Strategy Assessment in investment of a dry bulk tanker

Simonetta Zamparelli[1], Mauro Catalani[2*]

[1]Department of Economics, Management, Society and Institutions, University of Molise, Italy
[2]Department of Economic and Legal, University of Naples Parthenope, Italy

* Corresponding author: mauro.catalani@uniparthenope.it

Abstract

The knowledge of the financialstructure of a shipping company consisting of equity and loanis a pre-requisite for the evaluation of a strategicinvestment. The mainobjective of thispaperis the study of shipowner'sbehaviorwhenchoosing the best investmentamongdifferenttypesof dry bulk tanker. The methodology is based on the comparison of the FinancialCosts-Benefits Analysis (CBA) and the Random Utility Maximization (RUM) approaches for the choice of the best strategic decision of a Handy ship investment.
The choice alternatives are between a new building vessel (from the shipbuilding) and a second hand vessel (in operation by 5 years).
The effect of theresearch consists of a method that randomizes the variables influencing the behaviour strategy of the shipowner when choosing an investment.The data were provided by an Italian dry bulkshipping Group.

Keywords:
Shipowner's behavior, dry bulk, cba, rum model

1.Introduction

The manuscript studies the interaction between the choices of a shipowner with the options to purchase vessels in the market.The main objective of this paper is to evaluate the shipowner's behavior in choosing the best investment among different dry bulk tankers for maritime transport.

The choice of a shipowner depends on many factors, as: price of the ship and its age, technology, return of investment, quality of the service offered, the routings. All these elements are difficult to analyze conjunctly due to the high volatility of the dry bulk

market, but they are relevant even so in the process of choice. Indeed, they can also alter or modify substantially the equilibrium of businesses of all companies which operate in the same sector with the backlashes on the dynamics of the economy in contiguous sectors. That creates the need of an economic and financial analysis of new resources and it offers to the contenders the opportunity to draw new strategies befitting the maritime industry in which they are operating. In our case, it is the dry bulksector.

In the shipping industry, the companies are subjected to the strategic risks linked to the huge investments and the high technology. Generally, in the dry bulk sector the companies operate with medium size ships in which they hope to gain by reducing the running cost in the medium term by time charter contracts. If these investments don't produce returns, they could force the company to modify itsbehavior and to do additional investments due to the implementation of a new strategy. The company, in this way, could lose its ground towards competitors. Usually, the choices that have an economic-financial impact on a shipping company are related to the investments and disinvestments, funding and dividends. All these are linkedwith relations of mutual dependence (cause-effect). These decisions fall on the structural and economic stability of the companies. This stability is represented by the balance between the invested capital, equity, loanandthe relative influences ofleverage also by the shipowner market strategy.

Thepaper compares the results of two differentmethodologies of investmentanalysis: the financial cost-benefit analysis (Cariou P. and Wolf F.C. 2011, Tsolakis S.D. Cridland C. Haralambides H.M. 2003) and the Multinomial Logit (MNL) model appliedto the maritime industry (McFadden D. 1975, Frankel E.G. 1992).

2. The competitive dynamics of shipping

The shipping industry is characterizedby intensive competitivenessand relevant returns oninvestments. The global economic progressinfluences the demand of transport. The fluctuationsoffreights, in increase or decrease, depend on the movements of the demand of maritime transport. It is a demand closely related to global economyprogress.That is in particular, the demand on the transport of goods. The circuit closes considering this link that inevitably passes through the international commerce whichproducesitseffects in a short term (ex.seasonal demand) and in a long period, the reallocation on productive processing with the re-organization of transport services.

Therefore, the shipping industry is a complicated sector characterized by three main sectors as liquid bulk, dry bulk and general cargo;then the economic, financial and trading conditions that govern each of its subsectors are not necessarily applicable to all others. However, such sector has to be observedas a sum of all subsectors in the maritime industry. Each one presents its levelsofdemand and supply, the freight movements, technology and organized management.

In the last decade, an important strategic conflict was verified. The vessel represents the instrumental good in which the production is implemented on maritime transport services and it has two distinct characteristics towards other types of fixed assets. The first consists of flexibility in its use and expertise (transport of grain, petroleum, coal, iron ore, and etc.), the second characteristic is recognized in the fact that for its mobility: the ship can be purchased in a shipyard wherever part of the world. A

shipowner should consider these two variables in its budgets for economic convenience. The shipping company invests in typical enduring capital assets.

