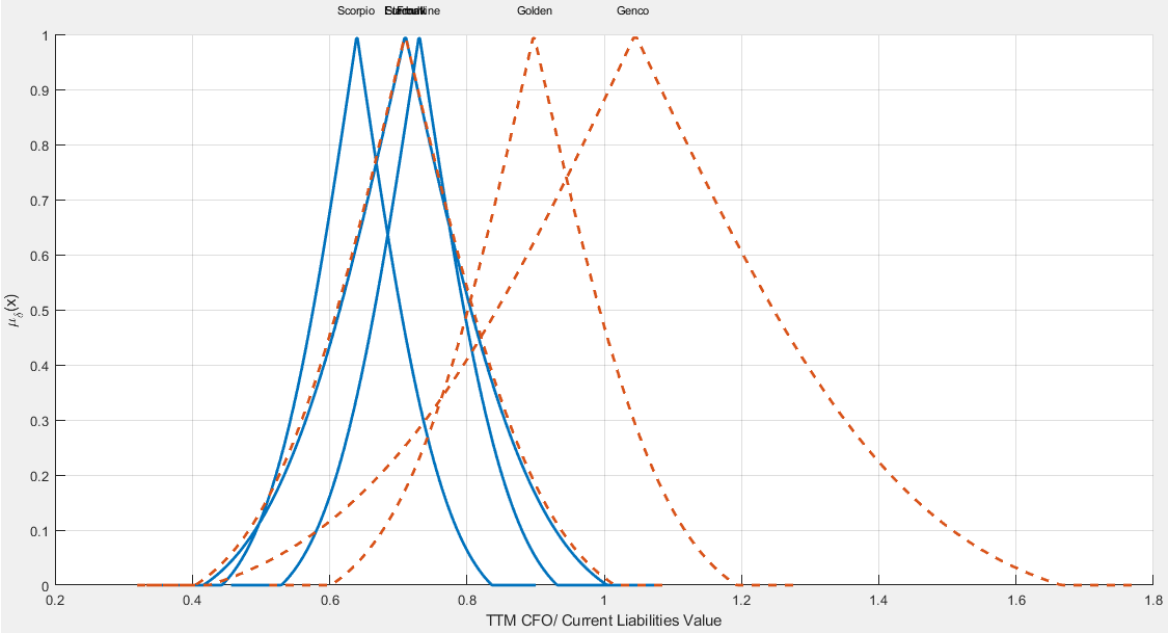


Figure 15: Fuzzy Membership Functions of TTM CFO/ Current Liabilities: Tanker vs Dry Bulk Firms

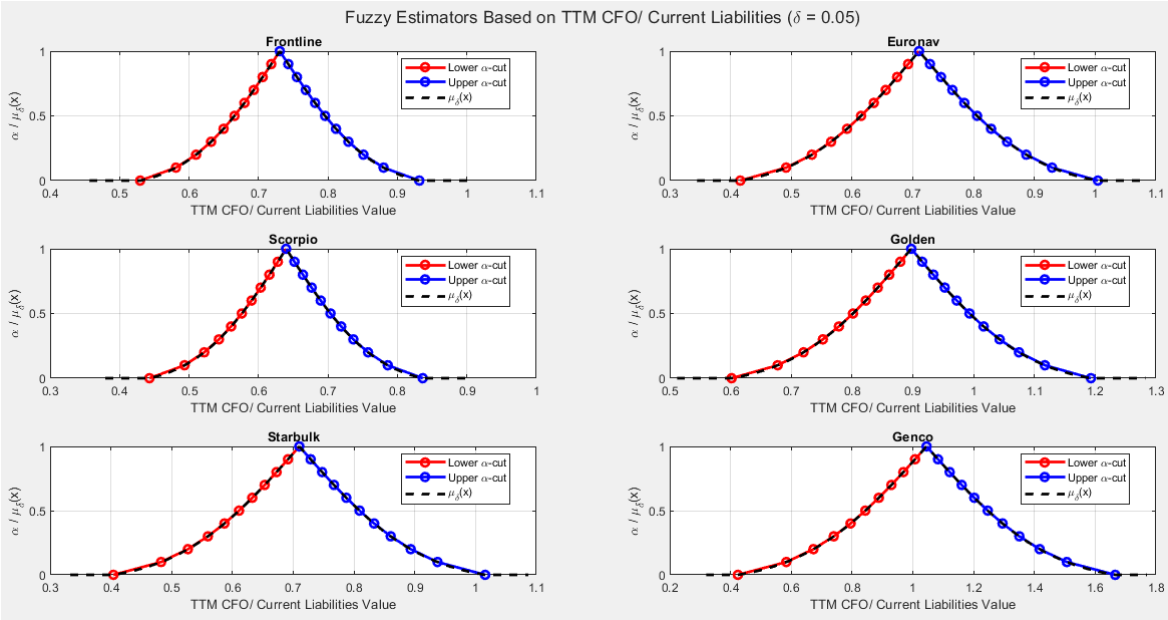


Figure 16: Fuzzy Estimators' Individual Membership Functions on TTM CFO/ Current Liabilities based on 95% confidence interval

## 4.5 Cash Flow to Total Assets

Total Assets consist of current (that can be liquidated almost immediately such as bunkers, stores/ supplies etc.) and fixed assets, such as ships, buildings, equipment etc. So, the ratio TTM CFO/ Assets is an efficiency ratio and can forecast the future operations-related cash flow. It helps firms prepare their budgets more carefully. As Marr (2012) stated, higher ratio signifies the firm's ability to efficiently manage its assets. In the article by Chrysafis et al. it is considered that if such ratio is close to 30% it is positive and values lower than 10% should alert the companies.

Regarding the benchmark formation of the tanker industry, the lower fuzzy estimates are roughly 4% (given from the left tail of Scorpio Tankers) while the maximum estimation surpasses 10% (Euronav's right tail). The fuzzy benchmark estimation of dry bulk shipping is even lower with left tail close to 1% (Genco Shipping) and right 9% (Star Bulk carriers). As can be seen in Tables 16 and 17, all values for all α-cuts are below 10% with the exception of Euronav's upper bound support. Additionally, as visualized in Figures 17 and 18, the situation is more or less similar for all six companies under benchmarking. Ships are assets with substantial value and in combination with market crisis resulting in limited operational cash flows this ratio is this low. Companies need to improve on efficient operation of their assets to yield returns.

| Tanker Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Assets Intervals for different alpha levels | | | | | | |
| **a-cut** | **Frontline** | | **Euronav** | | **Scorpio Tankers** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.04833694 | 0.081654475 | 0.055858088 | 0.104869254 | 0.039891455 | 0.079913311 |
| **0.1** | 0.052608312 | 0.077383103 | 0.062141413 | 0.098585929 | 0.045022333 | 0.074782433 |
| **0.2** | 0.055008875 | 0.07498254 | 0.065672719 | 0.095054623 | 0.04790595 | 0.071898816 |
| **0.3** | 0.056801385 | 0.07319003 | 0.068309558 | 0.092417784 | 0.050059157 | 0.069745608 |
| **0.4** | 0.058287952 | 0.071703463 | 0.070496346 | 0.090230996 | 0.051844859 | 0.067959907 |
| **0.5** | 0.059592923 | 0.070398492 | 0.072416001 | 0.08831134 | 0.053412424 | 0.066392342 |
| **0.6** | 0.060781214 | 0.069210201 | 0.074164015 | 0.086563327 | 0.054839828 | 0.064964938 |
| **0.7** | 0.061892112 | 0.068099303 | 0.075798181 | 0.084929161 | 0.056174266 | 0.0636305 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **0.8** | 0.0629522 | 0.067039215 | 0.077357605 | 0.083369736 | 0.05744767 | 0.062357095 |
| **0.9** | 0.06398131 | 0.066010105 | 0.078871459 | 0.081855883 | 0.058683863 | 0.061120903 |
| **1** | 0.064995708 | 0.064995708 | 0.080363671 | 0.080363671 | 0.059902383 | 0.059902383 |

Table 16: Fuzzy TTM CFO/ Assets ratio Bounds by α-Cut for Major Dry Bulk Shipping Companies

| **Dry Bulk Shipping Companies** | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy TTM CFO/ Assets Intervals for different alpha levels | | | | | | |
| **a-cut** | **Golden Ocean** | | **Star Bulk** | | **Genco** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | 0.039417401 | 0.073170473 | 0.042567625 | 0.089236093 | 0.016580531 | 0.061543583 |
| **0.1** | 0.043744609 | 0.068843264 | 0.048550611 | 0.083253106 | 0.02234488 | 0.055779234 |
| **0.2** | 0.046176553 | 0.06641132 | 0.051913124 | 0.079890594 | 0.025584516 | 0.052539598 |
| **0.3** | 0.047992495 | 0.064595378 | 0.054423924 | 0.077379794 | 0.028003563 | 0.050120551 |
| **0.4** | 0.049498495 | 0.063089379 | 0.056506185 | 0.075297533 | 0.030009731 | 0.048114383 |
| **0.5** | 0.050820526 | 0.061767348 | 0.058334082 | 0.073469635 | 0.031770832 | 0.046353283 |
| **0.6** | 0.05202435 | 0.060563523 | 0.059998542 | 0.071805175 | 0.033374467 | 0.044749647 |
| **0.7** | 0.053149769 | 0.059438104 | 0.061554596 | 0.070249121 | 0.034873658 | 0.043250457 |
| **0.8** | 0.054223716 | 0.058364158 | 0.063039481 | 0.068764237 | 0.03630428 | 0.041819834 |
| **0.9** | 0.055266278 | 0.057321595 | 0.064480973 | 0.067322744 | 0.037693095 | 0.040431019 |
| **1** | 0.056293937 | 0.056293937 | 0.065901859 | 0.065901859 | 0.039062057 | 0.039062057 |

Table 17: Fuzzy TTM CFO/ Assets ratio Bounds by α-Cut for Major Dry Bulk Shipping Companies

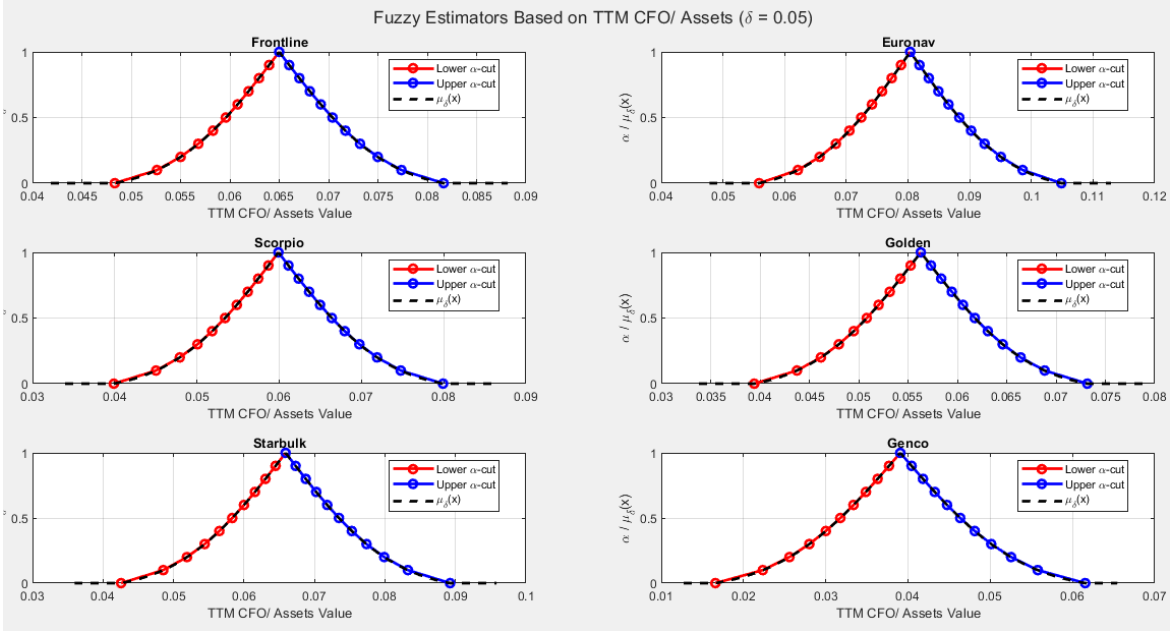


Figure 17: Fuzzy Estimators' Individual Membership Functions on TTM CFO/ Assets based on 95% confidence interval

