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Method for Estimating Price of Second hand Ship with Multi Method

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Abstract. Demand fleet as a means of marine transport could be met by building new ships and buying second-hand vessels. The current constraints in building a new ship are the cost relatively expensive and take a long time, while the profit for the procurement of second hand ships time relative faster and cheaper price. This study aimed to identify the price of second hand vessels and to develop a cost estimation model second hand vessels. Collecting data with survey vessel prices do with field surveys and market surveys via the internet on websites selling used shipbroker. Data survey include the price, type of vessel, the main dimension, tonnage, machines, materials and speed. Multi-methods data processing and analysis consisting of market price approach, comparative vessel and physical pricing approach. Estimated price or appraisal vessel obtained from the average value of the three methods.

Keywords: prices market, ship comparison, physical price, average value

1. Introduction

The demand for fleets as a means of sea transportation can be met by building new ships and buying second-hand ships. The current constraints in building new ships are relatively expensive and take a long time, while the advantages for procurement of second hand vessels are relatively faster and prices

Determination or estimation of second hand ship prices can be done by econometric analysis method and modelling second hand ship prices, and obtained used prices with different ship sizes/segments will give different reactions to changes in market variables [1]. The financing structure of second hand vessels both technically and economically is different from new vessels, and depends on several main factors by the varied practices between one country and another [2]. In Indonesia the factors considered are as follows: remaining life-time vessels, new ship market prices, market prices of similar used vessels (national and international), technical assessment of ships per item, scrapping cost levels. But in addition to the benchmark price, which is influenced by the above factors, the price of second hand vessels is strongly influenced by non-technical factors that are negotiable. These factors are; fees or fee agencies (brokers), the rules of a region or country, and the level of needs of the buyer. The process of estimating the value of used ships, nowadays many are carried out by experienced people and usually work as brokers.

Another estimation model with econometrics to analyse used container prices, by applying hedonic regression models, depreciation costs and age costs [3], and nonlinear prediction models to estimate the cyclonic movements of the Panamax ex-ship market [4]. The two models of estimated ship prices are specifically container ships and Panamax so it is difficult to apply to other types of vessels.

The logistics network model for ship dismantling activities, ranging from the ship procurement process to the redistribution process to steel manufacturing companies as the final consumer of this business [5]. This study uses single ship entry and scrap metal components as analysis and evaluation materials. In the next research can be used multi-ship, the sale of reusable components other than scrap metal and the determination of second hand vessel prices are more realistic.

Designing a second hand ship condition survey model-based online via the web that can be used to store the data of survey results and this program produces output in the form of current condition and price of second hand vessels [6]. The program also requires thoroughness and experience for surveyors to determine the estimated condition and price of ship components surveyed.

Modelling the price of used tankers using static methods with variable ship life, dwt, shipyard builders, Class and the country of origin of shipbuilders [7]. The results obtained used tanker price

modelling in the form of the regression model and did not conduct a direct survey of the ship model so that the objectivity of the estimation is less holistic.

The purpose of the preparation of second hand ship price estimation with multi-methods is to identify the price of second hand vessels with field surveys and market surveys, as well as to compile second hand ship estimates with multi-methods that are self-established methods of market price approach, ship comparison and physical price of the ship so that the accuracy of the estimate is more guaranteed.

2. Methods

The research was conducted with a community survey study to obtain data on the offer price or sale of ships that have specifications comparable or almost comparable to the vessels to be estimated. Ship price surveys will be conducted with field surveys and market surveys over the internet on the websites of ship sales brokers both domestically and abroad. From survey data covering price, ship type, main size, GRT, engine, material and ship speed. Primary and secondary data have been identified and modelled with three approaches: market price approach with regression analysis method, comparative ship and physical price of the ship. On each of these approaches will be obtained ship prices, so there will be three different ship prices. Each price of the three approaches will be summed up and taken the average value so that it can be summed up the estimated price of the ship.