The transport of dry bulk is usually donebytramp and it is a critical decision that a shipownerhas to look after in the positioning vessel in one or more convenient freight charges(Stopford R. 2009). The rates are determined in every transaction according to the stability of dry bulk market dynamics. The management implements investment policies in vessels that holds carefully into account the demand's evolution. Generally, the economy of scale that a sector offers are known to all operating companies (HaralambidesH. 1996). However, it's possible that the use of such economies of a firm does not depend on the desire to improve its competitive position, but rather to protect itself from competitors who are primarily organized to generate profitable advantages.

This strategic decision isn't indifferent to the motivation because the company has the problem of making the right move at the right time, considering its strength and weakness. There are other situations verified further in which some companies, despite of economies of scale, are concentrated on other aspects and loopholes. In consequence, taking advantage of this situation may lead the other companies to have a competitive economic advantage, no less of technological innovations, in pursuing against competitors. That is changing completely in such a way the stability of the sector. Therefore, it is crucial for a company never to glance down from these possibilities of strategic advantage. Furthermore, it's significant the decisions in ordering the correct size of the vessels of the potential bulks to be transported. So becomes strategic the decision to invest on a new vessel or a second hand vessel.

3.The strategic choices of shipowners

Bulk shippingoutlinesas a lessexpertsector in which the vesselsgenerally show a lowtechnologicalprocess. For such, the importantfactors of gain, for shipowner, derive by choicesabout the time charter, the voyage charter and the management of hisvesselsconsidering the possibilityof entrustingthe vessel to a pool; furthermore, the earning derive by the operation of buying and selling in the principal or secondhandmarkets. At times, suchoperations generate capital gain in the budget. In thispaper, weanalyze the strategyin purchasing of new vessels from the shipyards, or secondhandvessels from the market. In the last decade therewas a maximum growth of the investments in a Handysize vessel thatisdoubled. In effect, itreached from 15 milliondollars to almost 40 milliondollars(Clarkson 2013). But in the last years, suchvaluebroken down rapidlycaused by the global crisisthatasexpected, itfullyinvolved the demand of the maritimetransportasdirectdepending. In 2010,a light recoverybrought the value of capital intensive asset on levels of investmentreturnsstillpromising.

The productivecapacityand the pricesfixed of aHandy from the shipyardsdepend on aneconomic-financialevaluation for investmentdecisions of vessel. In effect, shipping companies have a greateradvantageif the investmenthappens in a shipyardthatappliesbargainprices, because are more convenient and with a betterstandards on quality. Besides, iftherewas the possibility for the companies to gain, makeinvestmentsduring a negative economic trend, thiswouldlead high economicyields, when progress in demandstakes a positive trend. Dry

bulkshippingcycleisdependentfrom market trends and classifiedas:trough, recovery, peak, collapse with repeatedcycle.

At peakmoments, a vessel increases in valueasthough forHandy in 2007. Usually, a secondhand vessel generates a higherattractivenessthan a new building sincebetweenitspurchaseorder and the delivery date itneeds more thanoneyear, while a secondhandisavailable in a short time. And it can evenfullysatisfy a dynamicdemand of a transportthatgenerates high profits.

4.The methodologicalapproach

In maritimeinvestmentanalysis the discrete choice model are generallyapplied and defined in the literature(Fan L. and Lou M. 2013, Frankel E.1992)

We analyze ship investment based on shipowner choice behavioral model derived to dry bulk companies RP/SP survey (revealed preference and stated preference methodology Hensher D.H., Rose J.M. and Greene W.H. 2005) with MNL model, and also in financial Cost Benefit Analysis by an application on real case directly provided by companies. In terms of ship selection, the methodological approach used supports the assumption that shipowners decide on a new buildingor second-hand purchase evaluating the more preferable returns. For new orders, the preference increases with high internal rate of return (IRR) and net present value (NPV). For second-hand ships, the preference derives by a worthwhile purchase price and loan . Anyway, for eachship types, the preference increases with increasing time-charter rate.

For shipownersthedecision of investingina vessel iscrucialbecausethe vessel may be the whole business itself.

This paper shows the progress of the methodology used and the results based on a real application of a maritime investment of Handy dry bulk tanker. The strategic option will conduct the shipowner eventually to purchase a new vessel or 5 years old second hand vessel.

The study examines and confronts two quantitative approaches: the cost-benefit analysis (CBA) and the multinomial logit model (MNL). The financial CBA considers the investment of a vessel exclusively based to the comparison of costs and benefitsthat it getsto the shipowner. The second, behavioral approach (MNL), allows the selection of the best alternative of vessel purchase based on the random utility maximization (RUM) as a sum of variables (attributes) considered.

