SHIP VALUATION

REGRESSION ANALYSIS

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Introduction

Overview

The maritime industry is strongly dependent on ship valuations to guide investment decisions, given their critical role in global trade. Generally, ship values are influenced by a set of different factors including but not limited to: model year, **Deadweight Tonnage (DWT)**, economic indicators such as **Baltix Dry Index (BDI)** among others. Furthermore, vessels are classified into categories based on their DWT and operational capabilities.

This report focuses on valuing the *Bet Performer*, a Capesize bulk carrier with specific characteristics, including its size, operational lifespan, and specific sale date.

SALES DATE	YEAR BUILT	AGE	DWT	BDI
May, 2008	1996	11	172	12,479

Table 1. Bet Performer Characteristics

Problem

Accurately valuing a ship in a volatile market is challenging, with scarce comparable transactions and fluctuating BDI complicating fair pricing. The bidding price must be precise, as a lower-than-market offer risks signaling a non-serious seller and jeopardizing the deal. With little room for counteroffers, the objective is to ensure the proposed price is competitive and credible to secure the transaction.

Proposed Solutions

A **hybrid valuation approach** was implemented, combining the **market method** with **statistical analysis** utilizing regression to estimate a fair value.

The market approach provided a foundational benchmark by referencing comparable transactions, while regression analysis quantified the influence of key factors such as age, deadweight tonnage (DWT), and the Baltic Dry Index (BDI). The combination of these methods ensured an accurate valuation.

Industry Benchmarks

There are three common approaches used by owners, appraisers, bankers, and brokers in the global maritime industry.

1. Cost Approach: Typically used when it's hard to find comparable ships on the market, it's frequently utilized for vessels with special features or adaptations. This technique determines the worth by accounting for the cost of purchasing or reconstructing a comparable ship, considering any modifications.

2. Income approach: The income approach relies on what the buyer of the potential ship can expect to make in revenue from the ship. Like any asset, the buyer expects to use the ship to make a profit over x number of years and can therefore predict their income based on years remaining in the ship's expected life.

3. Market approach: The market approach to ship valuation works by using the price of a recently sold, similar ship as a guide to estimate the value of a vessel. This approach guarantees that the transaction represents the genuine market value by assuming that the buyer and seller are both knowledgeable and acting freely. Often called the "mark-to-market" method, it is predicated on the notion that an efficient market will determine an asset's logical value because a buyer's willingness to pay will equal a seller's willingness to accept. **This was the approach implemented to identify the most comparable transaction** and ensure our further calculations, including regression analysis, are justified both statistically and by industry standards.

Comparable Transactions

To identify the most comparable transaction, z–scores for age at sale, Deadweight Tonnage (DWT), and the Baltic Dry Index (BDI) were calculated for each of the 48 available transactions to standardize the data and enable fair comparisons across different unit measures. These standardized values were then used to determine the Manhattan Distance for each transaction. This metric, which **sums the absolute differences across all factors**, evaluates the overall similarity of transactions by considering all attributes collectively. Based on this analysis, the **Cape Sun, which sold in March 2008 for $135 million, was identified as the most comparable transaction.** This sale set a price reference for the Bet Performer, based on the market approach.

Price Estimate

Reression Analysis

A simple linear regression was conducted to predict ship price and analyze relationships between ship price and five variables: Age, DWT, Baltic Capesize Index, Sale Date, and Year Built. Age at Sale and Model Year represent the same factor, as indicated by their close correlation (multiple R) with ship prices, at 0.79 and 0.81 respectively. Sale Date (0.17) has the lowest correlation and the least influence on price.

Therefore, the relationship between ship price and the variables **Age, DWT, and Capesize Index** will be analyzed, providing an economic rationale that might affect the ship's price.
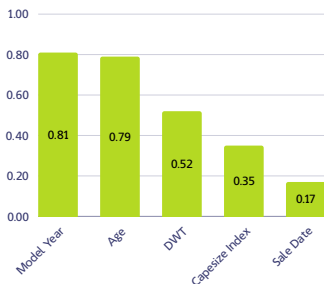

Exhibit 1. Correlation Figures from Simple Linear Regression

Sale Price vs. Age

In regression analysis, correlation coefficient (Multiple R) of 0.787 (Exhibit 2) suggests a strong negative correlation, **indicating that as a ship's age increases, its price tends to decrease significantly.** This is further supported by the R–squared value of 0.62 indicates that 62% of the variation in ship prices is explained by age, suggesting that, economically, age is a major determinant of a ship's value due to its impact on remaining lifespan.

