Proposed By
Group: 6

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EXECUTIVE SUMMARY

Project on Compass Maritime Services LLC : Valuing ships

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EXECUTIVE SUMMARY

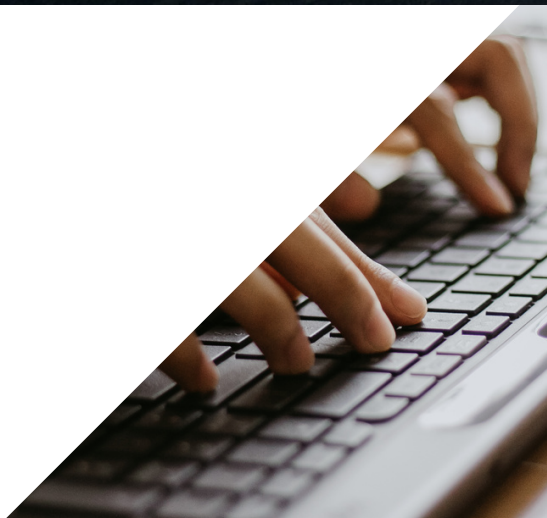
This comprehensive report delves into the valuation of the "Bet Performer" by examining recent capesize ship sales, scrutinizing attributes influencing costs. Employing statistical tools such as Linear Regression Models ,and regression, we arrived at a recommended value of $126 million. Our approach underscores the vessel's value.

The single-variable regression model highlights age at sale as the pivotal factor, boasting an impressive R-squared value of approximately 65%. Additionally, various elements like oil prices, current location, conditions, and market forces (demand and supply) intricately influence ship prices, elucidated further in the report.

The collective impact of ship attributes (Age at sale, DWT, Capesize) explains a substantial 92% of the variation in sale price. While this is noteworthy, it's crucial to acknowledge potential influences from external factors on this valuation.

OBJECTIVE

The central goal of this endeavor was to establish accurate and informed ship valuations, considering factors such as ship type, age, size (Deadweight Tonnage - DWT), condition, and main engine specifications. The report specifically highlights the valuation of the "Bet Performer" ship, incorporating a market-oriented approach.



Linear Regression Model

In our Project to find ships that are comparable in to the Bet performer we have used an approach where we formulated an equation based on the linear regression models.

The formula we came up with is is based on the linear regression model. Using this formula we are trying to find out the dependent variable which in this case is the price of the Bet Performer . This is found out based on the independent variables which in this case are

- Age of ship
- Deadweight Ton
- Capesize

Each coefficient represents the contribution of that corresponding independent variable.

Here the intercept/ constant term is found out to be 44.22, which is found out by formulating the model in the general form of the simple linear regression model using the formula

$Y=\beta 0+\beta 1 \cdot X+\varepsilon$

Where, β0 is the Intercept and the next is the slope.

Then we use the method of least square, where it minimizes the sum of square residuals using the formula

$\sum i=1n(Yi-(\beta 0\hat{}+\beta 1\hat{} \cdot Xi))2.$

Finally we use the Estimation to come up with the final formula.

REGRESSION ANALYSIS

Single variable regression analysis

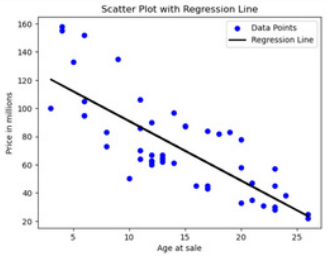
In our subsequent analysis, we delved into single-variable regression to unveil the intricate relationships within the data. This involved computing linear regression equations and scrutinizing scatter plots, along with key metrics like R-squared and P-values. The essence of regression analysis lies in discerning how independent variables exert influence on the dependent variable, encapsulated in a simple linear equation. This process enables us to approximate the dependent variable's value based on variations in the independent variable.

Our study extended to estimating the Bet Performer's price through regression analysis, exploring relationships with sale price and age at sale, sale price and DWT, as well as sale price and capsize. This multifaceted approach provides valuable insights into the interplay of these variables, enhancing our ability to predict and understand the Bet Performer's potential value.

