Valuation by Numbers

The effects on the brokerage side of our industry following the economic crisis of late 2008 have been profound.

***Apoise** recently sold at auction for €34.75m; the model got within about 15% of the sales price.*

Although there seems to have been a pick-up in activity of late, this comes from a low base and prices remain depressed. It is normal for markets to behave this way in the aftermath of a financial shock. Sellers are reluctant to lower their prices and buyers bid very low. This situation obtains until a new market level is reached. In thinly traded, illiquid markets such as ours we can expect disruption to persist for much longer than, for example, in the stock or foreign exchange markets. Is there anything the industry can do to assist buyers and sellers agree on fair market value? I believe there is and the answer comes from the real estate market.

Due to the size of the residential real estate market, there is a massive body of research available on market pricing and factors affecting liquidity. By contrast, the yacht industry is miniscule and, as far as I am aware, has not yet attracted any serious academic study. Although there are clearly large and obvious differences between the two markets, there are also a number of similarities which would suggest that the tools and techniques from real estate research can provide some useful insights when applied to the yacht market. For example, yachts and houses are both relatively illiquid assets, taking months rather than days to sell; they both require substantial search efforts on behalf of the buyers and sellers; in both markets deals are normally conducted through brokers and; both markets are asymmetric – that is sellers generally have more knowledge than buyers.

A common technique for valuing houses is hedonic regression modelling. This is academic jargon and although the maths involved is complex, the principle is easy to explain. Hedonic modelling is an attempt to break down the price of a good or service into its component parts. In the case of a house the individual attributes which might be considered include: plot size, floor area, number of bedrooms, desirability of neighbourhood etc. Regression analysis is a technique to explain the relationship between a dependent variable and one or more independent variables. When carrying out regression analysis to determine house prices, the price is the dependent variable because it depends on the independent variables such as plot size, number of bedrooms etc., which are being used in the model.

A couple of years ago, as part of an MBA project, I carried out a hedonic regression analysis into yacht prices. Taking selling price as the dependent variable, I chose the following independent variables:

Length
Year of build
Motor or sail
MCA compliant
Classed
Builder reputation

Whilst it is clear that length and year of build have numerical values, this is not so for the other attributes. These are known as dummy variables and in the case of motor or sail, MCA compliance and Classed, these are assigned zero or one (in effect yes or no) depending on whether or not they are in that particular category. Builder reputation is a subjective variable but is an important factor in the price of a yacht. In order to quantify this I sent out a questionnaire to a number of yacht brokers listing 161 of the major construction yards and asked them to rate them as: 2 = Excellent, 1 = Good, 0 = Average. I received a response from 10 brokers and took an average of each of their yard ratings to use in the analysis.

I had a data set of 61 yachts ranging in size from 21m to 55m. The sales took place over a seven-year period between 1999 and 2006. The data set is relatively small due to the difficulty in obtaining accurate selling prices and therefore the results should be treated with caution. Another drawback with the methodology is the selection of variables and the possibility that important ones have been omitted. The selection was based mainly on an intuitive feeling that the ones chosen were influential in setting the price and also because the information was readily available.

I would have preferred to have included gross tonnage either in addition to, or instead of, length as this gives a more accurate indication of the size of the accommodation. Unfortunately, gross tonnage is rarely included in yacht sales specifications.

I used a professional statistical software package and, having entered all of the data, the results displayed in table 1 below were obtained:

Using this model, the sale price for any yacht can be calculated using the following formula:
Sale price = -267.157636 +0.47586 Length +0.127773 Year -1.937022 M/S (S) +1.408667 MCA (Y) +1.422487 Class (Y) +5.914795 Builder rep (E) +2.752616 Builder rep (G)