3. Results

3.1.Identification of Secondhand Ship Prices

Identify primary and secondary data related to second hand ship prices with field surveys and market surveys. Ship price survey will be conducted by surveying the market through the internet on the websites of ship sales brokers both domestically and abroad. The brokerage websites accessed are http://www.boatsource.ca/, http://maritimesales.com/, http://www.ship-trader.com/, http://www.shipbroker.net/ (figure 1). From survey data covering price, ship type, the main size, GRT, engine, material and ship speed. Field surveys aim to observe, provide qualitative and quantitative assessments related to the condition, price, ship type, main size, GRT, engine, material and ship speed. Examples of market survey results and field surveys as follows (figure 1 and figure 2):

**Figure 1**. Example display of second hand ship brokerage sites offered in http://www.shipbroker.net/

Figure 2. Main engine (Example of field survey documentation)

3.2.Estimated Price of Second hand Ships

3.2.1.Second hand Ship Market Price Approach

The results of the market survey against several second hand ship sales broker sites on the internet then obtained ship data that has similar so that it can be used as a comparison of the price of secondhand ships. Some similarities in the ship's data include the year of manufacture, ship body type, type and number of payloads, type of construction material, propulsion system, and ship condition. The ship's data can be expressed on a ship's offer price chart which is a function of GRT or DWT or other dominant variables. The linear regression approach will be able to estimate the offer value of the secondhand ship in graphical form (figure 3), and that value will be reduced by 15% selling price factors and a 5% correction to estimate the secondhand ship price.
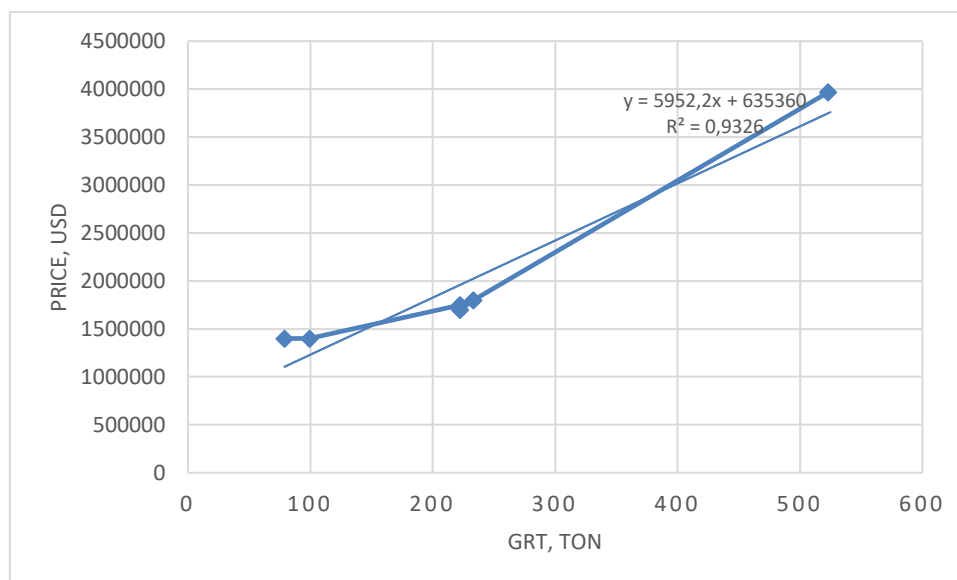
Figure 3. Example of linear graph of second hand ship price

3.2.2.Comparative Ship Approach

In this approach, the factor of the selection of comparative vessels is to determine the accuracy of the estimated price of the ship assessed. The specifications of the comparative ship should have similarities to the ship's estimated price in terms of ship type, main size, material, main engine and drive system. The estimated price of secondhand vessels using the price of the comparative ship, first calculating the

price per GRT of the comparative ship, then the price per GRT is multiplied by the size of the used ship GRT, it will be obtained the estimated price of the secondhand ship.