Age at Sale:

After using regression analysis between sale price & Age of sale, for bet performer whose age is at the time of sale is 11 years (X1),

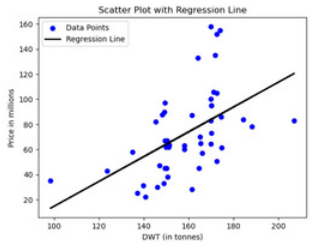
$$Y = \alpha + (\beta 1 * X1) + (\varepsilon 1)$$



Deadweight Tonnage (DWT):

(kilo tons): After using regression analysis between Sale price & DWT, given that the DWT for bet performer DWT is 172 kilo tons (X2),

$$Y = \alpha + (\beta 2 * X2) + (\varepsilon 2$$



PRICE PREDICTIONS FROM REGRESSION MODEL

Attribute Variable	Constant	Equation to calculate price
Age	DWT, Capesize	Price = -4.21(Age) + 133.13
DWT	Age, Capesize	Price = 0.98(DWT) - 84.16
Capesize	DWT, Age	Price = 0.0056(Capesize) + 28.57
Age, DWT, Capesize	-	Price = 44.22+ (-4.21(Age)+ 0.24(DWT)+0.007*(Capesize))

Our model underscores three pivotal factors influencing the ship's sale price: Age at sale,Deadweight tonnage (DWT),Capesize Index:

- For the Bet Performer, with an age at the time of sale standing at 11 years (X1), the regression analysis yielded the equation:

- Substituting the values, we derive the sale price as $94.33 million. The adjusted R-squared value of 61.5% indicates that this model explains 61.5% of the variance in the sale price, primarily attributed to age (Exhibit 5).

- Moving to Deadweight tonnage (DWT) analysis, for the Bet Performer with DWT at 172 kilo tons (X2), the regression equation is:

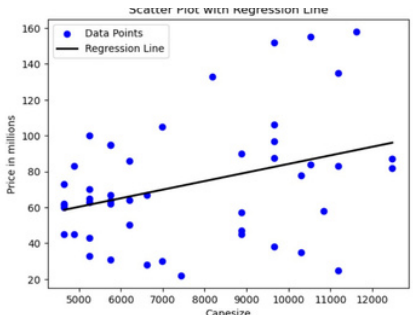
- To understand how DWT influences the sale price. This meticulous analysis enhances our grasp of the Bet Performer's pricing dynamics based on its age and Deadweight tonnage.

Capesize Index:

Considering a Capesize Index of 12479 for the Bet Performer in May 2008 (X3), the regression analysis produces a sale price of $111.36 million, with an adjusted R-squared value of 10.5%. This signifies that 10.5% of the sale price variation can be explained by the Capesize Index.

For instance, the age of sale analysis does not consider the influence of DWT and Capesize Index. Therefore, single-variable regression might not be optimal when multiple factors interplay in determining the dependent variable.

$$Y = \alpha + (\beta 3 * X3) + (\varepsilon 3)$$



MULTIVARIABLE REGRESSION ANALYSIS

In recognizing the substantial impact of all three factors—age at sale, Deadweight Tonnage (DWT), and Capesize Index—on the ship's sale price, a transition to a multivariable regression model was imperative. Unlike single variable regression, this approach considers the simultaneous influence of multiple independent variables on the dependent variable, leading to a more accurate prediction model.

The encompassing all influential factors, remarkably diminishes the variance of the sale price by 91.5%, reflected in an impressive R-squared value of 0.915. This marks a substantial improvement compared to the maximum R-squared value of 62% attained in the single-variable analysis.

Examining the coefficients (B) for each independent variable and the intercept (α) derived from the multi regression analysis offer the foundation for approximating the sale price. Utilizing these values alongside standard error considerations (E), the sale price equation becomes- where:

$$Y = \alpha + (\beta 1 * X1) + (\beta 2 * X2) + (\beta 3 * X3) + (\varepsilon) X1$$

- X1 - represents the age of the Bet Performer at the time of sale (11 years),
- X2 represents the DWT of the Bet Performer (172 Kilo tons), and
- X3 represents the Capsize Index

From Exhibit , the values are

The sale price approximation from the multivariable regression analysis is Y=126.54

The robustness of this model is underscored by the adjusted R-squared value of 91.5%, signifying that 91.5% of the variation in the sale price can be elucidated by the considered factors (Exhibit 6). This comprehensive multivariable approach enhances the accuracy of predicting the Bet Performer's sale price, offering a nuanced understanding of its valuation dynamics.