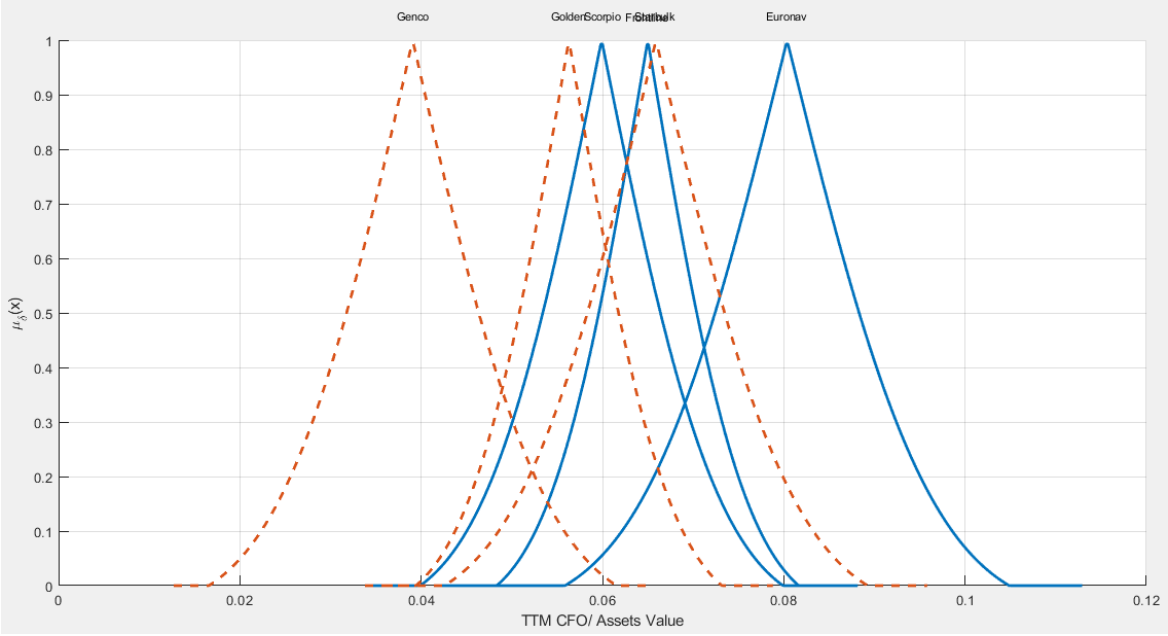


Figure 18: Fuzzy Membership Functions of TTM CFO/ Assets: Tanker vs Dry Bulk Firms

## 4.6 Cash Flow to Net Income

With Net Income, a company's profitability is shown and its ability to efficiently manage resources in order to produce revenue. (Kenton, 2024)

From the vessel's Revenues, the Costs must be first deducted. Those costs are divided into three main categories. There are the Operating costs such as the manning costs- which are the larger type of cost in this category- (i.e. crew wages, bonuses, repatriation expenses, medical insurance etc.), stores/ spares/ supplies and lubricants, maintenance and repairs costs, vessel's insurance and administration costs related to ship's management. Another cost category can be the voyage costs that- depending on the charterparty type- are either the responsibility of the shipowner or the charterer. More precisely, if the vessel is under voyage charter the shipowner is responsible for those types of costs, but in case of time charter the charterer covers them. The main element of voyage costs is the Bunkers that approximately represent over than 60% of the total voyage costs and are highly dependent on ship's fuel consumption and oil prices that suffer from strong and constant fluctuations. Then all the port expenses are included in the same category and any Canal dues that might occur. Lastly, there are the cargo handling costs needed for cargo loading or discharge. All those costs are influenced by global economic conditions, outside of company's control, but the company is responsible for ensuring efficient management to minimize the unnecessary expenses. They also differ among various ship types and ages. The ability of a shipping company to reduce those costs significantly improves her financial and business performance. There are several ways this can be achieved like having a modern fleet, experienced and well-trained crew members and office personnel, strong organizational structure etc. The ship's age plays an important role since older ships have higher operating and voyage costs than younger ones, but younger ships tend to have higher capital costs. (Stopford, 2009)

After deducting the total costs from the total revenue of the accounting period, the taxes are also deducted resulting in Net Income (Kenton, 2024).

The Cash Flows from Operations to Net Income ratio indicates the cash quantity generated by the firm for each unit of net income making it a profitability ratio. The goal is to achieve values over 100%. The largest fuzzy ratio value found in Euronav amounting to over 74.6 while the company's minimal lower interval was -18.6 which are both extreme amounts, influencing significantly the benchmarking of the tanker sector. As seen in the group chart of all six companies (Figure 19) Euronav had a significantly wider interval in comparison to the other six companies making their membership curves appear really thin. Concerning the dry bulk shipping companies, for α-cut tending to zero their left intervals were negative while their right ones were clearly over the unity for all membership grades. In tables 18 and 19, the detailed results of the proposed method are presented and are also depicted in Figures 19 (for all companies collectively) and 20 (separately for each firm in different subplots).

| Tanker Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy CFO/ Net Income Intervals for different alpha levels | | | | | | |
| **a-cut** | **Frontline** | | **Euronav** | | **Scorpio Tankers** | |
| | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** | **Lower Bound** | **Upper Bound** |
| **0** | -0.095539274 | 3.57851813 | -18.60426335 | 74.66850344 | -3.037635679 | 8.135964416 |
| **0.1** | 0.375481896 | 3.10749696 | -6.646516658 | 62.71075675 | -1.605158825 | 6.703487562 |
| **0.2** | 0.640201609 | 2.842777247 | 0.073884612 | 55.99035548 | -0.800089147 | 5.898417884 |
| **0.3** | 0.837868765 | 2.64511009 | 5.092032275 | 50.97220781 | -0.19894074 | 5.297269477 |
| **0.4** | 1.001798429 | 2.481180427 | 9.253691065 | 46.81054902 | 0.299604684 | 4.798724053 |
| **0.5** | 1.145702879 | 2.337275977 | 12.90697263 | 43.15726746 | 0.737249118 | 4.361079619 |
| **0.6** | 1.276740419 | 2.206238437 | 16.2336038 | 39.83063629 | 1.135762507 | 3.96256623 |
| **0.7** | 1.399243521 | 2.083735334 | 19.34357245 | 36.72066764 | 1.508320834 | 3.590007903 |
| **0.8** | 1.516143695 | 1.96683516 | 22.31130035 | 33.75293974 | 1.863839448 | 3.234489289 |
| **0.9** | 1.629627727 | 1.853351129 | 25.19230313 | 30.87193696 | 2.208968836 | 2.889359901 |
| **1** | 1.741489428 | 1.741489428 | 28.03212004 | 28.03212004 | 2.549164368 | 2.549164368 |

Table 18: Fuzzy α-Cut Boundaries of CFO/ Net Income Estimates in the Tanker Shipping Sector

| Dry Bulk Shipping Companies | | | | | | |
|---|---|---|---|---|---|---|
| Fuzzy CFO/ Net Income Intervals for different alpha levels | | | | | | |
| a-cut | Golden Ocean | | Star Bulk | | Genco | |
| | Lower Bound | Upper Bound | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| 0 | -0.958568672 | 5.718552607 | -2.543730302 | 6.958047091 | -0.345973392 | 3.231981818 |
| 0.1 | -0.102548982 | 4.862532917 | -1.325584309 | 5.739901097 | 0.112727294 | 2.773281132 |
| 0.2 | 0.378544652 | 4.381439284 | -0.640971221 | 5.05528801 | 0.370522742 | 2.515485684 |
| 0.3 | 0.737778989 | 4.022204947 | -0.12976818 | 4.544084969 | 0.563019525 | 2.3229889 |
| 0.4 | 1.035699823 | 3.724284113 | 0.294183599 | 4.12013319 | 0.722661286 | 2.163347139 |
| 0.5 | 1.297227436 | 3.4627565 | 0.66634655 | 3.747970239 | 0.862801632 | 2.023206794 |
| 0.6 | 1.535371115 | 3.224612821 | 1.005233344 | 3.409083445 | 0.990411628 | 1.895596798 |
| 0.7 | 1.758004564 | 3.001979371 | 1.322048539 | 3.09226825 | 1.109710421 | 1.776298005 |
| 0.8 | 1.97045542 | 2.789528516 | 1.624373546 | 2.789943243 | 1.223552841 | 1.662455585 |
| 0.9 | 2.176697881 | 2.583286055 | 1.91786379 | 2.496452999 | 1.334068474 | 1.551939951 |
| 1 | 2.379991968 | 2.379991968 | 2.207158394 | 2.207158394 | 1.443004213 | 1.443004213 |

Table 19: Fuzzy α-Cut Boundaries of CFO/ Net Income Estimates in the Dry Bulk Shipping Sector

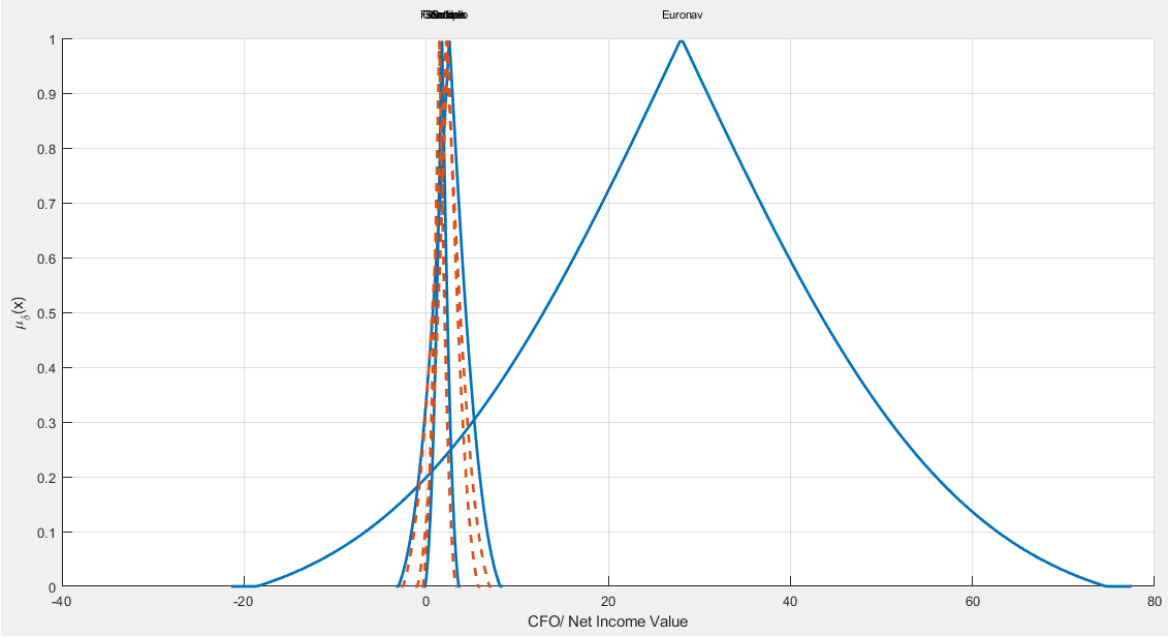


Figure 19: Fuzzy Membership Functions of TTM CFO/ Net Income: Tanker vs Dry Bulk Shipping Companies

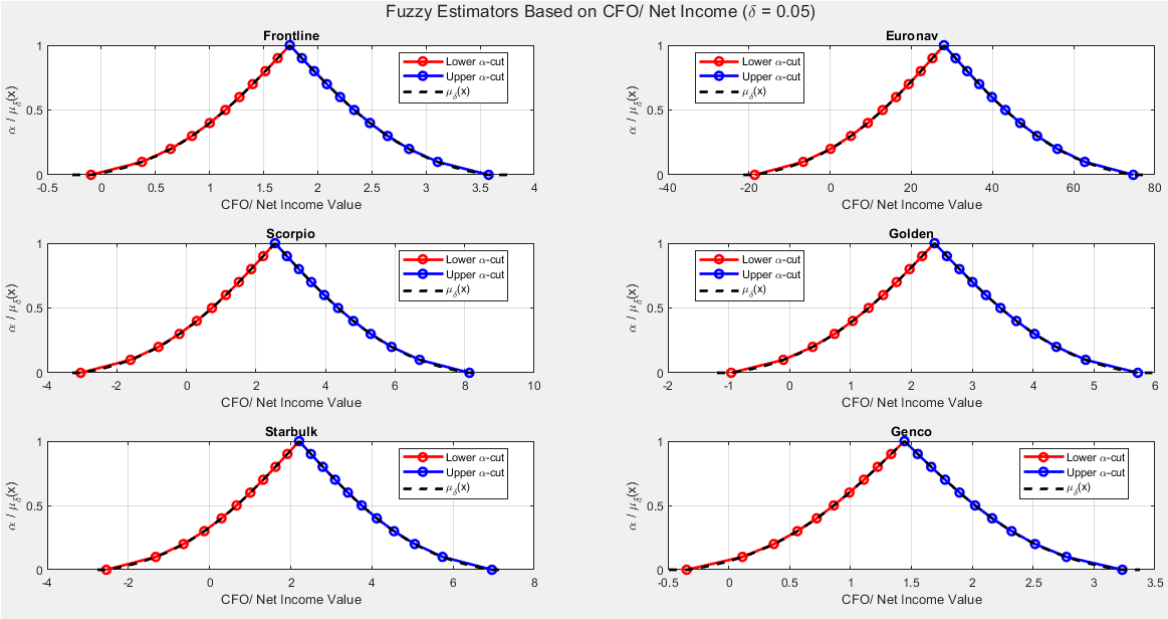


Figure 20: Fuzzy Estimators' Individual Membership Functions on TTM CFO/ Debt based on 95% confidence interval

# 5. Conclusion

The above findings indicate that the tanker shipping sector in the majority of KPIs outperformed the dry bulk shipping companies, making the tanker shipping sector financially more stable and resilient demonstrating better risk management. So, for an external investor, companies that own tankers could be a better investment, but still undertaking strong risk though. Concerning the tanker shipping companies, they were found to have more liquidity and stronger operating performance, with Euronav in most of the cases achieving the best operational management. Frontline, despite being the largest company among the three, in many cases had the lowest estimators under the period of examination. However, the difference between their support is relatively small depicting similar performance range. On the other hand, dry bulk shipping companies returned lower and narrower fuzzy intervals. Genco Shipping was clearly the weakest, with much lower values in all financial indicators and ratios. Golden Ocean and Star Bulk carriers performed moderately, but not on par with tankers. With regard to the above findings, both sectors need

to improve their financial performance related to business operations in order to firstly generate sufficient amount of cash to cover the obligations and expenses. One benefit that all these companies have and needs to be taken into account is that due to their large number of vessels they can achieve economies of scale.

