

2023 MCM

Problem Y: Understanding Used Sailboat Prices



Photo Credit: www.pixabay.com

Like many luxury goods, sailboats vary in value as they age and as market conditions change. The attached “[2023_MCM_Problem_Y_Boats.xlsx](#)” file includes data on approximately 3500 sailboats from 36 to 56 feet long advertised for sale in Europe, the Caribbean, and the USA in December 2020. A boating enthusiast provided these data to COMAP. Like most real-world data sets, it may have missing data or other issues that require some data cleaning prior to analysis.

The Excel file includes two tabs, one for *monohulled sailboats* and one for *catamarans*. In each tab, columns are labeled *Make*, *Variant*, Length (in feet), Geographic Region, Country/Region/State, *Listing Price* (in US dollars), and Year (of manufacture).

For a given make, variant, and year, there are many other sources beyond the provided Excel file that may provide detailed descriptions of the features of a particular sailboat. You may supplement the data set provided with any additional data you choose; however, you must include the data in “[2023_MCM_Problem_Y_Boats.xlsx](#)” in your modeling. Be sure to fully identify and document the source of any supplemental data used.

Sailboats are frequently sold through *brokers*. In a desire to better understand the sailboat market, one sailboat broker in Hong Kong (SAR), China has commissioned your team to prepare a report on the pricing of used sailboats. The broker would like you to:

- Develop a mathematical model that explains the listing price of each of the sailboats in the provided spreadsheet. Include any predictors you consider useful. You may draw on other sources to understand additional features of a given sailboat (such as *beam*, *draft*, *displacement*, *rigging*, *sail area*, *hull materials*, *engine hours*, sleeping capacity, *headroom*, electronics, etc.) and for economic data by year and region. Identify and describe all sources of data used. Include a discussion of the precision of your estimate for each sailboat variant’s price.
- Use your model to explain the effect, if any, of region on listing prices. Discuss whether any regional effect is consistent across all sailboat variants. Address the practical and statistical significance of any regional effects noted.

- Discuss how your modeling of the given geographic regions can be useful in the Hong Kong (SAR) market. Choose an informative subset of sailboats, split between monohulls and catamarans, from the provided spreadsheet. Find comparable listing price data for that subset from the Hong Kong (SAR) market. Model what the regional effect of Hong Kong (SAR) would be, if there is one, on each of the sailboat prices for the sailboats in your subset. Is the effect the same for both catamarans and monohull sailboats?
- Identify and discuss any other interesting and informative inferences or conclusions your team draws from the data.
- Prepare a one- to two-page report for the Hong Kong (SAR) sailboat broker. Include a few well-chosen graphics to help the broker understand your conclusions.

Your PDF solution of no more than 25 total pages should include:

- One-page Summary Sheet that clearly describes your approach to the problem and your most important conclusions from your analysis in the context of the problem.
- Table of Contents.
- Your complete solution.
- One- to two-page report to the broker.
- Reference List.

Note: The MCM Contest has a 25-page limit. All aspects of your submission count toward the 25-page limit (Summary Sheet, Table of Contents, Report, One- to Two-Page Report to the Broker, Reference List, and any Appendices). You must cite the sources for your ideas, data, images, and any other materials used in your report.

Attachment

Data File. [2023_MCM_Problem_Y_Boats.xlsx](#)

Monohulled Sailboats
Catamarans

Data File Entry Descriptions

Make: The name of the manufacturer of the boat.

Variant: The name identifying the particular model of the boat.

Length (ft): The length of the boat in feet.

Geographic Region: The geographic region of the boat's location (Caribbean, Europe, USA).

Country/Region/State: The specific country/region/state of the boat's location.

Listing Price (USD): The advertised price to purchase the boat in U.S. Dollars.

Year: The year the boat was manufactured.

Glossary

Beam: The width of a boat at its widest point.

Broker: A specialist who serves sellers and/or buyers as a representative for the sale or purchase of property. For this problem, the property is a sailboat.

Catamarans: A multi-hulled watercraft featuring two parallel hulls of equal size.

Displacement: The weight of the volume of water displaced by a boat.

Draft: The minimum depth of water required to float a boat without touching the bottom.

Engine Hours: The number of hours the boat's engine(s) have run since new.

Headroom: The height available to stand up in the cabin.

Hull: The main body or shell of a ship or other vessel, including the bottom, sides, and deck.

Hull Materials: The materials of which a boat's hull is made. Materials used include fiberglass, steel, wood, and composites.

Listing Price: The price asked by the seller. The boat may sell for a different price.

Make: The manufacturer of the sailboat.

Monohull Sailboats: Sailboats that have only one hull usually centered around a heavy keel (the center blade).

Rigging: The system of ropes, cables and pulleys that support and control the sails, steering and other systems of a boat.

Sail Area: The total surface area of the sails of a boat when fully raised.

Variant: The name identifying a particular model of sailboat. For example, "Sun Odyssey 54 DS."