The price of the secondhand ship needs to be corrected if there is a difference in the speed of service between the comparative ship and the secondhand ship, as this illustrates the difference in the performance of the ship's main engine.

The calculation is corrected if the difference in the year of manufacture between the comparative ship and the secondhand ship. Depreciation of the price due to the increasing age on the comparative ship can be calculated by assuming that the economic age of the ship is 35 years so that linearly the amount of depreciation per year can be calculated. So the final price of the secondhand ship after making correction due to the difference in speed and years of manufacture.

The difference in the number of cargo or passenger capacity between the comparative ship and the secondhand vessel needs to be taken into account as this concerns the number of safety equipment and passenger accommodation facilities. The cost of this difference can be estimated by first assuming the cost of providing safety equipment and passenger accommodation facilities taken 20% of the sale price of the comparison ship. These costs are divided by the passenger capacity of the comparative ship so that there are costs for safety facilities and accommodation per person. Furthermore, this cost is multiplied by the difference in passenger capacity between the two ships, and the depreciation value is obtained. Thus the final price of the secondhand ship is obtained after being corrected due to differences in passenger capacity and a reduced correction factor of 5%.

3.2.3. Ship Physical Pricing Approach
The estimated price of a new building can be explained as follows:
- Assumption : hull built year, hull shipyard, m/e built year, main engine;
- Principal particulars : length overall, length water line, breadth moulded, depth moulded, service speed

Example of shipbuilding cost calculation sees table 1.

To determine what the current value of the ship is is to calculate the amount of depreciation value which includes: depreciation due to the life of the ship, depreciation due to reduced ship function and depreciation due to the physical condition of the ship.

3.2.3.1. Depreciation due to ship life.
- It is assumed the economic lifespan of the ship's body is 35 years.
- The lifespan of the ship up to this time is n years.
- Depreciation of ship value per year is calculated linearly from the price of a new building in the year of construction until it reaches a value of 0 after the age of 35 years and the depreciation of the value per year of (1/35 x 100%)
- The depreciation value of the ship due to the life of the ship can be calculated with the following approach formula:

$$DO = 1/(1 + k)^n \qquad (1)$$

where :   k = depreciation per year
          n = age of the ship in years

3.2.3.2. Depreciation due to reduced ship function
- Planning the function of the secondhand ship is the speed of service (knot), the size of the GRT, and the passenger capacity of n people.
- Used vessels experienced a decrease in service speed based on sea trial documents. Depreciation of values due to this decrease in speed can be calculated as follows:

$$DV = \frac{\text{Current Capacity}}{\text{Initial capacity}} \times \frac{\text{Current Speed}}{\text{Initial speed}} \qquad (2)$$

Table 1. Example of shipbuilding cost calculation

No	Item	Volume		Price Unit (USD)	Amount Unit (USD)
A	Hull				
1	Aluminum Plate	60	Ton	8,500	510,000
2	Aluminum Profile	20	Ton	10,000	200,000
3	Electrode, Oxygen, Acetylene, Bolt etc.	1	Shipset	90,000	90,000
4	Paint and cathodic protection	5000	Liter	10	50,000
5	Others	1	Shipset	10,000	10,000
	Sub Total A				860,000
B	Hull Fitting				
1	Hull Outfit & Deck Machinery	1	Shipset	285,000	285,000
2	Furniture, Air Conditioner, Window etc.	1	Shipset	450,000	450,000
3	Life Saving Appliances	1	Shipset	80,000	80,000
	Sub Total B				815,000
C	Machinery				
1	Main engine, Gearbox, Stern Arrangement etc.	2	Sets	582,000	1,164,000
2	Water Jet and electric controller	2	Sets	145,500	291,000
3	Aux. Engine and Generator incl. acc Standard maker	2	Shipset	98,300	196,600
4	Pump and others	1	Sets	23,800	23,800
5	Pipe, elbow, valve and cock	1	Sets	90,800	90,800
	Sub Total C				1,766,200
D	Electric Equipment				
1	Main switchboard and panel	1	Shipset	25,000	25,000
2	Transformer, Battery, Charger, Lighting etc.	1	Shipset	50,000	50,000
3	Communication, Navigation & Automatic Equip.	1	Shipset	120,000	120,000
4	Others	1	Shipset	10,000	10,000
	Sub Total D				205,000
E	Labor Cost				
1	Shop drawing / drafter	50,000	Man-hour	8	400,000
	Sub Total E				400,000
F	Third Parties Cost				
1	Certificate, classification and authority fee	1	Shipset	100,000	100,000
	Sub Total F				100,000
G	General & Service Expenses				
1	Design, Administration, Selling, Familiarization	1	Shipset	175,000	175,000
	Sub Total G				175,000
	Total Amount				4,321,200