It was also highlighted that robust financial performance is driven by the efficiency and effectiveness of daily operations. Furthermore, to enhance the strength, reliability, and resilience of maritime chokepoints, the maritime transport and logistics sector must adopt green technologies, advance digitalization, and foster stronger international collaboration. Hence, the creation of adequate financial strength is necessary, but can often be challenging. This can be achieved during the periods of positive freight markets- and as a consequence secondhand market- by also making the correct investments (Stopford, 2009).

In conclusion, the key to surviving in those two very competitive shipping markets is financial performance by carefully selecting the ship's finance method and reducing operational costs as much as possible, but without decreasing quality of the services offered because there will be long-term economic losses.

To the best of author's knowledge there is no study in the current literature that sets fuzzy benchmarks and compares those two specific sectors, thus this is a useful contribution to the shipping industry that can be used by either those companies, competitors, investors and the rest stake holders or even future market entrants. Nevertheless, there is still room for further future analysis.

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# Annex A: Matlab Code for NAFEs based on Confidence Intervals

```
filename = 'Excel path with indicator's statistics';
delta = 0.05;
alpha = 0:0.1:1;

% Loading statistics from Excel
stats = readtable(filename, 'ReadVariableNames', true);
meanRow = stats{1, 2:end};
stdRow = stats{2, 2:end};
nRow = stats{3, 2:end};
companyNames = stats.Properties.VariableNames(2:end);

% Computing h(alpha): h(α) = ((1 - δ)/2) * α + δ/2
% Then getting z-scores: z_{h(α)} = Φ⁻¹(1 - h(α))

h_alpha = ((1 - delta)/2) * alpha + (delta / 2);
z = norminv(1 - h_alpha);

% Preparing export and plotting
allCuts = table();
mu_collection = {};
x_collection = {};

% Prepare plot layout & then exporting α-cuts for Benchmarking
figure('Name', 'Fuzzy Estimators for Each Company');
tiledlayout(3, 2);

for k = 1:length(companyNames)
    xbar = double(meanRow(k));
    s = double(stdRow(k));
    n = double(nRow(k));
    sqrt_n = sqrt(n);

    % α-cuts calculation using: [x̄ - z_{h(α)}·s/√n, x̄ + z_{h(α)}·s/√n]
    margin = z * (s / sqrt_n);
    lower = xbar - margin;
    upper = xbar + margin;

    % Debugging info
    fprintf('\n--- %s ---\n', companyNames{k});
    fprintf('Mean: %.2e\n', xbar);
    fprintf('Std: %.2e\n', s);
    fprintf('n: %d\n', n);
    fprintf('Lower(0.5): %.2e\n', lower(6));
    fprintf('Upper(0.5): %.2e\n', upper(6));

    % Store α-cut data for CSV export
    companyCol = repmat(string(companyNames{k}), length(alpha), 1);
```

```
    alphaCutTable = table(companyCol, alpha', lower', upper', ...
        'VariableNames', {'Company', 'Alpha', 'LowerBound', 'UpperBound'});
    allCuts = [allCuts; alphaCutTable];

    % Computing membership function μδ(x)
    z_delta = norminv(1 - delta/2);
    support_min = xbar - z_delta * (s / sqrt_n);
    support_max = xbar + z_delta * (s / sqrt_n);
    x_vals = linspace(support_min - 0.1*xbar, support_max + 0.1*xbar, 300);
    mu = zeros(size(x_vals));

    for i = 1:length(x_vals)
        x = x_vals(i);
        if x >= support_min && x <= xbar
            mu(i) = (2 / (1 - delta)) * normcdf((x - xbar) / (s / sqrt_n)) -
delta / (1 - delta);
        elseif x > xbar && x <= support_max
            mu(i) = (2 / (1 - delta)) * normcdf((xbar - x) / (s / sqrt_n)) -
delta / (1 - delta);
        else
            mu(i) = 0;
        end
    end

    mu_collection{k} = mu;
    x_collection{k} = x_vals;

    % Plot individual fuzzy number
    nexttile;
    plot(lower, alpha, 'ro-', 'LineWidth', 2); hold on;
    plot(upper, alpha, 'bo-', 'LineWidth', 2);
    plot(x_vals, mu, 'k--', 'LineWidth', 2);
    xlabel('CFO Value'); ylabel('\alpha / \mu_\delta(x)');
    title(companyNames{k}, 'Interpreter', 'none');
    legend('Lower \alpha-cut', 'Upper \alpha-cut', '\mu_\delta(x)', 'Location',
'best');
    grid on;
end

sgtitle('Fuzzy Estimators Based on Precomputed Stats (\delta = 0.05)');

% Exports α-cuts to CSV
writetable(allCuts, 'Fuzzy_Estimators_AlphaCuts.csv');

% Overlay all Membership Functions (Tankers vs Dry Bulk carriers)
figure('Name', 'Overlay of Membership Functions'); hold on;
tankerIdx = 1:3; bulkIdx = 4:6;
for k = 1:length(companyNames)
    if ismember(k, tankerIdx)
        plot(x_collection{k}, mu_collection{k}, '-', 'Color', [0 0.447 0.741],
'LineWidth', 2, 'DisplayName', companyNames{k});
    else
```

```
        plot(x_collection{k}, mu_collection{k}, '--', 'Color', [0.850 0.325
0.098], 'LineWidth', 2, 'DisplayName', companyNames{k});
    end

    % Add label at the peak of each curve
    [~, idxMax] = max(mu_collection{k});
    xLabel = x_collection{k}(idxMax);
    yLabel = mu_collection{k}(idxMax);
    text(xLabel, yLabel + 0.05, companyNames{k}, 'FontSize', 8,
'HorizontalAlignment', 'center');

end

xlabel('CFO Value'); ylabel('\mu_\delta(x)');
title('Overlay of Membership Functions: Tankers vs Dry Bulk');
grid on;
legend('Location', 'best');
```

# Annex B: Detailed Financial Data of Selected Shipping Companies

**Cash Flow from Operations (in thousand USD):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Star Bulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CFO | TTM CFO | CFO | TTM CFO | CFO | TTM CFO | CFO | TTM CFO | CFO | TTM CFO | CFO | TTM CFO |
| 2012 | Q1 | 13,545 | N/A | -18,944 | N/A | 995 | N/A | 12,567 | N/A | 12,214 | N/A | -7,969 | N/A |
| | Q2 | 34,085 | N/A | n/a | N/A | 4,331 | N/A | 11,921 | N/A | 7,140 | N/A | 8,527 | N/A |
| | Q3 | -2,758 | N/A | n/a | N/A | 2,044 | N/A | 10,407 | N/A | 121 | N/A | -4,570 | N/A |
| | Q4 | 23,702 | 68,574 | 7,595 | 69,812 | -5,442 | 1,928 | 1,904 | 36,799 | -476 | 18,999 | -14,822 | -18,834 |
| 2013 | Q1 | -28,648 | 26,381 | 7,595 | -8,917 | -1,576 | -643 | 3,397 | 27,629 | 8,977 | 15,762 | -17,366 | -28,231 |
| | Q2 | -17,155 | -24,859 | 7,595 | -8,917 | -5,461 | -10,435 | -918 | 14,790 | 5,985 | 14,607 | -7,904 | -44,662 |
| | Q3 | -3,112 | -25,213 | 7,595 | -8,917 | -582 | -13,061 | 3,644 | 8,027 | 7,469 | 21,955 | 644 | -39,448 |
| | Q4 | 6,231 | -42,684 | 7,595 | -8,917 | 1,933 | -5,686 | 6,190 | 12,313 | 5,064 | 27,495 | 21,482 | -3,144 |
| 2014 | Q1 | 21,152 | 7,116 | 7,595 | 30,380 | 5,284 | 1,174 | 14,746 | 23,662 | 1,502 | 20,020 | -2,604 | 11,618 |
| | Q2 | -429 | 23,842 | -6,217 | 16,568 | 13,330 | 19,965 | 1,048 | 25,628 | 8,983 | 23,018 | -20,452 | -930 |
| | Q3 | 17,730 | 44,684 | 316,428 | 325,401 | 15,418 | 35,965 | 6,697 | 28,681 | -2,816 | 12,733 | -34,551 | -36,125 |
| | Q4 | 14,941 | 53,394 | -303,024 | 14,782 | 59,884 | 93,916 | 2,373 | 24,864 | 5,150 | 12,819 | -2,545 | -60,152 |
| 2015 | Q1 | 49,644 | 81,886 | 77,624 | 84,811 | 64,439 | 153,071 | -6,194 | 3,924 | -8,594 | 2,723 | -12,320 | -69,868 |
| | Q2 | 38,455 | 120,770 | 106,435 | 197,463 | 94,106 | 233,847 | -4,762 | -1,886 | -905 | -7,165 | -17,510 | -66,926 |
| | Q3 | 32,199 | 135,239 | 133,747 | 14,782 | 127,411 | 345,840 | 2,290 | -6,293 | 1,422 | -2,927 | -9,563 | -41,938 |
| | Q4 | 87,048 | 207,346 | 132,726 | 450,532 | 106,019 | 391,975 | -6,161 | -14,827 | -6,501 | -14,578 | -16,693 | -56,086 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | Q1 | 121,468 | 279,170 | 189,521 | 562,429 | 78,870 | 406,406 | -21,570 | -30,203 | -26,533 | -32,517 | -27,304 | -71,070 |
| | Q2 | 82,346 | 323,061 | 101,244 | 557,238 | 47,738 | 360,038 | -14,877 | -40,318 | -9,439 | -41,051 | -13,926 | -67,486 |
| | Q3 | 48,531 | 339,393 | 75,059 | 498,550 | 28,731 | 261,358 | -4,228 | -46,836 | -4,656 | -47,129 | -4,677 | -62,600 |
| | Q4 | 33,671 | 286,016 | 72,378 | 438,202 | 23,172 | 178,511 | 17,623 | -23,052 | 7,180 | -33,448 | -6,400 | -52,307 |
| 2017 | Q1 | 79,784 | 244,332 | 74,429 | 323,110 | 33,541 | 133,182 | 4,468 | 2,986 | 6,105 | -810 | -6,567 | -31,570 |
| | Q2 | 29,652 | 191,638 | 58,807 | 280,673 | 26,333 | 111,777 | 6,078 | 23,941 | 14,231 | 22,860 | 5,398 | -12,246 |
| | Q3 | 10,907 | 154,014 | 41,443 | 247,057 | -20,895 | 62,151 | 27,435 | 55,604 | 18,139 | 45,655 | 4,890 | -2,679 |
| | Q4 | 5,352 | 125,695 | 36,616 | 211,295 | 2,822 | 41,801 | 56,896 | 94,877 | 42,495 | 80,970 | 20,350 | 24,071 |
| 2018 | Q1 | 12,045 | 57,956 | 13,222 | 150,088 | 34,849 | 43,109 | 28,540 | 118,949 | 31,582 | 106,447 | 9,461 | 40,099 |
| | Q2 | 1,200 | 29,504 | -1,947 | 89,334 | 17,879 | 34,655 | 33,657 | 146,528 | 29,505 | 121,721 | 15,558 | 34,701 |
| | Q3 | -1,767 | 16,830 | -41,349 | 6,542 | -17,722 | 37,828 | 63,631 | 182,724 | 48,086 | 151,668 | 18,356 | 63,725 |
| | Q4 | 34,693 | 46,171 | 30,915 | 841 | 22,784 | 57,790 | 60,717 | 186,545 | 59,836 | 169,009 | 22,532 | 65,907 |
| 2019 | Q1 | 97,757 | 131,883 | 86,800 | 74,419 | 74,567 | 97,508 | 25,077 | 183,082 | 12,408 | 149,835 | 11,612 | 77,519 |
| | Q2 | 43,079 | 173,762 | -1,266 | 75,100 | 46,710 | 126,339 | 3,413 | 152,838 | -4,781 | 115,549 | 3,211 | 55,711 |
| | Q3 | 28,245 | 203,774 | -32,602 | 83,847 | 19,171 | 163,232 | 45,844 | 135,051 | 27,659 | 95,122 | 13,935 | 51,290 |
| | Q4 | 108,896 | 277,977 | 219,059 | 271,991 | 69,064 | 209,512 | 84,096 | 158,430 | 53,239 | 88,525 | 30,768 | 59,526 |
| 2020 | Q1 | 204,720 | 384,940 | 301,749 | 486,940 | 44,102 | 179,047 | -4,829 | 128,524 | 32,097 | 108,214 | -4,038 | 43,876 |
| | Q2 | 240,788 | 582,649 | 239,943 | 728,149 | 247,994 | 380,331 | 16,039 | 141,150 | 23,363 | 136,358 | 4,939 | 45,604 |
| | Q3 | 132,088 | 686,492 | 306,859 | 1,067,610 | 110,645 | 471,805 | 58,075 | 153,381 | 57,019 | 165,718 | 15,114 | 46,783 |
| | Q4 | 26,462 | 604,058 | 121,234 | 969,785 | 16,641 | 419,382 | 71,356 | 140,641 | 58,073 | 170,552 | 20,881 | 36,896 |
| 2021 | Q1 | 12,001 | 411,339 | 50,621 | 718,657 | -1,828 | 373,452 | 6,578 | 152,048 | 79,176 | 217,631 | 13,494 | 54,428 |
| | Q2 | 29,216 | 199,767 | -46,257 | 432,457 | 27,750 | 153,208 | 134,179 | 270,188 | 140,491 | 334,759 | 49,058 | 98,547 |
| | Q3 | -3,525 | 64,154 | 14,069 | 139,667 | -2,842 | 39,721 | 200,485 | 412,598 | 251,032 | 528,772 | 72,435 | 155,868 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q4 | 25,238 | 62,930 | -43,738 | -25,305 | 50,220 | 73,300 | 219,156 | 560,398 | 296,372 | 767,071 | 96,132 | 231,119 |
| 2022 | Q1 | 19,943 | 70,872 | -44,213 | -120,139 | 5,534 | 80,662 | 123,624 | 677,444 | 229,156 | 917,051 | 52,555 | 270,180 |
| | Q2 | 71,793 | 113,449 | 105,592 | 31,710 | 134,268 | 187,180 | 155,476 | 698,741 | 239,931 | 1,016,491 | 46,604 | 267,726 |
| | Q3 | 71,437 | 188,411 | 25,863 | 43,504 | 313,186 | 503,208 | 98,681 | 596,937 | 184,475 | 949,934 | 54,289 | 249,580 |
| | Q4 | 222,157 | 385,330 | 168,311 | 255,553 | 316,345 | 769,333 | 125,605 | 503,386 | 116,336 | 769,898 | 35,875 | 189,323 |
| 2023 | Q1 | 270,014 | 635,401 | 203,081 | 502,847 | 276,477 | 1,040,276 | 76,519 | 456,281 | 83,190 | 623,932 | 19,566 | 156,334 |
| | Q2 | 283,140 | 846,748 | 225,999 | 623,254 | 224,872 | 1,130,880 | 45,549 | 346,354 | 96,880 | 480,881 | 19,382 | 129,112 |
| | Q3 | 202,532 | 977,843 | 148,898 | 746,289 | 178,318 | 996,012 | 47,398 | 295,071 | 67,103 | 363,509 | 13,218 | 88,041 |
| | Q4 | 100,494 | 856,180 | 259,402 | 837,380 | 185,765 | 865,432 | 96,871 | 266,337 | 88,604 | 335,777 | 39,618 | 91,784 |

