STATISTICS 610-675

FINAL GROUP PROJECT

Compass Maritime Services, LLC: Valuing Ships

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How much is the Bet Performer worth based on comparable transactions? Which ship is the best reference transaction?

*Let's **consider the Baltic Dry Index** which is an indicator of the demand of bulk carriers and shipping rates . When we considered the Trailing 1- year Average monthly Baltic Dry Cape size Index.*

	Cape size Index
mean	*7643.71*
std dev	*2499.31*
min	*4647.00*
max	*12479.00*
range	*7832.00*

*We can see that the std dev is bigger with respect to the average. This means that the index fluctuates significantly, indicating the volatility of the market. But the trend of Index is increasing with time. So our comparable transaction should have a **higher than average index**. Moreover, index is **positively correlated** to price. We can take the Baltic index in May 2008 as the highest at **12,479 or more**., based on max data and market conditions.*

Now, let's consider Dead Weight in tons which is an indicator of carrying capacity of the cargo

	Dead-Weight Tons (000)
mean	158.94
std dev	17.65
min	98.40
max	207.10
range	108.70

Smaller std dev indicates that there is moderate variation in the DWT of ships given in the data. So our comparable transaction ship should be closer to DWT value as the Bet Performer **172**. We should also consider that DWT has **positive correlation** with price, so as Bet Performers DWT is more than average, the bid value should also be higher. **Higher dwt compared to avg** will give us a higher price.

But is price negatively correlated with age of ship? So, if they are the same age, under the same Index, same built year and same sale date, will they sell at a higher price if the DWT is lower?? This may be because of variation across averages, or the condition of the ship.

Column 1	Sale Date	Vessel Name	Sale Price ($US millions)	Year Built	Age of sale (years)	Dead-Weight Tons (000)	Cape size Index
3	Jan-07	Spring Brave	62.00	1995	12	151.1	4,647
4	Jan-07	Martha Verity	60.00	1995	12	158	4,647

Now, when we consider Age of sale in years,

	Age of sale (years)
mean	14.27
std dev	6.33
min	3.00
max	26.00
range	23.00

Greater std dev compared to mean tells us that there is greater variation in age in data. The age of our ship **11 years** falls within the std dev limits. So the comparable transaction should have a range within SD.
Also, age is **negatively correlated** to price. So, **lower than average** age of ship will have a higher comparable value. But the negative correlation is also higher.

Consider comparable transactions, we should consider the characteristics of the ship:

Column1	**Sale Date**	**Vessel Name**	**Sale Price ($US millions)**	**Year Built**	**Age of sale (years)**	**Dead-Weight Tons (000)**	**Cape size Index**
45	**Mar-08**	**Cape Sun**	**135.00**	**1999**	**9**	**171.7**	**11,193**

So, based on the above analysis, using only mean, std dev, correlation, and comparable transaction, we can compute the price of Bet Performer to be closer to $135 million.

What is the relationship between ship price and each ship feature?

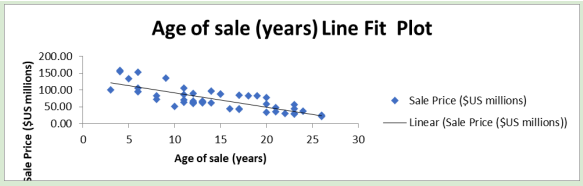
What is the economic logic for why each feature might affect ship price?

Sales price analysis using Linear regression with other metrics

(Y = Sales Price)	Age at sale	DWT	CapeX
Intercept	133.12	-84.16	36.43
Standard Error (SE)	21.11	29.37	32.06
Coefficient	-4.21	0.988	0.0047
Multiple R	0.78	0.51	0.35
R Square	0.62	0.26	0.12
Adjusted R-Square	0.61	0.24	0.10
Sale price	86.75	85.87	96.06

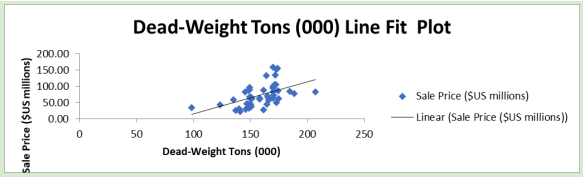
Correlation between sales price and other variables

sale Price with year build	0.810683322
sale Price with age at sale	-0.790143874
sale Price with Dead-weight ton	0.513247284
sale Price with Trailing 1-Year Average Monthly Baltic Dry	0.349597696

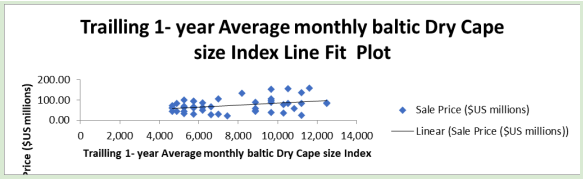


The above graph delivers the sales price relationship with age at sale. The reason for this analysis is to understand the shift in the valuation in respect to the increasing age:

The value of the ship goes down by **$4.2 M** when the age of the ship increases.
P-value: 2.53×10e−21 This extremely low p-value indicates that the age of the ship is highly significant in predicting sale price



Price goes up by **$0.98 M** when one unit increases in DWT. **P-value**: 0.0113. This p-value is low, indicating that dead-weight tons are statistically significant in predicting sale price



Price of ship increases by **$0.0048 M** for each unit increase in CapeX. **P-value**: 1.57×10−15

shows the Baltic Dry Index is also highly significant in predicting sale price.