Table 1: Multiple Linear Regression – Hedonic Pricing Model

Dependent Variable – Sale Price

Variable	*Beta*	*St. Error*	*t-Value*	*Probability*
Intercept	b0 = -267.157636		t = -3.418723	P = 0.0012
Length	b1 = 0.47586	r = 0.710412	t = 7.348657	P < 0.0001
Year	b2 = 0.127773	r = 0.407562	t = 3.249199	P = 0.002
M/S (S)	b3 = -1.937022	r = -0.223683	t = -1.670773	P = 0.1007
MCA (Y)	b4 = 1.408667	r = 0.173773	t = 1.284633	P = 0.2045
Class (Y)	b5 = 1.422487	r = 0.152679	t = 1.124706	P = 0.2658
Builder rep (E)	b6 = 5.914795	r = 0.497322	t = 4.173237	P = 0.0001
Builder rep (G)	b7 = 2.752616	r = 0.318014	t = 2.44195	P = 0.018

Analysis of variance from regression

Source of variation	*Sum Squares*	*DF*	*Mean Square*
Regression	3025.960959	7	432.280137
Residual	639.036664	53	12.057296
Total (corrected)	3664.997623	60	

Root MSE = 3.472362
F = 35.852164 P < 0.0001

Multiple correlation coefficient (R) = 0.908646
R^2 = 82.56379%
Ra^2 = 80.260895%

Durbin-Watson test statistic = 1.484026

(*The Variable "Intercept" is a sort of constant in calculations such as these rather than a coefficient of a yacht – Ed.*)

The analysis of variance shows that the model is statistically significant. The R^2 figure means that the model accounts for 82.56% of the variation in sales prices; therefore, for the data set in use, this model appears robust. However, not all of the variables are equally significant. The probability column in the table shows the probability of the beta coefficient value being arrived at purely by chance. The smaller the number, the more significant the beta coefficient is likely to be. It can be seen that length, year of build and excellent builder reputation are the most statistically significant variables and Class is the least.

The numbers in the formula are the beta coefficients from table 1. They represent the change in price, in millions of euros, for each of the variables in the equation. Taking each coefficient in turn:

Length: for each metre in length, the value of a yacht increases by €0.47586m.

For each year, the value increases by €0.1277773m – note that this is the year of build and not the age of the yacht. This means that more recently built yachts will be worth more than older yachts by the amount above for each year of difference.

The coefficient for motor/sail (S) means that if a yacht is a sailboat it is worth €1.937022m less than a motoryacht, which is equivalent in every other measure. (*Though S/Ys are more complex this may be due to smaller absolute volume for given LOA and the lower desirability generally across the market of sailing yachts – Ed.*)

A yacht which is MCA compliant is worth €1.408667m more than a non-compliant yacht.

A classed vessel is worth €1.422487m more than one that is not classed. A yacht built at a yard with an excellent reputation is worth €5.914795m more than a yacht built by a yard with an average reputation. A yacht built at a yard with a good reputation is worth €2.752616m more than a yacht built by a yard with an average reputation.

To take an example, the likely sale price of a 67m Lürssen (a builder with an excellent reputation) motoryacht, built in 2006, which is MCA compliant and classed would be calculated as follows:
Sale price = -267.157636 + (0.47586 x 67) + (0.127773 x 2006) + 1.408667 +1.422487 +5.914795 = €29.78m

The observant reader might recognise *Apoise* in the equation above. This yacht recently sold at auction for €34.75m. The fact the model got within about 15% of the sales price is interesting, although perhaps coincidental as the data set did not include any vessels of this size.

As well as providing a simple means of calculating a likely sales price, this tool is useful for giving values to the different attributes of a yacht. When an owner asks his broker if it is worth getting his yacht classed, or put through MCA compliance the broker can give him actual figures based on the model. Using the equation above, it can be seen that a classed and MCA compliant yacht will fetch about €2.8m more than a non-Classed, non-compliant vessel of the same age, size and from a yard with the same reputation. The owner can then make an informed decision on whether or not it would be worth the investment.

For the reasons mentioned above and also because it is now a little dated, this particular model provides limited predictive power. Nevertheless, the technique is valid and regression modelling can provide a powerful tool to brokerage houses having large amounts of sales data to draw upon, enabling them to maintain an up-to-date index of prices for their own business purposes and for the benefit of their clients.