**Debt (in thousand USD) & CFO/ Debt (TTM):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Debt** | **TTM CFO/ Debt** | **Debt** | **TTM CFO/ Debt** | **Debt** | **TTM CFO/ Debt** | **Debt** | **TTM CFO/ Debt** | **Debt** | **TTM CFO/ Debt** | **Debt** | **TTM CFO/ Debt** |
| 2012 | Q1 | 494,570 | N/A | 923,268 | N/A | n/a | N/A | 152,840 | N/A | 250,113 | N/A | 1,568,513 | N/A |
| | Q2 | 494,644 | N/A | n/a | N/A | n/a | N/A | 151,940 | N/A | 242,113 | N/A | 1,561,515 | N/A |
| | Q3 | 484,864 | N/A | n/a | N/A | n/a | N/A | 137,843 | N/A | 234,114 | N/A | 1,413,439 | N/A |
| | Q4 | 483,992 | 0.141684 | 1,044,168 | 0.066859 | 142,559 | 0.013524 | 111,678 | 0.32951 | 224,114 | 0.084774 | 1,524,357 | -0.012355 |
| 2013 | Q1 | 478,298 | 0.055156 | 1,044,168 | -0.00854 | 174,892 | -0.00368 | 107,646 | 0.256665 | 211,376 | 0.074569 | 1,413,439 | -0.019973 |
| | Q2 | 488,833 | -0.05085 | 1,044,168 | -0.00854 | 173,821 | -0.06003 | 95,000 | 0.155684 | 198,513 | 0.073582 | 1,414,439 | -0.031576 |
| | Q3 | 483,396 | -0.05216 | 1,044,168 | -0.00854 | 171,297 | -0.07625 | 95,000 | 0.084495 | 194,424 | 0.112923 | 1,436,439 | -0.027462 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q4 | 531,676 | -0.08028 | 973,585 | -0.009159 | 167,129 | -0.03402 | 95,000 | 0.129611 | 190,334 | 0.144457 | 1,480,064 | -0.002124 |
| 2014 | Q1 | 518,737 | 0.013718 | 973,585 | 0.031204 | 317,017 | 0.003703 | 95,000 | 0.249074 | 259,876 | 0.077037 | 1,472,004 | 0.007893 |
| | Q2 | 478,232 | 0.049854 | 973,585 | 0.017018 | 801,269 | 0.024917 | 125,000 | 0.205024 | 253,882 | 0.090664 | 165,750 | -0.005611 |
| | Q3 | 325,270 | 0.137375 | 1,118,353 | 0.290964 | 801,269 | 0.044885 | 305,000 | 0.094036 | 516,413 | 0.024657 | 405,045 | -0.089188 |
| | Q4 | 302,809 | 0.176329 | 1,465,702 | 0.010085 | 1,538,590 | 0.06104 | 363,500 | 0.068402 | 811,793 | 0.015791 | 430,135 | -0.139844 |
| 2015 | Q1 | 259,961 | 0.314993 | 1,090,086 | 0.077802 | 1,717,187 | 0.089141 | 1,132,826 | 0.003464 | 816,169 | 0.003336 | 434,608 | -0.160761 |
| | Q2 | 649,109 | 0.186055 | 1,202,472 | 0.164214 | 1,917,139 | 0.121977 | 1,118,327 | -0.00169 | 808,068 | -0.00887 | 448,617 | -0.149183 |
| | Q3 | 635,535 | 0.212796 | 1,227,851 | 0.012039 | 1,991,290 | 0.173676 | 980,451 | -0.00642 | 882,870 | -0.00332 | 462,278 | -0.09072 |
| | Q4 | 803,270 | 0.258127 | 1,052,448 | 0.42808 | 1,996,697 | 0.196312 | 961,776 | -0.01542 | 847,378 | -0.0172 | 579,023 | -0.096863 |
| 2016 | Q1 | 915,725 | 0.304862 | 967,528 | 0.581305 | 1,889,960 | 0.215034 | 1,056,821 | -0.02858 | 808,354 | -0.04023 | 561,097 | -0.126663 |
| | Q2 | 962,372 | 0.335692 | 1,073,181 | 0.51924 | 1,926,371 | 0.1869 | 1,082,584 | -0.03724 | 761,597 | -0.0539 | 553,301 | -0.12197 |
| | Q3 | 1,016,032 | 0.334038 | 1,136,358 | 0.438726 | 1,901,327 | 0.137461 | 1,074,288 | -0.0436 | 749,903 | -0.06285 | 540,455 | -0.115828 |
| | Q4 | 981,957 | 0.291271 | 1,085,562 | 0.403664 | 1,882,681 | 0.094817 | 1,058,418 | -0.02178 | 743,719 | -0.04497 | 513,020 | -0.101959 |
| 2017 | Q1 | 1,153,380 | 0.21184 | 1,016,228 | 0.31795 | 1,973,633 | 0.067481 | 1,111,188 | 0.002687 | 759,430 | -0.00107 | 514,315 | -0.061383 |
| | Q2 | 1,364,804 | 0.140414 | 915,225 | 0.306671 | 2,029,325 | 0.055081 | 1,287,498 | 0.018595 | 994,266 | 0.022992 | 515,620 | -0.02375 |
| | Q3 | 1,594,473 | 0.096592 | 744,736 | 0.331738 | 2,123,147 | 0.029273 | 1,330,900 | 0.041779 | 988,002 | 0.046209 | 516,972 | -0.005182 |
| | Q4 | 1,580,152 | 0.079546 | 751,101 | 0.281314 | 2,050,054 | 0.02039 | 1,288,459 | 0.073636 | 979,184 | 0.082691 | 515,392 | 0.046704 |
| 2018 | Q1 | 1,746,954 | 0.033175 | 777,164 | 0.193123 | 2,043,030 | 0.021101 | 1,438,278 | 0.082702 | 1,010,258 | 0.105366 | 501,308 | 0.079989 |
| | Q2 | 1,779,636 | 0.016579 | 1,610,851 | 0.055458 | 2,041,612 | 0.016974 | 1,383,608 | 0.105903 | 1,001,061 | 0.121592 | 443,937 | 0.078166 |
| | Q3 | 1,754,263 | 0.009594 | 1,647,514 | 0.003971 | 1,585,565 | 0.023858 | 1,376,355 | 0.132759 | 1,415,476 | 0.10715 | 550,800 | 0.115695 |
| | Q4 | 1,730,772 | 0.026677 | 1,620,344 | 0.000519 | 1,489,934 | 0.038787 | 1,349,042 | 0.13828 | 786,826 | 0.214798 | 535,148 | 0.123157 |
| 2019 | Q1 | 1,721,367 | 0.076615 | 1,524,766 | 0.048807 | 1,402,167 | 0.069541 | 1,162,585 | 0.157478 | 1,373,440 | 0.109095 | 518,873 | 0.149399 |
| | Q2 | 1,752,188 | 0.099169 | 1,519,984 | 0.049408 | 1,390,453 | 0.090862 | 1,147,680 | 0.133171 | 1,417,752 | 0.081502 | 498,670 | 0.111719 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | 1,723,473 | 0.118235 | 1,300,026 | 0.064496 | 1,218,000 | 0.134016 | 1,127,043 | 0.119828 | 1,542,151 | 0.061681 | 504,551 | 0.101655 |
| | Q4 | 1,693,379 | 0.164155 | 1,362,686 | 0.199599 | 1,234,750 | 0.16968 | 1,113,870 | 0.142234 | 1,110,939 | 0.079685 | 482,730 | 0.123311 |
| 2020 | Q1 | 2,177,803 | 0.176756 | 1,169,832 | 0.416248 | 1,232,803 | 0.145236 | 1,110,558 | 0.115729 | 1,541,235 | 0.070213 | 476,691 | 0.092043 |
| | Q2 | 2,185,586 | 0.266587 | 1,062,562 | 0.685277 | 1,223,493 | 0.310857 | 1,087,735 | 0.129765 | 1,512,334 | 0.090164 | 482,826 | 0.094452 |
| | Q3 | 2,156,987 | 0.318264 | 901,212 | 1.184638 | 1,181,038 | 0.399483 | 1,064,920 | 0.144031 | 1,583,313 | 0.104665 | 464,783 | 0.100656 |
| | Q4 | 2,136,006 | 0.282798 | 1,008,213 | 0.961885 | 1,143,877 | 0.366632 | 1,045,483 | 0.134523 | 1,083,599 | 0.157394 | 439,575 | 0.083936 |
| 2021 | Q1 | 2,133,001 | 0.192845 | 1,160,990 | 0.619004 | 1,072,170 | 0.348314 | 964,034 | 0.157721 | 1,591,338 | 0.13676 | 261,787 | 0.207909 |
| | Q2 | 2,217,900 | 0.09007 | 1,406,921 | 0.307378 | 1,057,660 | 0.144856 | 943,369 | 0.286408 | 1,582,407 | 0.211551 | 359,607 | 0.274041 |
| | Q3 | 2,258,233 | 0.028409 | 1,589,818 | 0.087851 | 1,053,954 | 0.037688 | 1,352,269 | 0.305115 | 1,588,587 | 0.332857 | 296,771 | 0.525213 |
| | Q4 | 2,316,196 | 0.02717 | 1,358,371 | -0.018629 | 901,687 | 0.081292 | 1,262,345 | 0.443934 | 1,089,255 | 0.704216 | 238,229 | 0.970155 |
| 2022 | Q1 | 2,230,817 | 0.03177 | 1,491,679 | -0.080539 | 783,143 | 0.102998 | 1,229,922 | 0.550802 | 1,490,302 | 0.615346 | 189,895 | 1.422786 |
| | Q2 | 2,328,425 | 0.048723 | 1,794,431 | 0.017671 | 543,328 | 0.344506 | 1,197,469 | 0.583515 | 1,377,398 | 0.737979 | 181,568 | 1.474522 |
| | Q3 | 2,349,296 | 0.080199 | 1,731,958 | 0.025118 | 519,998 | 0.967711 | 1,154,461 | 0.51707 | 1,378,687 | 0.689014 | 173,245 | 1.440619 |
| | Q4 | 2,390,314 | 0.161205 | 1,470,046 | 0.17384 | 295,610 | 2.602527 | 1,120,856 | 0.449109 | 1,094,581 | 0.703372 | 164,921 | 1.147962 |
| 2023 | Q1 | 2,382,625 | 0.266681 | 1,403,264 | 0.358341 | 559,747 | 1.858475 | 1,201,718 | 0.379691 | 1,245,970 | 0.50076 | 156,589 | 0.998372 |
| | Q2 | 2,295,157 | 0.368928 | 1,563,581 | 0.398607 | 655,414 | 1.725444 | 1,359,041 | 0.254852 | 1,155,367 | 0.416215 | 148,261 | 0.870843 |
| | Q3 | 2,255,176 | 0.433599 | 1,583,585 | 0.471266 | 841,552 | 1.183542 | 1,421,392 | 0.207593 | 1,013,627 | 0.358622 | 139,994 | 0.628891 |
| | Q4 | 3,456,463 | 0.247704 | 691,905 | 1.210253 | 1,160,153 | 0.745964 | 1,370,067 | 0.194397 | 1,219,164 | 0.275416 | 190,169 | 0.482644 |