What is the economic logic for why each feature might affect ship price?

Age at Sale: *Statistical Relationship:* Negative correlation - older ships sell for lower prices *Economic Logic:* ● Higher maintenance costs ● Repairs and replacement parts ● Shorter economic life period ● Might not comply with new regulations	**Dead-Weight Tons (DWT):** *Statistical Relationship:* Positive correlation - larger ships command higher prices *Economic Logic:* ● Larger cargo capacity is proportional to more revenue potential ● Operational scale is higher ● More versatile in terms of trade routes and cargo types
Year Built: *Statistical Relationship:* Positive correlation - newer ships command higher prices *Economic Logic:* ● Indicates maintenance costs ● Indicates economic life period ● Latest ships have better compliance with regulations	**Baltic Dry Capesize Index:** *Statistical Relationship:* Strong positive correlation - ships sell for more when the index is higher *Economic Logic:* ● Higher index indicates stronger shipping rates ● Reflects market's supply-demand balance ● Indicates stronger overall market sentiment ● The index directly reflects current charter rates that ships can earn ● Rising index creates positive sentiment

Which single feature is the best predictor of ship price?

Year Built is the feature most strongly positively correlated with Sale price, having a value of 0.810. That is, the newer the ship built, the higher the price it usually fetches. This is understandable because the newer the ship, the less the problem it usually has due to wear and tear, its technology is also up to date, and operational efficiency increases accordingly.

Can you think of other factors that may affect ship prices?

Primary Factors (Based on Data)

1. Dead-Weight Tons (DWT): Larger ships with higher cargo capacity typically have higher prices due to increased profitability in transporting more goods.

2. Capesize Index: Reflects global market demand for large ships, with higher index values often signaling stronger market conditions and, therefore, higher ship prices.

Secondary Factors (Industry Insights)

1. Condition and Maintenance:

- Ships in better condition with regular maintenance histories generally command higher prices due to reduced immediate repair costs and increased reliability.

2. Fuel Efficiency, Engine, and Technology:

- Newer ships or those with advanced fuel-efficient engines and technology are more valuable, as they offer cost savings over time and better regulatory compliance.

3. Supply and Demand in the Market:

- The balance of ship supply and demand within the global market has a significant impact on prices. Higher demand for ships or a limited supply can increase ship values, while an oversupply may decrease them.

4. Geopolitical Scenario:

- Political factors, such as trade tensions or international sanctions, can influence the shipping industry and the capesize index. For example, trade disruptions can lead to changes in shipping demand, affecting ship prices.

5. Freight Rates:

- High freight rates often correspond to greater demand for shipping capacity, which can drive up ship prices. This is particularly relevant for vessels intended for cargo transport.

6. Build Reputation:

- Ships constructed by reputable shipyards or manufacturers tend to fetch higher prices due to a perception of higher build quality, durability, and reliability.

7. Regulatory Compliance:

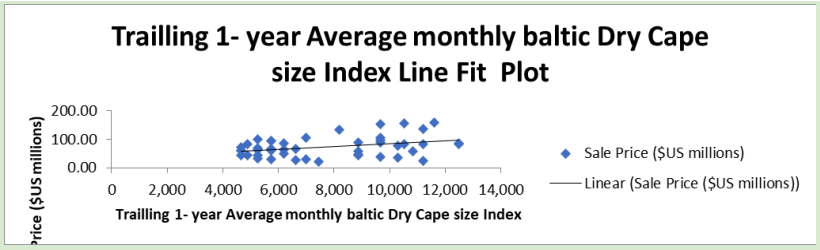
- Compliance with environmental, safety, or emissions standards (such as IMO regulations) is becoming increasingly valuable. Ships adhering to these standards are seen as more sustainable investments, often attracting a premium price.

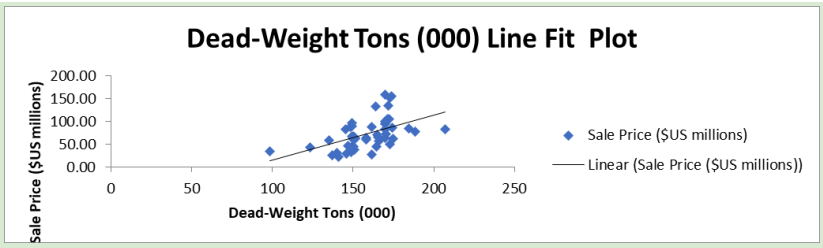
How well do all ship features jointly explain ship prices?