3.2.3.3. Depreciation due to the physical condition of the ship

- The physical condition of the ship in question is the construction condition, main engine and auxiliary engine, propulsion system, a navigation system, electrical installation, safety equipment, deck equipment and accommodation equipment whether or not it is still functioning properly at the time of purchase.
- From the results of the field survey, it can be explained the physical condition of the ship (table 2).

Table 2. Example physical condition of second hand vessels

No	Item	Condition (%)
1.	Construction and shell of the ship	70
2.	Main engine and auxiliary machine	65
3.	Propulsion system	70
4.	Navigation system	70
5.	Electrical installation	70
6.	Safety equipment	70
7.	Deck fittings	70
8.	Accommodation supplies	75
	Average condition (DP)	70

The conclusion of the estimated price of the second hand ship at the time of purchase after depreciation of the price of the new building is the price of the new ship x DO x DV x DP. Based on three approaches, namely the approach of ship market data, comparative vessels and the physical price of the ship, and after being taken on average it can be concluded that the value of the second hand ship is USD.

3.3. The Compare Estimated Price of Second hand Ships

The comparison of ship price estimates aims to verify the multi methods that have resulted from the study. Comparison is done with the method of approaching the age of the ship and country of origin [2] and the data of calculation results from multi-method passenger ship type ferry catamaran in 2006. Based on table 3 presented the main size of the ship to be estimated, and in table 4 shows the percentage difference in the estimated price of second hand ships between the two methods by 24.92%. A significant difference indicates that the estimated price of used vessels requires thoroughness and accuracy and the ship is an order product whose specifications and complexity are very varied. So that multi-method for estimating the price of second hand ships consisting of world ship market data, comparative vessels and physical prices of ships, is quite comprehensive and holistic.

Table 3. Technical specifications

No	Item	Description
1	Year of Manufacture	1990
2	Material	Aluminium
3	Length (LOA)	34 m
4	Width (B)	8 m
5	Draught (D)	1,2 m
6	Service speed	34 knots
7	Maximum speed	38 knots
8	GRT	258 tons
9	Net Tonnage	89 tons
10	Main engine	MTU (2 unit)
11	Propulsion	Water jets (2 unit)
12	Number of passangers	200 orang

Table 4. The Compare Estimated Price of Second hand Ships

No	Estimation method	Price (USD)			
		Ship market data	Comparative vessels	Physical prices of ships	Results
1	Multi-method	1,769,566.6	1,650,085.31	1,587,702.2	1,669,118
2	Adji [2]				1,253,148
3	Price Difference				415,970
4	Price Difference (%)				24,92

4. Conclusion

Identification of second hand ship prices is carried out by field survey to ship object, internet market survey on ship sales broker sites in http://www.boatsource.ca/, http://maritimesales.com/, http://www.ship-trader.com/, http://www.shipbroker.net/. and the physical price approach of the ship is carried out by calculating the cost of building new ships minus various depreciations. Based on three methods (multi-method) namely approach of ship market data, comparative ship and physical price of the ship, then the estimated price or estimate of a second hand ship is taken the average value of the three methods.

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