**Revenue (TTM- in thousands USD) & CFO/ Revenue (TTM):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TTM Revenue | TTM CFO/ Revenue | TTM Revenue | TTM CFO/ Revenue | TTM Revenue | TTM CFO/ Revenue | TTM Revenue | TTM CFO/ Revenue | TTM Revenue | TTM CFO/ Revenue | TTM Revenue | TTM CFO/ Revenue |
| 2012 | Q1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Q2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Q3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Q4 | 668,107 | 0.10264 | 320,836 | 0.2176 | 115,382 | 0.01671 | 37,315 | 0.9862 | 85,773 | 0.2215 | 223,159 | -0.0844 |
| 2013 | Q1 | 626,724 | 0.04209 | 320,836 | -0.0278 | 131,182 | -0.0049 | 30,146 | 0.9165 | 76,066 | 0.20721 | 203,810 | -0.1385 |
| | Q2 | 571,370 | -0.0435 | 320,836 | -0.0278 | 155,228 | -0.0672 | 24,848 | 0.5952 | 71,396 | 0.20459 | 186,639 | -0.2393 |
| | Q3 | 571,055 | -0.0442 | 224,327 | -0.0398 | 184,317 | -0.0709 | 32,687 | 0.2456 | 70,322 | 0.31221 | 191,641 | -0.2058 |
| | Q4 | 517,190 | -0.0825 | 304,622 | -0.0293 | 207,580 | -0.0274 | 37,546 | 0.3279 | 68,296 | 0.40259 | 224,179 | -0.014 |
| 2014 | Q1 | 561,285 | 0.01268 | 368,681 | 0.0824 | 239,390 | 0.0049 | 51,182 | 0.4623 | 69,447 | 0.28828 | 247,683 | 0.0469 |
| | Q2 | 559,035 | 0.04265 | 384,915 | 0.043 | 245,302 | 0.08139 | 64,115 | 0.3997 | 75,998 | 0.30288 | 254,287 | -0.0037 |
| | Q3 | 568,160 | 0.07865 | 416,036 | 0.7821 | 270,437 | 0.13299 | 73,501 | 0.3902 | 95,203 | 0.13375 | 243,659 | -0.1483 |
| | Q4 | 559,688 | 0.0954 | 473,985 | 0.0312 | 342,808 | 0.27396 | 96,715 | 0.2571 | 145,041 | 0.08838 | 217,576 | -0.2765 |
| 2015 | Q1 | 483,208 | 0.16946 | 570,576 | 0.1486 | 426,780 | 0.35866 | 94,693 | 0.0414 | 171,093 | 0.01592 | 188,005 | -0.3716 |
| | Q2 | 468,173 | 0.25796 | 679,433 | 0.2906 | 557,799 | 0.41923 | 123,433 | -0.0153 | 203,159 | -0.0353 | 170,232 | -0.3931 |
| | Q3 | 440,010 | 0.30735 | 765,729 | 0.0193 | 703,050 | 0.49191 | 169,789 | -0.0371 | 235,427 | -0.0124 | 171,422 | -0.2446 |
| | Q4 | 458,934 | 0.4518 | 846,507 | 0.5322 | 755,710 | 0.51868 | 190,237 | -0.0779 | 234,035 | -0.0623 | 150,784 | -0.372 |
| 2016 | Q1 | 592,519 | 0.47116 | 856,861 | 0.6564 | 760,132 | 0.53465 | 217,164 | -0.1391 | 234,859 | -0.1385 | 137,306 | -0.5176 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q2 | 680,338 | 0.47485 | 834,428 | 0.6678 | 708,882 | 0.5079 | 223,400 | -0.1805 | 231,715 | -0.1772 | 134,994 | -0.4999 |
| | Q3 | 730,039 | 0.4649 | 763,628 | 0.6529 | 595,076 | 0.4392 | 228,715 | -0.2048 | 222,854 | -0.2115 | 123,698 | -0.5061 |
| | Q4 | 754,306 | 0.37918 | 684,264 | 0.6404 | 522,746 | 0.34149 | 257,337 | -0.0896 | 221,987 | -0.1507 | 133,246 | -0.3926 |
| 2017 | Q1 | 704,330 | 0.3469 | 633,547 | 0.51 | 480,419 | 0.27722 | 294,302 | 0.0101 | 240,596 | -0.0034 | 151,364 | -0.2086 |
| | Q2 | 662,722 | 0.28917 | 570,405 | 0.4921 | 461,623 | 0.24214 | 338,415 | 0.0707 | 266,596 | 0.08575 | 165,274 | -0.0741 |
| | Q3 | 646,036 | 0.2384 | 541,670 | 0.4561 | 470,406 | 0.13212 | 394,358 | 0.141 | 287,510 | 0.15879 | 178,564 | -0.015 |
| | Q4 | 646,326 | 0.19448 | 513,368 | 0.4116 | 512,732 | 0.08153 | 460,022 | 0.2062 | 331,976 | 0.2439 | 209,698 | 0.1148 |
| 2018 | Q1 | 638,820 | 0.09072 | 447,346 | 0.3355 | 546,377 | 0.0789 | 527,988 | 0.2253 | 388,167 | 0.27423 | 248,365 | 0.1615 |
| | Q2 | 655,493 | 0.04501 | 425,525 | 0.2099 | 569,754 | 0.06082 | 569,195 | 0.2574 | 442,166 | 0.27528 | 289,152 | 0.12 |
| | Q3 | 703,796 | 0.02391 | 481,895 | 0.0136 | 565,916 | 0.06684 | 631,502 | 0.2893 | 549,835 | 0.27584 | 330,254 | 0.193 |
| | Q4 | 742,266 | 0.0622 | 600,024 | 0.0014 | 585,047 | 0.09878 | 656,070 | 0.2843 | 651,561 | 0.25939 | 367,522 | 0.1793 |
| 2019 | Q1 | 810,920 | 0.16263 | 734,477 | 0.1013 | 624,431 | 0.15615 | 632,142 | 0.2896 | 530,504 | 0.28244 | 384,070 | 0.2018 |
| | Q2 | 837,507 | 0.20748 | 799,212 | 0.094 | 633,441 | 0.19945 | 607,032 | 0.2518 | 722,182 | 0.16 | 381,463 | 0.146 |
| | Q3 | 836,373 | 0.24364 | 813,330 | 0.1031 | 650,227 | 0.25104 | 637,110 | 0.212 | 782,159 | 0.12161 | 392,976 | 0.1305 |
| | Q4 | 957,322 | 0.29037 | 932,377 | 0.2917 | 704,324 | 0.29747 | 705,798 | 0.2245 | 821,365 | 0.10778 | 389,496 | 0.1528 |
| 2020 | Q1 | 1,130,866 | 0.34039 | 1,116,456 | 0.4361 | 762,661 | 0.23477 | 717,193 | 0.1792 | 657,945 | 0.16447 | 394,368 | 0.1113 |
| | Q2 | 1,324,541 | 0.43989 | 1,381,800 | 0.527 | 958,095 | 0.39697 | 717,660 | 0.1967 | 804,079 | 0.16958 | 385,024 | 0.1184 |
| | Q3 | 1,384,311 | 0.49591 | 1,431,211 | 0.7459 | 999,278 | 0.47215 | 683,907 | 0.2243 | 755,857 | 0.21925 | 368,772 | 0.1269 |
| | Q4 | 1,221,185 | 0.49465 | 1,210,341 | 0.8012 | 915,892 | 0.45789 | 607,944 | 0.2313 | 693,241 | 0.24602 | 355,560 | 0.1038 |
| 2021 | Q1 | 1,003,357 | 0.40996 | 902,504 | 0.7963 | 795,890 | 0.46923 | 628,589 | 0.2419 | 732,846 | 0.29697 | 344,815 | 0.1578 |
| | Q2 | 786,292 | 0.25406 | 567,116 | 0.7626 | 589,093 | 0.26007 | 788,045 | 0.3429 | 898,123 | 0.37273 | 391,617 | 0.2516 |
| | Q3 | 710,707 | 0.09027 | 436,631 | 0.3199 | 531,114 | 0.07479 | 990,081 | 0.4167 | 1,113,589 | 0.47484 | 459,345 | 0.3393 |
| | Q4 | 749,380 | 0.08398 | 419,770 | -0.0603 | 540,786 | 0.13554 | 1,203,181 | 0.4658 | 1,427,423 | 0.53738 | 547,129 | 0.4224 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | Q1 | 772,830 | 0.0917 | 425,307 | -0.2825 | 580,668 | 0.13891 | 1,310,312 | 0.517 | 1,587,839 | 0.57755 | 595,765 | 0.4535 |
| | Q2 | 903,252 | 0.1256 | 474,698 | 0.0668 | 846,299 | 0.22117 | 1,351,275 | 0.5171 | 1,693,762 | 0.60014 | 612,521 | 0.4371 |
| | Q3 | 1,113,613 | 0.16919 | 604,024 | 0.072 | 1,217,024 | 0.41347 | 1,245,706 | 0.4792 | 1,642,210 | 0.57845 | 593,239 | 0.4207 |
| | Q4 | 1,430,208 | 0.26942 | 854,669 | 0.299 | 1,562,833 | 0.49227 | 1,113,456 | 0.4521 | 1,437,156 | 0.53571 | 536,934 | 0.3526 |
| 2023 | Q1 | 1,710,099 | 0.37156 | 1,080,256 | 0.4655 | 1,773,217 | 0.58666 | 1,044,789 | 0.4367 | 1,300,308 | 0.47983 | 495,098 | 0.3158 |
| | Q2 | 1,922,422 | 0.44046 | 1,279,723 | 0.487 | 1,697,443 | 0.66623 | 941,507 | 0.3679 | 1,121,660 | 0.42872 | 447,890 | 0.2883 |
| | Q3 | 1,917,321 | 0.51 | 1,334,562 | 0.5592 | 1,498,626 | 0.66462 | 881,121 | 0.3349 | 980,611 | 0.3707 | 395,281 | 0.2227 |
| | Q4 | 1,802,184 | 0.47508 | 1,235,127 | 0.678 | 1,341,222 | 0.64526 | 885,768 | 0.3007 | 949,269 | 0.35372 | 383,825 | 0.2391 |