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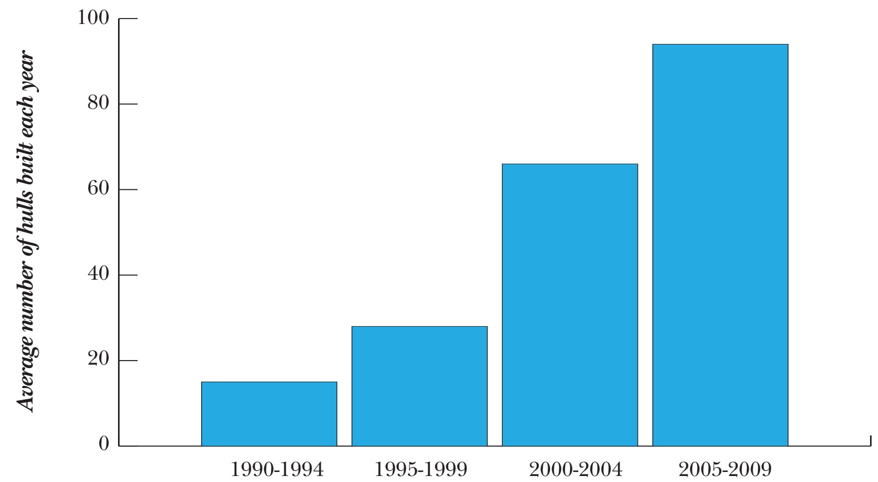
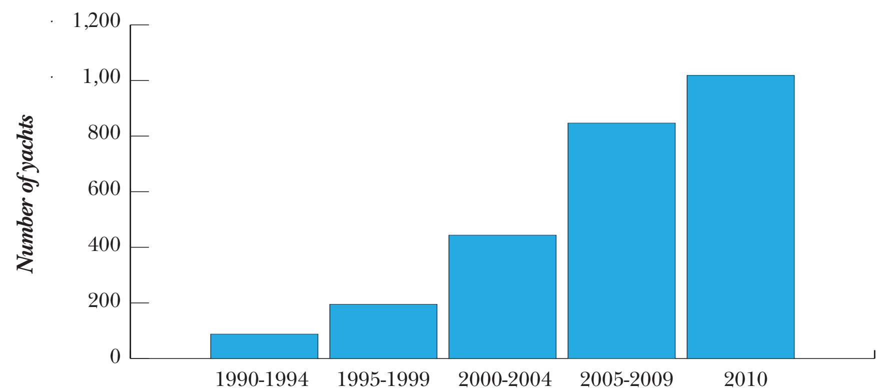
Composites & Class

More composite use is both inevitable and desirable in advanced performance sailing and motoryachts. Roby Scalvini of Marine Survey Bureau feels that they appear to have not kept pace with the ever-changing world of modern composite construction and asks if it is time for Class to review their rules and inspection procedures for this increasingly popular construction media. He argues that NDE (Non-Destructive Examination) should be a part of such inspection not only at the final stages, but through the build for quality control.



Number of composite yachts (with LOA >30m) built during the last two decades (1990-2009)



Total number of composite yachts (with LOA >30m) in fleet between 1990 and 2010

Data and graphs kindly provided by SuperyachtIntelligence.com

During the last couple of decades we have seen a staggering increase in number and size of composite built vessels. Their total number in the world fleet passed from a meagre eight yachts in the year 1990 to over 1,000 yachts today. Although no exact statistics are available we assume that approximately 99% of these yachts were built in compliance with the rules and regulations of some Classification Society.

The advent of new building techniques and advanced materials led to a new generation of high-tech composite structures built to the limit of their performance envelope. This frantic technological step-up is giving rise to new types of manufacturing defects and failure modes, some of which are not quite yet entirely understood and/or characterised.

Manufacturing defects of various natures are often 'incidentally' detected during the course of NDE (also sometimes referred to as NDT – Non Destructive Testing) assessments – carried out for other reasons – on vessels already in service. Some of the defects detected may not be critical but others may become so as fatigue progresses into the structure over time.