REGRESSION STATISTICS	AGE vs. $$	DTW vs. $$	CAPESIZE INDEX vs. $$
Multiple R	0.787	0.515	0.352
R Square	0.620	0.265	0.124
Standard Error	21.116	29.373	32.065
Significance F	3.1E-11	0.000181	0.014048
Intercept	133.130	-84.165	36.431
Coefficients	-4.217	0.989	0.005

Exhibit 2: Simple Linear Regression Results

The negative age coefficient (–4.217) indicates that each additional year in a ship's age reduces its price by 4.217 million, reflecting depreciation as older ships lose value due to wear and reduced efficiency. The low p-value indicates a statistically significant relationship between a ship's age and its price, confirming that market participants heavily consider age as a critical factor in assessing a ship's value.

> **"each additional year in a ship's age reduces the price by $4.217 million"**

Sale Price vs. DWT

The regression analysis shows a relatively weak relationship between ship price and Deadweight Tonnage (DWT), with a correlation coefficient (Multiple R) of 0.515 (Exhibit-2) indicating only a moderate positive relationship. In practical terms, although larger ships (with higher DWT) generally command higher prices, the effect is not particularly strong or consistent. The R-squared value of 0.265 indicates that **DWT accounts for only 26.5% of the variation in ship prices**, leaving 73.5% unexplained, which economically suggests that other factors—such as a ship's condition, fuel efficiency, and technological features—are likely to be more influential in determining price due to their impact on long-term profitability. The positive DWT coefficient (0.989) suggests that each additional unit increase in DWT leads to a slight price increase, but its small magnitude implies that simply enlarging a ship's carrying capacity does not significantly boost its price; factors such as maintenance costs, age may be more influential in determining market price. The low p-value indicates that DWT is statistically relevant in the pricing model, yet DWT is just one of many factors, with buyers assessing broader attributes to determine a ship's overall economic value.

Sale Price vs. Capesize Index

The analysis shows a weak relationship between ship price and the Capesize index, with a correlation coefficient (Multiple R) of 0.352 (Exhibit-2) indicating only a modest positive link, **meaning changes in the Capesize index are not strongly associated with changes in ship prices.**

The R-squared value of 0.124 indicates that only 12.4% of the variation in ship prices is explained by the Capesize index, suggesting that while freight rates may affect profitability and indirectly influence ship value, they are not the primary determinant of sale price; the remaining 87.6% of variation is likely driven by other factors, such as market conditions. The small coefficient for the Capesize index (0.005) **indicates that each unit increases ship prices by only 0.005 million on average**, suggesting that they have minimal impact on a ship's resale market price. A statistically significant relationship (p-value of 0.014) between the Capesize index and ship price suggests that Capesize index has some measurable impact on price but overlooking other considerations.

Best Price Predictor

Age is the strongest predictor of ship price among the three variables because it has the highest R-squared value (0.6201), indicating that it explains 62% of the variation in prices, compared to much lower values for DWT and the Capesize index. Additionally, age has a stronger correlation with ship price (0.7875), showing a more consistent and direct relationship. The impact of age on price is also more pronounced, as indicated by the larger coefficient (-4.217), meaning each additional year significantly decreases price, reflecting economic depreciation. Finally, the **lower standard error (Exhibit-2) in the age model suggests that the estimates related to age are more precise,** giving more confidence in its predictive power.

Considering All Variables

The R Square (R²) is 0.9204, or almost 92%. This indicates a very significant explanatory power, with the **model's properties accounting for 92% of the variability in ship pricing.** A high R2 score indicates that the model incorporates the most significant variables influencing ship prices, enabling it to successfully identify the key patterns in the data.

R-squared adjusted: 0.9150, or almost 91.5%. The model's number of predictors is taken into account by adjusted R2, which penalizes needless complexity. The close R2 and Adjusted R2 values show that the model's extra variables make a significant, non-overfitting contribution to the explanation of ship prices.

The closeness of R² and Adjusted R² values indicates the model's robustness and simplicity. It indicates that the incorporated features effectively explain ship prices, indicating an accurate match with little danger of overfitting. The model's balance of high R² and near Adjusted R² indicates its reliability and effectiveness in explaining ship price fluctuation.