**Current Liabilities (in thousand USD) & CFO/ Current Liabilities (TTM):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Current Liabilities | TTM CFO/ Current Liabilities | Current Liabilities | TTM CFO/ Current Liabilities | Current Liabilities | TTM CFO/ Current Liabilities | Current Liabilities | TTM CFO/ Current Liabilities | Current Liabilities | TTM CFO/ Current Liabilities | Current Liabilities | TTM CFO/ Current Liabilities |
| 2012 | Q1 | 173,156 | N/A | 979,204 | N/A | n/a | N/A | 9,503 | N/A | 43,709 | N/A | 251,348 | N/A |
| | Q2 | 193,683 | N/A | n/a | N/A | n/a | N/A | 11,998 | N/A | 49,031 | N/A | 250,597 | N/A |
| | Q3 | 190,807 | N/A | n/a | N/A | n/a | N/A | 39,554 | N/A | 46,660 | N/A | 28,277 | N/A |
| | Q4 | 186,621 | 0.367451 | 243,766 | 0.286389 | 22,763 | 0.084699 | 11,498 | 3.200470 | 42,450 | 0.447562 | 25,680 | -0.733411 |
| 2013 | Q1 | 124,335 | 0.212177 | 243,766 | -0.036580 | 22,180 | -0.028990 | 24,506 | 1.127438 | 38,148 | 0.413180 | 1,476,774 | -0.019117 |
| | Q2 | 130,281 | -0.190811 | 243,766 | -0.036580 | 39,363 | -0.265097 | 6,004 | 2.463358 | 27,845 | 0.524583 | 1,477,474 | -0.030229 |
| | Q3 | 134,886 | -0.186921 | 243,766 | -0.036580 | 26,877 | -0.485955 | 8,234 | 0.974860 | 30,009 | 0.731614 | 1,476,952 | -0.026709 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q4 | 130,772 | -0.326400 | 244,792 | -0.036427 | 60,486 | -0.094005 | 7,417 | 1.660105 | 29,734 | 0.924699 | 1,481,626 | -0.002122 |
| 2014 | Q1 | 173,755 | 0.040954 | 244,792 | 0.124105 | 85,760 | 0.013689 | 6,765 | 3.497709 | 40,257 | 0.497305 | 1,482,928 | 0.007835 |
| | Q2 | 323,140 | 0.073782 | 244,792 | 0.067682 | 92,872 | 0.214973 | 14,858 | 1.724862 | 45,819 | 0.502368 | 44,945 | -0.020692 |
| | Q3 | 324,364 | 0.137759 | 381,846 | 0.852179 | 92,872 | 0.387253 | 31,104 | 0.922100 | 106,487 | 0.119573 | 70,084 | -0.515453 |
| | Q4 | 328,588 | 0.162495 | 295,395 | 0.828680 | 190,366 | 0.493344 | 32,175 | 0.772774 | 140,198 | 0.091435 | 63,938 | -0.940786 |
| 2015 | Q1 | 244,137 | 0.335410 | 248,060 | 0.341897 | 242,614 | 0.630924 | 115,504 | 0.033973 | 165,859 | 0.016418 | 76,230 | -0.916542 |
| | Q2 | 153,113 | 0.788764 | 255,570 | 0.312924 | 219,621 | 1.064775 | 229,441 | -0.008220 | 137,126 | -0.052251 | 79,322 | -0.843726 |
| | Q3 | 102,600 | 1.318119 | 265,000 | 0.055781 | 217,023 | 1.593564 | 125,029 | -0.050332 | 147,566 | -0.019835 | 79,157 | -0.529808 |
| | Q4 | 242,037 | 0.856671 | 179,507 | 0.504706 | 237,376 | 1.651283 | 80,034 | -0.185259 | 166,949 | -0.087320 | 607,548 | -0.092315 |
| 2016 | Q1 | 226,505 | 1.232511 | 161,757 | 3.476999 | 259,699 | 1.564912 | 64,341 | -0.469421 | 935,673 | -0.034753 | 584,942 | -0.121499 |
| | Q2 | 232,831 | 1.387534 | 179,025 | 1.171640 | 251,076 | 1.433980 | 71,983 | -0.560104 | 38,421 | -1.068452 | 577,128 | -0.116934 |
| | Q3 | 193,753 | 1.751679 | 183,737 | 2.713389 | 337,200 | 0.775083 | 68,527 | -0.683468 | 33,460 | -1.408518 | 563,631 | -0.111066 |
| | Q4 | 182,749 | 1.565076 | 189,095 | 0.408513 | 385,318 | 0.463282 | 43,601 | -0.528703 | 28,119 | -1.189516 | 28,949 | -1.806867 |
| 2017 | Q1 | 230,509 | 1.059967 | 174,416 | 1.852525 | 348,749 | 0.381885 | 104,268 | 0.028638 | 41,075 | -0.019720 | 27,334 | -1.154972 |
| | Q2 | 197,446 | 0.970584 | 170,283 | 0.426733 | 269,011 | 0.415511 | 56,941 | 0.420453 | 40,928 | 0.558542 | 31,579 | -0.387789 |
| | Q3 | 213,694 | 0.720722 | 185,287 | 1.333375 | 278,287 | 0.223334 | 88,574 | 0.627769 | 108,370 | 0.421288 | 37,239 | -0.071941 |
| | Q4 | 222,000 | 0.566194 | 158,740 | 0.223669 | 209,064 | 0.199944 | 181,727 | 0.522085 | 219,274 | 0.369264 | 52,449 | 0.458941 |
| 2018 | Q1 | 255,838 | 0.226534 | 177,888 | 0.843722 | 219,557 | 0.196345 | 377,920 | 0.314747 | 187,237 | 0.568515 | 53,751 | 0.746014 |
| | Q2 | 238,417 | 0.123750 | 422,217 | 0.074328 | 322,319 | 0.107518 | 309,967 | 0.472721 | 181,750 | 0.669717 | 77,791 | 0.446080 |
| | Q3 | 224,274 | 0.075042 | 288,337 | 0.022689 | 446,948 | 0.084636 | 332,888 | 0.548905 | 243,788 | 0.622131 | 109,635 | 0.581247 |
| | Q4 | 214,218 | 0.215533 | 287,122 | -0.143405 | 447,200 | 0.129226 | 541,500 | 0.344497 | 222,717 | 0.758851 | 101,867 | 0.646991 |
| 2019 | Q1 | 226,385 | 0.582561 | 416,685 | 0.178598 | 412,338 | 0.236476 | 398,067 | 0.459928 | 232,157 | 0.645404 | 100,598 | 0.770582 |
| | Q2 | 237,898 | 0.730405 | 403,049 | 0.208311 | 476,469 | 0.265157 | 351,274 | 0.435096 | 251,931 | 0.458653 | 108,688 | 0.512577 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | 525,832 | 0.387527 | 346,593 | 0.241918 | 487,611 | 0.334759 | 228,142 | 0.591960 | 278,171 | 0.341955 | 119,236 | 0.430155 |
| | Q4 | 848,123 | 0.327756 | 316,050 | -0.094064 | 486,231 | 0.430890 | 233,367 | 0.678888 | 310,931 | 0.284709 | 127,655 | 0.466304 |
| 2020 | Q1 | 640,273 | 0.601212 | 347,692 | 1.400492 | 523,373 | 0.342102 | 549,344 | 0.233959 | 366,114 | 0.295575 | 116,648 | 0.376140 |
| | Q2 | 666,339 | 0.874403 | 325,183 | 0.867863 | 453,494 | 0.838668 | 529,611 | 0.266516 | 324,521 | 0.420182 | 109,681 | 0.415788 |
| | Q3 | 363,387 | 1.889148 | 271,412 | 3.933540 | 434,413 | 1.086075 | 228,276 | 0.671910 | 319,920 | 0.517998 | 113,675 | 0.411550 |
| | Q4 | 281,361 | 2.146914 | 203,594 | 1.130602 | 406,175 | 1.032516 | 241,675 | 0.581943 | 266,432 | 0.640133 | 113,621 | 0.324729 |
| 2021 | Q1 | 273,258 | 1.505314 | 271,898 | 2.643112 | 354,436 | 1.053651 | 239,026 | 0.636115 | 311,119 | 0.699510 | 98,856 | 0.550579 |
| | Q2 | 426,679 | 0.468190 | 449,775 | 0.186176 | 469,346 | 0.326429 | 304,249 | 0.888049 | 356,053 | 0.940194 | 94,362 | 1.044350 |
| | Q3 | 267,470 | 0.239855 | 593,904 | 0.235168 | 503,806 | 0.078842 | 282,335 | 1.461377 | 300,440 | 1.759992 | 42,634 | 3.655955 |
| | Q4 | 292,675 | 0.215017 | 321,033 | 0.023689 | 527,841 | 0.138868 | 248,073 | 2.259004 | 290,796 | 2.637832 | 41,895 | 5.516625 |
| 2022 | Q1 | 538,130 | 0.131701 | 379,473 | -0.316594 | 589,764 | 0.136770 | 246,377 | 2.749624 | 311,790 | 2.941246 | 37,815 | 7.144784 |
| | Q2 | 542,844 | 0.208990 | 304,900 | -0.116512 | 428,888 | 0.436431 | 230,225 | 3.035035 | 304,872 | 3.334157 | 48,916 | 5.473179 |
| | Q3 | 424,612 | 0.443725 | 329,491 | 0.132034 | 488,583 | 1.029934 | 230,511 | 2.589625 | 294,320 | 3.227555 | 55,320 | 4.511569 |
| | Q4 | 391,659 | 0.983841 | 254,338 | 0.078494 | 473,251 | 1.625634 | 211,628 | 2.378636 | 282,555 | 2.724772 | 36,540 | 5.181253 |
| 2023 | Q1 | 474,965 | 1.337785 | 290,712 | 1.729708 | 508,500 | 2.045774 | 244,835 | 1.863627 | 310,816 | 2.007400 | 34,194 | 4.571972 |
| | Q2 | 467,574 | 1.810939 | 389,995 | 0.698564 | 460,910 | 2.453581 | 243,333 | 1.423375 | 329,467 | 1.459573 | 29,224 | 4.418013 |
| | Q3 | 476,941 | 2.050239 | 326,156 | 2.288135 | 706,371 | 1.410041 | 260,595 | 1.132297 | 343,620 | 1.057881 | 36,228 | 2.430192 |
| | Q4 | 409,054 | 2.093073 | 424,753 | 0.456524 | 510,404 | 1.695582 | 226,191 | 1.177487 | 359,363 | 0.934367 | 35,286 | 2.601145 |

