**Technical Report for a Ship Valuation: Bet Performer**

**Presented for STAT 610 by Group 7:**

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**EXECUTIVE SUMMARY**

We propose the Bet Performer as the appropriate capsize bulk carrier ship, whose value we assessed is to be at $125.82 Million (US). With respect to the volatile shipping market, we suggest they make an offer on the ship between the following price range: $125.82 Million to $132.76 Million given the market trend of 2008. In the following sections, a brief background on the case, methods used to identify and assess the value of the ship will be discussed along with and reasons behind the proposed price range for negotiation. Lastly, factors that might contribute to any fluctuations in the price are addressed briefly.

**BACKGROUND**

Mr. Karatzas, the director for Projects and Finance at Compass Maritime Services, a New-Jersey-based firm was informed about a potential buyer interested in buying a capsize bulk carrier by Tom Roberts, the founding father of the company. The potential buyer needed assistance in 3 things: a) identifying an appropriate ship, b) assessing the value of the ship and c) suggestions on negotiation strategy. Upon referring to the “ships-for sale” bulletins, Mr. Karatzas, found the Bet Performer as a suitable ship for the client.

Bet Performer is an 11-year old ship, built by Nihon Kokan Kabushili-Kaisha (NKK) in Japan in 1997 (Exhibit 1: Picture of the Bet Performer). To assess the appropriate value of this ship and suggest possible negotiation strategy, Group 8 was approached.

To determine the value of the ship, three main approaches were considered – the market approach, income approach and the cost approach. The market approach is where the value of the ship equals the market price of a recently completed sale of a ship that is comparable to the one being assessed between both a willing and knowledgeable buyer and seller. Whereas, in the income approach, a forecast of the future cash flows (i.e financial model) is required to assess the value of the ship, where daily charter rates of the ship and one-year charter rates for capsize ships over the past five years play an important factor. Lastly, the least common approach, the cost approach, is when a ship is assessed by the cost price of replacing a given ship and its functionality. Such an approach is usually taken when the ship has unique functionalities or customized features.

Despite the existence of multiple methods to evaluate a ship, the market approach is the most commonly used approach and can generate an accurate price. To do so, we identified a set of comparable specifications (parameters or features) of the ship that would aid in assessing the value of the ship – age of the ship, size (measured in DWT), ship type (Capesize vs. Panamax) and its condition. Next, we identified a dataset of multiple ships that had recently completed transactions, in both an active and a slow market to better understand the transactions of comparable ships.

**METHODS**

To accomplish the above goals,we used 2 methods to compare and validate our results to each other. First,we compared ships similar to the Bet Performer and second, we conducted a linear regression analysis.

***Ship Comparison:***

We first looked into specification of the Bet Performer and each of its features independently which we then compared it with other ships that share similar features and the price they were sold at to get a rough sale price for Bet Performer.

Bet Performer, the ship whose values is being assessed is an 11-year-old, 172,000 deadweight ton (DWT) capsize bulk carrier built by Nihon Kokan Kabushili Kaisha (NKK) in Japan in 1997. This ship had a Burmeister & Wain (B&W) 6S70MC engine, had nine holds and hatches and, was previously named “Mineral Poterne” which was sold for $70 million. (Exhibit 1 shows a picture of the ship).

Table 1 below, summarizes the feature and price comparison of Gran Traer and Surnihou, ships that that share features similar to Bet Performer.

*Table 1*: Similar Ships Comparison

|  |  |  |
| --- | --- | --- |
| BET PERFORMER | GRAN TRAER | SURNIHOU |
| Year Built: 1997 | Year Built: 2001 | Year Built: 1996 |
| Weight: 172K DWT | Weight: 172.6K DWT | Weight: 171.1K DWT |
| Age at Sale: 11 | Age at Sale: 6 | Age at Sale: 11 |
| Sale Date: Yet to be sold | Sale Date: November 2007 | Sale Date: November 2007 |
| Sale Price: Yet to be sold | Sale Price: $152 M | Sale Price: $106 M |

From the table above, we can see that Surnihou is built nearly the same time as Bet Performer but just weighs a tad-bit less than Bet Performer and was sold for $106M in November 2007. Whereas, the Gran Traer weighs nearly the same as the Bet Performer but is much younger in age, though sold around the same time as the Surnihou, it valued at $152M. So, it would be safe to say that the value of Bet Performer should fall between $106M and $152M.