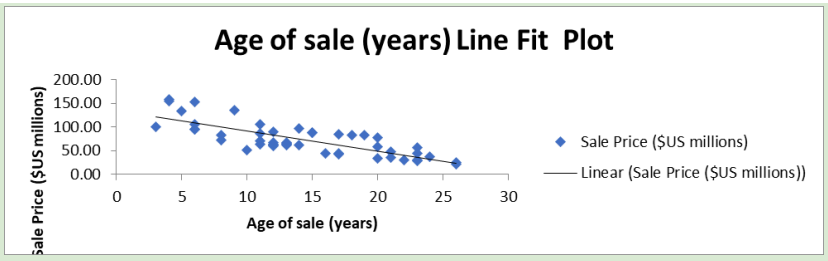
We used Multiple Linear Regression. There is a 95% confidence interval for the intercept. which means that the predicted value has a 95% chance of being correct based on the dataset of 48 ships.

Year built 0.1436 – A p-value above 0.05 indicates that Year built not be statistically significant in the model. so we need to remove year built as a factor.

This is how Sale price is affected with each variable if seen individually.







Using the Regression Equation to calculate the predicted price:

Formula:

Predicted Sale Price = (Intercept) + (Age of Sale Coefficient × 11) + (DWT Coefficient × 172) + (Baltic Index Coefficient × May 2008 Index)

We get the price **$127.75 million**

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	44.22554998	16.3832143	2.699442805	0.00981766	11.20735111	77.24375	11.207351	77.243749
Age of sale (years)	-4.54380392	0.26146926	-17.37796621	2.5257E-21	-5.07076059	-4.01685	-5.0707606	-4.016847
Dead-Weight Tons (000)	0.242154623	0.09161598	2.643148343	0.01133676	0.05751475	0.426794	0.0575147	0.4267945
Trailling 1- year Average monthly	0.007206924	0.00059806	12.05050005	1.5681E-15	0.006001613	0.008412	0.0060016	0.0084122

What would the price be if the ship was 5 years younger? 20K Deadweight Tons lighter? Or if charter rates were 30% lower?

If the ship were 5 years younger:

Each year younger adds $4.21 million to the price. For 5 years younger, this adds

$5 \times 4.21 = 21.05$ million.

Adjusted Price: $135 million + $21.05 million = $156.05 million

If the ship were 20,000 DWT lighter:

A reduction of 1,000 tons in DWT decreases the price by $0.988 million. For 20,000 tons lighter, this reduces price by

$20 \times 0.988 = 19.76$ million.

Adjusted Price: $135 million - $19.76 million = $115.24 million.

If charter rates were 30% lower:

A 30% decrease changes the Capesize Index from 10,000 to 7,000, reducing it by 3,000 points. With each point decreasing price by $0.0047 million, this results in a reduction of

$3{,}000 \times 0.0047 = 14.1$ million.

Adjusted Price: $135 million - $14.1 million = $120.9 million

If you were Basil Karatzas, what would you recommend to your client regarding an offer price for the Bet Performer? What concerns or recommendations do you have?

Concerns and Additional Considerations:

Market Volatility:

The Baltic Dry Index has shown high volatility, which could impact future valuation if market conditions change. This risk should be factored into the long-term value assessment.

Depreciation with Age:

The Bet Performer's age, while within an acceptable range, is a factor in the eventual depreciation. As ships age, maintenance costs and regulatory compliance demands increase, potentially affecting resale value.

Operational Efficiency and Condition:

Assessing the ship's current operational condition and fuel efficiency could provide leverage in negotiations. Ships that are well-maintained or have higher fuel efficiency generally command higher prices.

Global Economic Factors:

Consider potential shifts in demand due to geopolitical or economic changes, as these can impact both the Baltic Dry Index and the resale value.

Room for Negotiation:

While $___ million is a recommended offer, there should be room for negotiation, considering the market volatility and other costs associated with acquiring and maintaining an 11-year-old ship.

Recommendations to client the Bet Performer

Apart from the above concerns, clients must focus on the Scrap metal value. Ships are still getting sold in the market once they stop working or they extend shelf life. The reason is that the materials such as metal that are used in the vessel. The owner must use the scrap metal market as an exit strategy for the bet performer.

The current scrap prices of metal in New Jersey for 2024 are:

Copper: $3.70 per lb for #2 copper, $3.85 per lb for bare bright copper wire, and $4.00 per lb for bare bright copper wire. **Aluminum**: $0.31 per lb for clean aluminum radiators, $0.55 per lb for bare aluminum, aluminum wheels, and cast aluminum, $0.20 per lb for dirty aluminum, and $0.10 per lb for aluminum engines and transmissions. **Brass**: $2.30 per lb for brass. **Bronze**: $2.60 per lb for bronze. **Stainless**: $0.40 per lb for stainless. **Lead**: $0.65 per lb for lead. **Steel**: $10.00 per hundred lbs for cast iron and steel. **Light iron**: $6.75 per hundred lbs