**Assets (in thousand USD) & CFO/ Assets (TTM):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Assets | TTM CFO/ Assets | Assets | TTM CFO/ Assets | Assets | TTM CFO/ Assets | Assets | TTM CFO/ Assets | Assets | TTM CFO/ Assets | Assets | TTM CFO/ Assets |
| 2012 | Q1 | 1,819,483 | N/A | 1,674,883 | N/A | n/a | N/A | 513,702 | N/A | 696,072 | N/A | 3,115,009 | N/A |
| | Q2 | 1,803,043 | N/A | n/a | N/A | n/a | N/A | 503,644 | N/A | 681,589 | N/A | 3,074,139 | N/A |
| | Q3 | 1,725,718 | N/A | n/a | N/A | n/a | N/A | 432,706 | N/A | 365,591 | N/A | 2,894,573 | N/A |
| | Q4 | 1,688,221 | 0.04062 | 2,089,203 | 0.03342 | 573,280 | 0.00336 | 397,420 | 0.09259 | 354,706 | 0.05356 | 2,843,371 | -0.00662 |
| 2013 | Q1 | 1,583,665 | 0.01666 | 2,089,203 | -0.00427 | 1,058,886 | -0.00061 | 386,905 | 0.07141 | 342,144 | 0.04607 | 2,803,190 | -0.01007 |
| | Q2 | 1,468,189 | -0.01693 | 2,089,203 | -0.00427 | 1,362,411 | -0.00766 | 362,810 | 0.04077 | 328,613 | 0.04445 | 2,777,660 | -0.01608 |
| | Q3 | 1,409,143 | -0.01789 | 2,089,203 | -0.00427 | 1,554,834 | -0.00840 | 361,714 | 0.02219 | 404,374 | 0.05429 | 2,837,724 | -0.01390 |
| | Q4 | 1,367,605 | -0.03121 | 1,920,761 | -0.00464 | 1,646,676 | -0.00345 | 409,858 | 0.03004 | 468,088 | 0.05874 | 2,957,254 | -0.00106 |
| 2014 | Q1 | 1,374,081 | 0.00518 | 1,920,761 | 0.01582 | 1,870,048 | 0.00063 | 414,757 | 0.05705 | 539,601 | 0.03710 | 2,902,184 | 0.00400 |
| | Q2 | 1,251,802 | 0.01905 | 1,920,761 | 0.00863 | 2,161,413 | 0.00924 | 680,268 | 0.03767 | 535,963 | 0.04295 | 2,828,686 | -0.00033 |
| | Q3 | 1,038,035 | 0.04305 | 2,761,994 | 0.11781 | 2,161,413 | 0.01664 | 1,205,385 | 0.02379 | 1,634,054 | 0.00779 | 1,926,599 | -0.01875 |
| | Q4 | 962,179 | 0.05549 | 3,096,360 | 0.00477 | 2,804,643 | 0.03349 | 1,262,740 | 0.01969 | 2,062,084 | 0.00622 | 1,752,913 | -0.03432 |
| 2015 | Q1 | 1,863,692 | 0.04394 | 2,948,586 | 0.02876 | 3,004,599 | 0.05095 | 2,477,016 | 0.00158 | 2,321,318 | 0.00117 | 1,694,819 | -0.04122 |
| | Q2 | 1,555,713 | 0.07763 | 3,124,847 | 0.06319 | 3,400,084 | 0.06878 | 2,434,020 | -0.00077 | 2,468,346 | -0.00290 | 1,669,600 | -0.04009 |
| | Q3 | 1,550,008 | 0.08725 | 3,130,861 | 0.00472 | 3,502,795 | 0.09873 | 2,264,693 | -0.00278 | 2,500,660 | -0.00117 | 1,648,217 | -0.02544 |
| | Q4 | 2,883,468 | 0.07191 | 3,040,746 | 0.14816 | 3,523,455 | 0.11125 | 2,172,870 | -0.00682 | 2,148,846 | -0.00678 | 1,714,663 | -0.03271 |
| 2016 | Q1 | 2,979,513 | 0.09370 | 3,067,833 | 0.18333 | 3,445,383 | 0.11796 | 2,410,256 | -0.01253 | 2,101,317 | -0.01547 | 1,644,099 | -0.04323 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q2 | 2,948,063 | 0.10958 | 3,071,385 | 0.18143 | 3,363,882 | 0.10703 | 2,404,312 | -0.01677 | 2,063,240 | -0.01990 | 1,530,388 | -0.04410 |
| | Q3 | 2,922,859 | 0.11612 | 3,072,299 | 0.16227 | 3,292,830 | 0.07937 | 2,376,503 | -0.01971 | 2,058,635 | -0.02289 | 1,493,456 | -0.04192 |
| | Q4 | 2,966,317 | 0.09642 | 3,046,911 | 0.14382 | 3,230,187 | 0.05526 | 2,361,623 | -0.00976 | 2,011,702 | -0.01663 | 1,568,960 | -0.03334 |
| 2017 | Q1 | 3,149,690 | 0.07757 | 3,014,470 | 0.10719 | 3,319,044 | 0.04013 | 2,465,600 | 0.00121 | 2,136,491 | -0.00038 | 1,551,431 | -0.02035 |
| | Q2 | 3,221,072 | 0.05950 | 3,053,417 | 0.09192 | 3,539,301 | 0.03158 | 2,730,070 | 0.00877 | 2,136,343 | 0.01070 | 1,541,719 | -0.00794 |
| | Q3 | 3,411,314 | 0.04515 | 2,860,774 | 0.08636 | 4,485,631 | 0.01386 | 2,794,906 | 0.01989 | 2,128,633 | 0.02145 | 1,516,483 | -0.00177 |
| | Q4 | 3,133,728 | 0.04011 | 2,810,973 | 0.07517 | 4,498,376 | 0.00929 | 2,870,058 | 0.03306 | 2,145,764 | 0.03773 | 1,520,959 | 0.01583 |
| 2018 | Q1 | 3,271,983 | 0.01771 | 2,800,909 | 0.05359 | 4,443,398 | 0.00970 | 3,037,228 | 0.03916 | 2,196,083 | 0.04847 | 1,452,567 | 0.02761 |
| | Q2 | 3,255,118 | 0.00906 | 4,187,109 | 0.02134 | 4,400,150 | 0.00788 | 2,977,526 | 0.04921 | 2,243,318 | 0.05426 | 1,508,098 | 0.02301 |
| | Q3 | 3,131,583 | 0.00537 | 4,183,756 | 0.00156 | 4,480,144 | 0.00844 | 2,999,115 | 0.06093 | 3,036,300 | 0.04995 | 1,632,274 | 0.03904 |
| | Q4 | 3,077,841 | 0.01500 | 4,127,351 | 0.00020 | 4,784,164 | 0.01208 | 2,951,354 | 0.06321 | 3,022,137 | 0.05592 | 1,627,470 | 0.04050 |
| 2019 | Q1 | 3,122,308 | 0.04224 | 4,148,419 | 0.01794 | 4,755,993 | 0.02050 | 2,937,025 | 0.06234 | 3,014,470 | 0.04971 | 1,606,170 | 0.04826 |
| | Q2 | 3,169,057 | 0.05483 | 4,116,041 | 0.01825 | 4,692,072 | 0.02693 | 2,903,587 | 0.05264 | 3,032,428 | 0.03810 | 1,564,444 | 0.03561 |
| | Q3 | 3,588,440 | 0.05679 | 4,065,056 | 0.02063 | 5,170,125 | 0.03157 | 2,935,234 | 0.04601 | 3,215,785 | 0.02958 | 1,561,964 | 0.03284 |
| | Q4 | 3,697,818 | 0.07517 | 4,164,843 | 0.06531 | 5,164,010 | 0.04057 | 2,966,057 | 0.05341 | 3,238,671 | 0.02733 | 1,528,892 | 0.03893 |
| 2020 | Q1 | 3,997,913 | 0.09629 | 4,188,077 | 0.11627 | 5,267,142 | 0.03399 | 2,803,019 | 0.04585 | 3,269,718 | 0.03310 | 1,380,966 | 0.03177 |
| | Q2 | 4,051,653 | 0.14381 | 4,132,001 | 0.17622 | 5,349,200 | 0.07110 | 2,715,978 | 0.05197 | 3,167,031 | 0.04306 | 1,354,566 | 0.03367 |
| | Q3 | 3,983,749 | 0.17232 | 3,746,408 | 0.28497 | 5,256,329 | 0.08976 | 2,717,493 | 0.05644 | 3,259,130 | 0.05085 | 1,317,547 | 0.03551 |
| | Q4 | 3,918,221 | 0.15417 | 3,687,239 | 0.26301 | 5,158,624 | 0.08130 | 2,721,067 | 0.05169 | 3,191,793 | 0.05343 | 1,232,809 | 0.02993 |
| 2021 | Q1 | 3,927,737 | 0.10473 | 3,793,907 | 0.18942 | 5,202,379 | 0.07178 | 2,989,280 | 0.05086 | 3,399,647 | 0.06402 | 1,180,343 | 0.04611 |
| | Q2 | 3,981,582 | 0.05017 | 3,809,838 | 0.11351 | 5,154,364 | 0.02972 | 3,482,676 | 0.07758 | 3,488,955 | 0.09595 | 1,182,465 | 0.08334 |
| | Q3 | 3,988,433 | 0.01609 | 3,952,790 | 0.03533 | 5,033,865 | 0.00789 | 3,548,616 | 0.11627 | 3,597,138 | 0.14700 | 1,034,294 | 0.15070 |
| | Q4 | 4,117,098 | 0.01529 | 3,768,523 | -0.00671 | 5,013,969 | 0.01462 | 3,454,177 | 0.16224 | 3,754,719 | 0.20430 | 1,203,002 | 0.19212 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | Q1 | 4,060,953 | 0.01745 | 3,869,495 | -0.03105 | 4,723,125 | 0.01708 | 3,361,441 | 0.20153 | 3,710,694 | 0.24714 | 1,167,502 | 0.23142 |
| | Q2 | 4,365,102 | 0.02599 | 4,088,347 | 0.00776 | 4,609,643 | 0.04061 | 3,387,705 | 0.20626 | 3,639,804 | 0.27927 | 1,186,143 | 0.22571 |
| | Q3 | 4,548,661 | 0.04142 | 4,046,982 | 0.01075 | 4,651,789 | 0.10818 | 3,324,511 | 0.17956 | 3,589,598 | 0.26464 | 1,205,733 | 0.20699 |
| | Q4 | 4,768,443 | 0.08081 | 3,969,073 | 0.06439 | 4,559,163 | 0.16874 | 3,257,291 | 0.15454 | 3,433,624 | 0.22422 | 1,173,866 | 0.16128 |
| 2023 | Q1 | 4,719,189 | 0.13464 | 4,077,313 | 0.12333 | 4,692,828 | 0.22167 | 3,314,541 | 0.13766 | 3,372,137 | 0.18503 | 1,143,900 | 0.13667 |
| | Q2 | 4,701,735 | 0.18009 | 4,078,781 | 0.15280 | 4,320,432 | 0.26175 | 3,464,281 | 0.09998 | 3,285,842 | 0.14635 | 1,135,393 | 0.11372 |
| | Q3 | 4,600,015 | 0.21257 | 4,004,008 | 0.18639 | 4,309,435 | 0.23112 | 3,543,447 | 0.08327 | 3,171,933 | 0.11460 | 1,094,997 | 0.08040 |
| | Q4 | 5,882,766 | 0.14554 | 3,419,280 | 0.24490 | 4,228,652 | 0.20466 | 3,489,018 | 0.07634 | 3,028,255 | 0.11088 | 1,141,902 | 0.08038 |

**Net Income (Quarterly values- in thousands USD) & CFO/ Net Income (based on Quarterly values):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Net Income | CFO/ Net Income | Net Income | CFO/ Net Income | Net Income | CFO/ Net Income | Net Income | CFO/ Net Income | Net Income | CFO/ Net Income | Net Income | CFO/ Net Income |
| 2013 | Q1 | -18,755 | 1.52749 | -10,700 | -0.70981 | 6,610 | -0.23843 | -6,938 | -0.48962 | 1,158 | 7.75216 | -48,163 | 0.36057 |
| | Q2 | -120,277 | 0.14263 | -39,300 | -0.19326 | 3,968 | -1.37626 | -984 | 0.93293 | 806 | 7.42556 | -45,369 | 0.17422 |
| | Q3 | -36,446 | 0.08539 | -39,300 | -0.19326 | 667 | -0.87256 | 1,008 | 3.61508 | -168 | -44.45833 | -35,034 | -0.01838 |
| | Q4 | -13,031 | -0.47817 | -23,273 | -0.32634 | 5,771 | 0.33495 | 3,011 | 2.05580 | 54 | 93.77778 | -19,175 | -1.12031 |
| 2014 | Q1 | -12,085 | -1.75027 | 1,369 | 5.54785 | 53,338 | 0.09907 | 10,718 | 1.37582 | -878 | -1.71071 | -39,105 | 0.06659 |
| | Q2 | -78,230 | 0.00548 | -19,883 | 0.31268 | -574 | -23.22300 | 6,282 | 0.16683 | -2,992 | -3.00234 | -60,524 | 0.33792 |
| | Q3 | -59,647 | -0.29725 | -23,347 | -13.55326 | -1,159 | -13.30285 | -6,167 | -1.08594 | 221 | -12.74208 | 874,629 | -0.03950 |
| | Q4 | -12,976 | -1.15143 | -3,935 | 77.00737 | 495 | 120.97778 | 5,162 | 0.45971 | -8,074 | -0.63785 | -185,826 | 0.01370 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | Q1 | 11,038 | 4.49755 | 80,855 | 0.96004 | 40,695 | 1.58346 | -75,343 | 0.08221 | -40,176 | 0.21391 | -38,442 | 0.32048 |
| | Q2 | 23,160 | 1.66041 | 92,396 | 1.15194 | 57,588 | 1.63413 | -33,472 | 0.14227 | -65,021 | 0.01392 | -40,332 | 0.43415 |
| | Q3 | 61,868 | 0.52045 | 72,190 | 1.85271 | 85,251 | 1.49454 | -40,683 | -0.05629 | -41,973 | -0.03388 | -66,625 | 0.14353 |
| | Q4 | 58,558 | 1.48653 | 104,859 | 1.26576 | 34,212 | 3.09888 | -69,267 | 0.08895 | -311,007 | 0.02090 | -49,498 | 0.33725 |
| 2016 | Q1 | 78,906 | 1.53940 | 113,542 | 1.66917 | 28,031 | 2.81367 | -68,236 | 0.31611 | -48,788 | 0.54384 | -54,483 | 0.50115 |
| | Q2 | 14,312 | 5.75363 | 40,148 | 2.52177 | 3,846 | 12.41238 | -39,216 | 0.37936 | -32,908 | 0.28683 | -110,653 | 0.12585 |
| | Q3 | 5,471 | 8.87059 | 72 | 1,042.49 | -27,115 | -1.05960 | -26,734 | 0.15815 | -39,406 | 0.11815 | -27,514 | 0.16999 |
| | Q4 | 18,320 | 1.83794 | 50,287 | 1.43930 | -29,666 | -0.78110 | 6,476 | 2.72128 | -32,742 | -0.21929 | -25,107 | 0.25491 |
| 2017 | Q1 | 27,020 | 2.95278 | 34,324 | 2.16842 | -11,533 | -2.90826 | -17,878 | -0.24992 | -15,950 | -0.38276 | -15,600 | 0.42096 |
| | Q2 | -19,379 | -1.53011 | -24,236 | -2.42643 | -68,250 | -0.38583 | -11,961 | -0.50815 | -10,279 | -1.38447 | -14,513 | -0.37194 |
| | Q3 | -24,071 | -0.45312 | -28,060 | -1.47694 | -36,948 | 0.56552 | 368 | 74.55163 | -7,426 | -2.44263 | -31,182 | -0.15682 |
| | Q4 | -248,432 | -0.02154 | 19,355 | 1.89181 | -41,509 | -0.06799 | 27,123 | 2.09770 | 23,884 | 1.77922 | 2,570 | 7.91829 |
| 2018 | Q1 | -13,641 | -0.88300 | -39,091 | -0.33824 | -31,794 | -1.09609 | 16,683 | 1.71072 | 9,900 | 3.19010 | -55,813 | -0.16951 |
| | Q2 | -22,860 | -0.05249 | -12,511 | 0.15562 | -68,901 | -0.25949 | 8,980 | 3.74800 | 10,728 | 2.75028 | -1,120 | -13.89107 |
| | Q3 | 2,241 | -0.78849 | -58,747 | 0.70385 | -71,709 | 0.24714 | 35,285 | 1.80334 | 26,054 | 1.84563 | 5,708 | 3.21584 |
| | Q4 | 25,380 | 1.36694 | 279 | 110.80645 | -17,668 | -1.28956 | 23,586 | 2.57428 | 11,715 | 5.10764 | 18,285 | 1.23227 |
| 2019 | Q1 | 40,031 | 2.44203 | 19,526 | 4.44535 | 14,476 | 5.15108 | -7,465 | -3.35928 | -5,342 | -2.32273 | -7,801 | -1.48853 |
| | Q2 | 1,082 | 39.81423 | -38,556 | 0.03284 | -29,720 | -1.57167 | -33,086 | -0.10316 | -40,173 | 0.11901 | -34,476 | -0.09314 |
| | Q3 | -9,962 | -2.83527 | -22,903 | 1.42348 | -45,289 | -0.42330 | 36,699 | 1.24919 | 5,815 | 4.75649 | -14,591 | -0.95504 |
| | Q4 | 108,821 | 1.00069 | 154,163 | 1.42096 | 12,042 | 5.73526 | 41,043 | 2.04897 | 23,499 | 2.26559 | 883 | 34.84485 |
| 2020 | Q1 | 165,331 | 1.23824 | 225,613 | 1.33746 | 46,627 | 0.94585 | -160,820 | 0.03003 | 2,755 | 11.65045 | -120,350 | 0.03355 |
| | Q2 | 199,661 | 1.20598 | 259,631 | 0.92417 | 143,941 | 1.72289 | -41,281 | -0.38853 | -44,120 | -0.52953 | -18,204 | -0.27131 |
| | Q3 | 57,068 | 2.31457 | 46,198 | 6.64226 | -20,183 | -5.48209 | 39,061 | 1.48678 | 23,251 | 2.45232 | -21,098 | -0.71637 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q4 | -9,187 | -2.88037 | -58,204 | -2.08292 | -76,261 | -0.21821 | 25,370 | 2.81261 | 27,774 | 2.09091 | -65,921 | -0.31676 |
| 2021 | Q1 | 28,895 | 0.41533 | -71,013 | -0.71284 | -62,394 | 0.02930 | 23,579 | 0.27898 | 35,763 | 2.21391 | 1,985 | 6.79798 |
| | Q2 | -26,631 | -1.09707 | -89,677 | 0.51582 | -52,782 | -0.52575 | 104,495 | 1.28407 | 124,209 | 1.13109 | 32,037 | 1.53129 |
| | Q3 | -33,206 | 0.10616 | -105,907 | -0.13284 | -73,267 | 0.03879 | 195,329 | 1.02640 | 220,407 | 1.13895 | 57,132 | 1.26785 |
| | Q4 | 19,783 | 1.27574 | -72,180 | 0.60596 | -45,992 | -1.09193 | 203,818 | 1.07525 | 300,151 | 0.98741 | 90,853 | 1.05810 |
| 2022 | Q1 | 28,968 | 0.68845 | -43,372 | 1.01939 | -84,448 | -0.06553 | 125,323 | 0.98644 | 170,364 | 1.34510 | 41,689 | 1.26064 |
| | Q2 | 51,275 | 1.40016 | -4,904 | -21.53181 | 191,131 | 0.70249 | 163,749 | 0.94948 | 200,146 | 1.19878 | 47,382 | 0.98358 |
| | Q3 | 156,241 | 0.45722 | 16,448 | 1.57241 | 266,165 | 1.17666 | 104,565 | 0.94373 | 109,693 | 1.68174 | 40,828 | 1.32970 |
| | Q4 | 239,053 | 0.92932 | 235,079 | 0.71598 | 264,403 | 1.19645 | 68,208 | 1.84150 | 85,796 | 1.35596 | 28,677 | 1.25100 |
| 2023 | Q1 | 199,626 | 1.35260 | 175,046 | 1.16016 | 193,237 | 1.43077 | -8,822 | -8.67366 | 45,875 | 1.81341 | 2,634 | 7.42825 |
| | Q2 | 230,674 | 1.22745 | 161,820 | 1.39661 | 132,403 | 1.69839 | 34,890 | 1.30550 | 44,319 | 2.18597 | 11,562 | 1.67635 |
| | Q3 | 107,743 | 1.87977 | 114,577 | 1.29955 | 100,368 | 1.77664 | 28,734 | 1.64954 | 43,655 | 1.53712 | -32,004 | -0.41301 |
| | Q4 | 118,371 | 0.84897 | 406,584 | 0.63800 | 120,890 | 1.53664 | 57,471 | 1.68556 | 39,707 | 2.23145 | 4,938 | 8.02309 |