However, to determine the exact value of the Bet Performer, we needed data on multiple ships and referred to the Sales of Capsize Ships from January 2007 to May 2008 dataset.

Firstly, we computed the basic descriptive statistics and correlational coefficients to describe the characteristics of the data and access the strength between the parameters respectively. Secondly, adopting the linear regression analysis we computed several regression models to determine the optimal combination of parameters to determine the value of the Bet Performer.

***Linear Regression Analysis:***

The data on the Sales of Capsize Ships from January 2007 to May 2008 consists of 48 ships, that were previously sold and considered the following parameter to estimate its price: the sale price ($ US millions), year built, age at sale (years), Dead-Weight Tons and Baltice Dry Capesize Index.

To determine the optimal price predictor combination, we conducted the linear regression analysis. Optimal predictor combination here refers to the ideal combination of the parameters that best predicts the sale price of the ship and explains the most variance in sale price. Before, conducting the linear regression, we computed the basic descriptive statistics for each of the 4 parameters and the sales price to determine the spread of the data by analyzing the central tendency (mainly means) and measure of variability (distribution of standard deviation). The correlation between the parameters and between each of the parameter and the sales price was also computed to determine the strength and directionality between them. Table 1, below shows the means, standard deviations and correlations for the parameters and the sales price. A higher correlation number indicates a strong relationship between the parameters and, a positive number indicates that as one parameter (from left-column variable) increases so does the other (from the top-row variable); an inverse in directionality exists for negative values.

*Table 2*: Descriptive statistics and correlations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Mean | Standard Deviation | Sale\_Price | Sale\_Years | Weight | Capesize |
| Sale\_Price | 72.95625 | 33.89537 | 1 |  |  |  |
| Sale\_Years | 14.27083 | 6.330405 | -0.7874908 | 1 |  |  |
| Weight | 158.9354 | 17.65098 | 0.5148053 | -0.431264 | 1 |  |
| Capesize | 7643.708 | 2499.309 | 0.3523476 | 0.2173602 | 0.042766 | 1 |

A visual presentation of each of the parameters individually with respect to Sale\_Price are shown in Appendix: Exhibit 2. From the above table, we conclude that sale\_price and sale-years have a strong negative correlation (r = -0.787) i.e. the older the ship, lesser the price of the ship. A similar trend is observed between sale\_year and weigh (r = -0.431). The remaining parameters are positively correlated with weight and capesize having the highest values after sales\_year with respect to sale\_price.

Based on Table 2, we see that sales\_year, is the strongest correlation with sales\_price, meaning this single parameter is the best predictor of the ship. So we first conducted a linear regression with sales\_year as the only parameter. We then added, weight to the equation, the second best predictor of the ship and conducted a multiple regression. Finally, we use all the three parameters – sales\_year, weight and capsize and computed a multiple regression. Table 2 below, presents the intercept, coefficient, its significance (P-value), R square, Adjusted R square values, Degree of freedom and standard error for each of the 3 models.

To determine the best model fit, we referred to the p-value and the adjusted R square values. Adjusted R square refers to the variance in sale\_price explained by the specified parameter. The closer the value of R square to 1, the better and, the closer the p-value to 0, the better.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Model Combination  Sale\_Price | Intercept | Coefficient | P-value | R-squared | Adjusted R-Squared | Degree of freedom | Standard Error |
| Sale\_Years | 133.1295 | 0.9886 | 3.147e-11 | 0.6201 | 0.6119 | 46 | 21.12 |
| Sale\_Years+Weight | 60.3521 | -3.7196  0.4133 | 3.311e-11 | 0.6578 | 0.6426 | 45 | 20.26 |
| Sale\_Years+Weight+  Capesize | 44.2255500 | -4.5438039  0.2421546  0.0072069 | 2.2e-16 | 0.9204 | 0.915 | 44 |  |