Bidding Price
Regression Analysis

Based on the previous regression model, **a competitive price for the Bet Performer will be $134 million**. This price is derived largely based on the ships 11-year age, with its deadweight tons of carrying capacity and the spot price for the Capesize Index playing lesser roles. Additionally, the standard error was included in the model to ensure a price that is competitive but not overvalued. The current availability of credit in the US, makes the marginal cost of financing more attractive.

Commodity prices are continuing to hold strong, despite global financial system uncertainty, meaning that income is likely to hold somewhat steady despite other market volatilities. The suggested price falls within the 95% certainty range based on regression and does not exceed a fair valuation of the vessel.

> ❝
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Scenario Analysis

To evaluate how key factors influence the valuation of the Bet Performer, various scenarios were analyzed to understand the sensitivity of the ship's price to changes in its age, Deadweight Tonnage (DWT), and charter rates. These scenarios provide insights into how adjustments in these variables impact the ship's market value, helping stakeholders assess potential trade-offs and market dynamics under different conditions. This analysis ensures that the proposed price is both robust and aligned with realistic market fluctuations.

If the ship were **5 years younger**, its estimated price would be **$148.55**. This shows that a newer age adds significant value, most likely due to enhanced operational efficiency, reduced maintenance requirements, and increased market demand for newer ships.

A **20K reduction in Deadweight Tons (DWT)** would result in a price of **$120.99**, suggesting that lighter ships may be valued differently, maybe due to lesser carrying capacity, which could be a trade-off based on the market's demand for capacity or operational flexibility.

A 30% fall in charter rates would reduce the price to **$98.85**, demonstrating how vulnerable ship prices are to charter rate swings. Lower charter rates diminish the ship's income potential, thereby affecting its market value.

When all three factors—age, DWT, and charter rates—are considered together, the price adjusts to $116.73.

-5 YEARS	-20K DTW	-30% RATES	ALL
$148.55	$120.99	$98.85	$116.73

Exhibit 3: Scenario Analysis Adjusting Variables

Limitations

While the previous approach can be justified, there are two core concerns that arise. First, the current growth of the Baltic Dry Index, and Capesize Index by extension, are not sustainable. In this regard, the proposed price is competitive to obtain the ship, but not overly inflated by letting a potentially over-valued market drive the decision-making process. The second concern is associated to the global financial insecurity. While the financial markets have driven investors into commodities as a comparatively stable investment, there is potential spill over, particularly as an economic recession loom in the US. Economic growth in China remains largely unchanged, and their desire for commodities continues to rise as well.

However, caution was advised in ensuring that the client does not over-leverage themselves to purchase a ship they could still afford—prices don't remain high forever.

Additional Factors

Although not directly included in this analysis, additional factors such as fuel prices, engine manufacturers, global economic indicators, and freight market volatility could significantly impact the vessel's price.

Fuel Prices: Fuel prices have risen sharply since before 2008, making fuel a major operational expense for shipping companies. As a result, fuel-efficient ships are highly sought after, offering a means to significantly reduce fuel costs and improve profit margins.

Engine Manufacturer (Supplier): Ships equipped with engines from trusted names like MAN and Wärtsilä hold greater market value due to their reduced need for maintenance and established durability. Such ships command higher prices, appealing to buyers focused on long-term reliability and lower upkeep costs.

Worldwide Economic Indicators: Global demand for shipping remains robust, driven by rapid economic growth in countries like China, which creates an upswing in shipping rates and prices for all vessel types. This demand directly increases the value of ships like ours, which serve as crucial assets amid expanding trade across international markets.

International Trade Policies and Tariffs: The push for open markets and the development of new trade routes continue to increase demand for versatile vessels, enhancing their market value. For ships involved in international trade, this demand surge strengthens their pricing. However, trade policies and tariffs intermittently impact certain ship types and trade lanes, causing fluctuations in value depending on the routes served.

Conclusion

This analysis provides a comprehensive valuation of the Bet Performer, a Capesize bulk carrier, using a hybrid approach that combines market comparables and regression analysis. **Age proved to be the strongest predictor of price, highlighting the economic impact of depreciation on ship values.**

The valuation methods applied—particularly the regression analysis—established a reliable pricing model that explains a substantial portion of price variability.

However, factors such as the volatile Baltic Dry Index, broader financial uncertainties, and potential economic fluctuations underscore the need for caution in investment decisions. T**he suggested price of $134 million represents a balanced offer, competitive yet mindful of market conditions.** Additional considerations, including fuel costs and global economic indicators, may further impact the vessel's valuation but were beyond the scope of this model. The proposed price positions the Bet Performer attractively within current market realities while mitigating overvaluation risks.