**EBITDA (in thousands USD) & EBITDA margin (both based on Quarterly values):**

| Year | Quarter | Frontline | | Euronav | | Scorpio Tankers | | Golden Ocean | | Starbulk | | Genco | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EBITDA | EBITDA Margin | EBITDA | EBITDA Margin | EBITDA | EBITDA Margin | EBITDA | EBITDA Margin | EBITDA | EBITDA Margin | EBITDA | EBITDA Margin |
| 2012 | Q1 | 54,984 | 32.87% | -8,822 | -10.15% | 5,278 | 18.12% | 14,293 | 104.80% | 18,001 | 64.43% | 25,200 | 42.69% |
| | Q2 | 30,396 | 17.21% | n/a | n/a | 1,105 | 4.02% | 3,807 | 29.38% | 8,390 | 38.48% | 26,829 | 43.19% |
| | Q3 | 2,464 | 1.94% | n/a | n/a | 1,715 | 5.98% | 4,425 | 209.62% | 7,629 | 41.58% | 18,389 | 34.31% |
| | Q4 | 34,781 | 17.62% | 43,500 | 50.05% | 3,786 | 12.58% | 5,089 | 59.12% | 6,338 | 35.83% | 12,119 | 25.03% |
| 2013 | Q1 | 26,142 | 20.76% | 43,500 | 50.05% | 13,051 | 29.05% | 3,259 | 50.38% | 8,734 | 47.91% | 7,710 | 19.43% |
| | Q2 | -73,109 | -60.31% | 73,100 | 84.10% | 11,655 | 22.62% | 2,608 | 34.05% | 8,401 | 49.04% | 11,185 | 24.89% |
| | Q3 | 4,060 | 3.21% | 73,100 | 84.10% | 10,830 | 18.75% | 4,687 | 47.11% | 7,809 | 45.21% | 23,732 | 40.49% |
| | Q4 | 44,657 | 31.10% | 20,860 | 24.00% | -681 | -1.28% | 6,980 | 51.83% | 7,387 | 47.17% | 40,414 | 49.92% |
| 2014 | Q1 | 29,123 | 17.13% | 46,534 | 43.11% | 15,896 | 20.72% | 14,083 | 70.05% | 7,796 | 40.22% | 18,511 | 29.30% |
| | Q2 | -42,191 | -35.46% | 22,057 | 21.38% | 4,316 | 7.51% | 10,529 | 51.13% | 9,596 | 40.52% | -5,137 | -9.97% |
| | Q3 | -9,025 | -6.65% | 36,304 | 30.76% | 25,077 | 30.25% | 894 | 4.62% | 9,668 | 26.50% | 900,731 | 1877.42% |
| | Q4 | 65,992 | 48.85% | 67,588 | 46.66% | 57,061 | 45.38% | 13,463 | 36.70% | 16,564 | 25.29% | -161,864 | -294.97% |
| 2015 | Q1 | 68,659 | 73.42% | 131,332 | 64.21% | 86,410 | 53.77% | -3,612 | -19.97% | -5,638 | -12.41% | -14,189 | -42.22% |
| | Q2 | 92,617 | 89.11% | 142,323 | 67.13% | 112,314 | 59.59% | -9,064 | -18.37% | 6,262 | 10.99% | -15,553 | -46.05% |
| | Q3 | 79,510 | 73.99% | 127,888 | 62.59% | 150,839 | 66.12% | -3,592 | -5.47% | 6,128 | 8.91% | -41,355 | -84.11% |
| | Q4 | 100,957 | 65.55% | 174,156 | 77.18% | 99,520 | 55.79% | -4,777 | -8.36% | 6,623 | 10.33% | -22,501 | -65.72% |
| 2016 | Q1 | 140,834 | 62.01% | 176,416 | 82.10% | 92,362 | 55.93% | -14,172 | -31.49% | -7,309 | -15.80% | -26,840 | -133.33% |
| | Q2 | 72,858 | 38.00% | 106,004 | 55.92% | 65,866 | 48.00% | -7,046 | -12.68% | 1,630 | 3.10% | -83,891 | -266.66% |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q3 | 54,304 | 34.55% | 68,981 | 51.66% | 42,081 | 36.80% | 8,571 | 12.07% | 11,869 | 19.82% | -1,946 | -5.14% |
| | Q4 | 52,554 | 29.48% | 125,078 | 85.51% | 29,997 | 28.28% | 24,208 | 28.23% | 15,488 | 24.49% | 208 | 0.48% |
| 2017 | Q1 | 76,473 | 43.17% | 101,251 | 61.68% | 46,870 | 38.17% | 17,458 | 21.30% | 18,074 | 27.86% | 9,538 | 24.94% |
| | Q2 | 33,930 | 22.60% | 43,525 | 34.43% | 43,165 | 36.45% | 29,740 | 29.83% | 25,731 | 32.73% | 10,898 | 24.02% |
| | Q3 | 30,332 | 21.59% | 40,804 | 38.94% | 37,808 | 30.71% | 40,447 | 31.86% | 28,552 | 35.34% | -5,983 | -11.69% |
| | Q4 | -193,345 | -108.27% | 87,780 | 74.40% | 46,464 | 31.31% | 65,324 | 43.14% | 55,690 | 46.00% | 27,544 | 36.77% |
| 2018 | Q1 | 35,166 | 20.73% | 25,747 | 26.24% | 57,608 | 36.82% | 53,272 | 35.53% | 46,422 | 38.35% | -31,597 | -41.08% |
| | Q2 | 31,364 | 18.80% | 61,684 | 58.96% | 47,300 | 33.36% | 54,046 | 38.36% | 52,028 | 39.24% | 22,912 | 26.59% |
| | Q3 | 54,434 | 28.84% | 44,655 | 27.71% | 29,254 | 24.53% | 78,846 | 41.66% | 80,058 | 42.48% | 29,571 | 32.05% |
| | Q4 | 86,768 | 39.98% | 125,353 | 53.09% | 78,316 | 46.75% | 70,417 | 40.01% | 82,379 | 39.33% | 44,440 | 39.61% |
| 2019 | Q1 | 96,905 | 40.67% | 123,964 | 53.30% | 113,246 | 57.83% | 36,022 | 28.59% | 43,875 | 26.35% | 17,523 | 18.75% |
| | Q2 | 55,799 | 28.85% | 67,642 | 39.94% | 71,821 | 47.63% | 21,506 | 18.58% | 31,157 | 19.75% | -9,154 | -10.96% |
| | Q3 | 43,116 | 22.98% | 88,092 | 50.26% | 54,484 | 40.04% | 81,118 | 36.98% | 72,199 | 29.06% | 10,498 | 10.12% |
| | Q4 | 166,198 | 49.17% | 260,970 | 73.48% | 124,399 | 56.13% | 73,860 | 30.19% | 88,323 | 35.52% | 25,832 | 23.76% |
| 2020 | Q1 | 242,722 | 58.94% | 327,932 | 78.70% | 158,710 | 62.44% | 12,285 | 8.94% | 32,565 | 20.24% | -96,425 | -98.06% |
| | Q2 | 260,852 | 67.39% | 354,883 | 81.64% | 251,993 | 72.78% | 4,198 | 3.61% | 35,204 | 24.09% | 2,946 | 3.97% |
| | Q3 | 108,238 | 43.75% | 144,658 | 64.38% | 82,109 | 46.32% | 76,742 | 41.35% | 79,849 | 39.88% | 13 | 0.01% |
| | Q4 | 40,373 | 23.09% | 36,546 | 27.22% | 45,190 | 32.69% | 59,328 | 35.17% | 81,456 | 43.79% | -45,554 | -47.70% |
| 2021 | Q1 | 61,643 | 31.78% | 28,579 | 26.26% | 42,121 | 31.39% | 54,590 | 34.54% | 84,667 | 42.23% | 19,896 | 22.71% |
| | Q2 | 25,730 | 15.13% | 18,095 | 18.22% | 50,298 | 36.07% | 130,459 | 47.32% | 182,476 | 58.60% | 50,228 | 41.51% |
| | Q3 | 19,328 | 11.25% | 4,642 | 4.93% | 25,365 | 21.27% | 229,652 | 59.25% | 277,824 | 66.83% | 75,250 | 48.47% |
| | Q4 | 58,487 | 27.39% | 34,480 | 29.36% | 56,949 | 38.50% | 243,544 | 63.79% | 355,128 | 71.05% | 108,067 | 58.96% |
| 2022 | Q1 | 61,692 | 28.37% | 42,662 | 37.30% | 79,425 | 45.63% | 149,359 | 56.32% | 225,881 | 62.59% | 57,973 | 42.56% |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q2 | 11,628 | 3.87% | 71,408 | 48.02% | 289,485 | 71.46% | 191,643 | 60.52% | 258,299 | 61.89% | 64,240 | 46.63% |
| | Q3 | 153,891 | 40.27% | 102,560 | 45.88% | 360,013 | 73.47% | 118,188 | 41.90% | 189,850 | 52.14% | 58,394 | 42.95% |
| | Q4 | 288,289 | 54.38% | 317,798 | 86.34% | 351,768 | 71.25% | 112,447 | 45.06% | 134,584 | 45.65% | 46,211 | 36.39% |
| 2023 | Q1 | 296,438 | 59.61% | 258,527 | 76.05% | 286,386 | 74.50% | 54,715 | 27.84% | 84,802 | 37.85% | 19,837 | 21.02% |
| | Q2 | 310,071 | 60.47% | 247,606 | 71.12% | 235,227 | 71.43% | 80,404 | 37.68% | 96,185 | 40.30% | 29,964 | 33.09% |
| | Q3 | 173,084 | 45.90% | 209,625 | 75.30% | 200,284 | 68.78% | 78,878 | 35.58% | 84,188 | 37.74% | -13,567 | -16.27% |
| | Q4 | 198,065 | 47.73% | 474,427 | 176.61% | 237,452 | 70.60% | 123,184 | 48.46% | 114,036 | 43.28% | 23,474 | 20.32% |