*Table 3*: Regression Models

The regression equation for the optimal parameter combination for price\_sale is:

***Price\_sale* = 44.2256 – 4.5438\**Sale\_Years* + 0.2421\**Weight* + 0.0072\**Capesize***

Upon plugging the values of the Bet Performer in the above equation we generate the value of the ship to be $125.84 Million

**125.82 = 44.2256 – 4.5438\*(11) + 0.2421\*(172) + 0.0072\*(12479)**

Therefore, our optimal estimated price for the Bet Performer is $125.82 Million keeping in mind that is 11-years old, weights 172,000 DWT and has a capsize of 124,79. However, were any of these parameters to change, so will the price of the ship. For instance, if the ship was 5 years younger while the rest of the parameters remained the same, it would value at $ 148.45 Million. If it was 20K DWT lighter, it would value at $ 120.89 Million or if the charter rates were 30% lower, it would value at $98.779 Million.

Nonetheless, the estimated value of Bet Performer with its specific parameters, values at $125.82 Million. Comparing this values with Table 1, with the sale price of Gran Traer and Surnihou we can safely say that the estimated price for the Bet Perfomer falls with the range of $106 M (Surnihou) and $152 M (Gran Traer).

**NEGOTIATION STRATEGY**

$125.84 million is the assessed value of Bet Performer. However, the market should be taken into consideration when placing an offer to buy the ship. Since January 2007, the market has been volatile, and any offer made even just a bit below the asking or market price has previously severely jeopardized the chance of buying the ship. To foreflight the assumption that offers made below the asking price as the buyer not being serious, we suggest that the client place a bid between $125.84 M to 132.76 M as this is the 95% interval of the ship to be in its optimal value. As one goes over or below this range, we lose confidence in the price of the ship and cannot guarantee one will get the right price for the ship for the right market value.

Few other factors to consider while making the offer are the economy, government regulations and geopolitical conditions of the location as they can drastically sway the demand and supply of the ship.

**APPENDIX**

*Exhibit 1*: Picture of Bet Performer

*Exhibit 2*: Visual representation of the each of the parameters individually with Sale\_Price

|  |  |
| --- | --- |
| Sale Price vs Year Build  plot(Sale\_Price~Year\_Built, data =casedata )  https://lh4.googleusercontent.com/A3hSjHybFlnHAjhHSVAxyzlrobSrIjAl5zTzeU5YHA3mF3ZOoWnfFiBX3VssVuDL-x-LhMWb4r9EL76MTnbiNW0dxM978ctocx9qZU_l1BNWjxShU1JCVJcA2StlMDdKLzCNHVP5 | Sale Price vs Sale\_Year  Plot (Sale\_Price~Sale\_Year, data= casedata) |
| Sale price vs weight  plot(Sale\_Price~Weight, data =casedata )  https://lh6.googleusercontent.com/UDbBvdyNmf8FbUz0-Nw_X-XL3VkUVQFQWwj0QaKaPJum9T9LYruKhpArgReykj3EU_-xQeSctrEiWpMWDZo5ahVga_Jxe1ZPZ7wgkTo3iLqchj7lM0Mcl9K6_JDpuqqDeBw0NrG9 | Sale price vs Name  plot(Sale\_Price ~ Name, data=casedata) |
| Sale price vs Capesize  plot(Sale\_Price~Capesize, data =casedata )  https://lh5.googleusercontent.com/rTr5oisD1dP6jM4lTt19eLwgqs1zJBVqWnZRuBAVM8YR8KoxWgl_X3f9mSmT2F7q0lsprtt6JotT6YWgqrKyelRX0fkjOTluE3Y0kKCq_487So4uQlC4LweKDdJMto-Hb_pJjHrS |  |
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*Exhibit 3: R-code for reference*

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