Regression Statistics	
Multiple R	0.959393172
R Square	0.920435259
Adjusted R Square	0.91501039
Standard Error	9.881509713
Intercept	44.22554998
Age at Sale Coefficient	-4.543803922
DWT Coefficient	0.242154623
Capesize Coefficient	0.007206924
Sale Price Coefficient	**126.543**

Analyzing the data, we find that subtle changes in key variables can significantly impact the predicted sale price of the ship. If the ship were 5 years younger, the estimated price would rise to $147.59 million. Similarly, a reduction of 20,000 kilo tons in Deadweight Tonnage (DWT) could lead to a sale price of $121.74 million. Introducing a 30% decrease in the charter rate would result in a projected sale price of $100.33 million. Interestingly, if all these conditions were met simultaneously,

In our pursuit of rigor, we sought validation through a machine learning model. Employing linear regression, we divided the dataset into training (85%) and testing (15%) subsets. The model, trained on variables such as DWT, Capesize, and age at sale, demonstrated a remarkable 96% accuracy and a mean squared error (MSE) of 8 when predicting sale prices. Taking this a step further, we applied the model to predict the value of the ship, resulting in a projected price of $126.543 million.

IMPACT OF EXTERNAL FACTORS

Several factors play a crucial role in influencing ship prices. Notably, oil prices have a direct impact on the current market rates of the Baltic Capesize Index (BACI). It's essential to recognize that the capsize index tends to rise when the prices of iron ore and coal increase. Importantly, the prices of these key commodities, iron ore, and coal, are closely linked to changes in oil prices.

- Back in May 2008, when we assessed the ship's value, a few important things were happening.
- Oil Prices: They were sky-high, reaching nearly $145, which had a big impact on ship prices because the cost of transporting goods, like iron ore and coal, closely ties to oil prices.
- Low Loan Rates: Getting loans was easy since interest rates were low. However, predicting future rates was uncertain.
- Economic Volatility: Things were a bit shaky economically, making sellers more powerful in negotiations. Offering below the market rate came with risks.
- Average Ship Prices: From March to May, the average price for ships with more than 160 DWT was $126.73 million.
- High Demand: The market was booming with high demand, influencing prices positively.
- Location Matters: Where the ship was docked played a big role in determining its final price.
- Ship's Condition: The ship's current state and how well it was maintained also affected its price.
- All these factors, from the cost of oil to economic conditions and maintenance, contributed to the ship's value in a bustling market.
- Reference:- https://tradingeconomics.com/commodity/baltic

Determining the bet performer's price:-

After carefully considering all the findings from our regression analyses and taking into account external market factors, we suggest that the estimated price for the Bet Performer stands at $ million.

Specifically, the price determined through multiple linear regression analysis is $125.75 million, with a standard error of 9.88. To arrive at the final recommended price, we add this standard error to the regression price, resulting in the suggested value of $137 million. This comprehensive approach ensures a more reliable estimate, considering both statistical analysis and broader market conditions.

Constraints:-

- Unknown Location: We don't have details about where the ship will be when it's sold.
- Condition Uncertainty: The current condition of the ship is unknown.
- Other Quality Factors: Any other factors related to the ship's quality and physical characteristics were not taken into account.
- Port Charges: Differences in port charges worldwide, which can impact the ship's price, were not factored in.
- While these elements weren't part of our analysis, they are significant considerations in determining the ship's actual value.

Conclusion:-

After crunching the numbers and thoroughly analyzing, we propose that the Bet Performer's estimated price comes in at $125.43 million. It's a solid figure derived from careful consideration. However, we recommend our client to stay tuned to the external market dynamics we've discussed earlier. These factors can be game-changers in determining the ship's price, so keeping an eye on them could lead to even more informed decisions.