The aim of thispaperis to aid the finaldecision of the shipowner by evaluatingof investmentprojectbased on the application of twoproposedmethods.

4.1 Results of the assessment of the vessel investment with CBA

The costs-benefits analysis (CBA) is a well consolidated methodology in literature and applied in various fields. In maritime transport for investment analysis, Alizard A. H. and Nountios N. (2011) in Culliname K. Ed,Grammenos C. (2010), Karakitsos E. and Varnavides L. (2014)KavussanosM. G.(2010).This paper considers anapplication in a selection of two vessels of the same class but of different age to find the most convenient alternative within the financial profile. The new buildingis available in 2016 and presumably resold in 2020. *Is this the better alternative for a shipowner compared to the purchase of a second hand vessel?*

The classical procedures used to answer this query are Net Present Value (NPV) and Internal Rate of Return (IRR).

It has been done a financial application of CBA based on a real case of investment in a new building and a second hand ship based on the assumptions of reselling vessel in together hypothesis.

The following tables (1,2,3, 4)show the vessel characteristics and the main results.

Table 1 New vessel data

HANDY BULK	37.000,00
Price	33.000.000,00
Leverage	65,00%
Loan	21.450.000,00
OPEX	5.500,00
Installments	24

Our elaboration

Table2 New buildingresults

Year	1	2	3	4	5
Roe	0,10%	0,25%	0,37%	0,48%	-3,76%
VAN	605.539,56				
IRR	5,73%				

Our elaboration

Table3 Second hand ship data

HANDY BULK	37.000,00
Price	26.000.000,00
Leverage	60,00%
Loan	15.600.000,00
OPEX	6.000,00
Installments	24

Our elaboration

Table 4 Second hand ship results

Year	1	2	3	4	5
Roe	5,58%	5,47%	5,33%	5,18%	-0,77%
VAN	1.842.297,78				
IRR	8,58%				

Our elaboration

The business plan foresees the revenues from time charter and the amortization to constant capital share. Furthermore, to be considered the running cost that a vessel hasto bear. Financially, to be examined the equity, debt and leverage. The assessment's principal elements in the selection of a vessel are: price of the vessel, the running cost,

equity, loan, interest rate and leverage, but in the two hypothesis of investment these parameters used differ from each other.

From the CBA results the net preference for second hand vessel. The new ship with an investment of 33.000.000 million $,an increasing ROE for first 4 years and a net reduction in the five last year of -3.76, Van of 605.000 $ and IRR of 5.73. On the contrary all the parameters of second hand are better, with a lower price of 26.000.000 million $ and are higher ROE with a modest reduction at five year of -.77, VAN 1.842.297 and IRR 8.58.

4.2 Results of the assessment of thevessel investment with MNL

The multinomiallogit model (MNL), used in thisapplication, isbased on a random utility maximization (RUM) and alsoitiswelldefined in the literature. The systematic utility is a sum of attributes in which the values are calculated on RP/SPsurvey (Hensher A., Rose J M., Greene W. H. 2005). The MNL, Ben AkivaM.andLerman S. (1985)isbased on the hypothesisthat the random residuals are independently and identicallydistributedasGambel .

The model hasbeencalibrated by maximum likelihoodsimulationapproach with the repeatedchoices of the shipowners (3).

The alternatives considered are the same used in the CBA:new vessel and 5 years second hand old.

The most common application of the MNL uses the followingformulas, Cascetta E.(2001):

$$p\,(\,j\,) = \frac{\exp\,(V_j\,/\theta\,)}{\sum_k \exp\,(V_k\,/\theta\,)} \tag{1}$$

In the case of onlytwo alternative the MNL k and j iscalledBinomialLogit and can be expressedas:

$$p(j) = \frac{1}{1 + \sum_{k \neq j} \exp\!\left[(V_k - V_j)/\theta\right]} \tag{2}$$

The choiceprobability of alternative j depends on the differencebetween the systematic utilities.

The maximum likelihoodmethodis:

$$\rho^2 = 1 - \frac{\ln\,L\left(\beta^{ML}\right)}{\ln\,L\left(0\right)} \tag{3}$$

The data are available from the shipping companiescooperation, with a sample of 24 shipsanalyzed. The SP repeatedchoicehasbeendirectlymanaged by shipowners.

The attributes of the utility function applied to the model are the following:

- price
- running cost
- time charter
- investment risk

These attributes are all quantitative values excluded the investment risk. In particular, in qualitative terms, it defines the owner's risk in doing an strategic investment linked to its return.This attribute was standardized in appropriate range by shipowners.
The results of the NLOGIT 3.0 software are shown in Table 5 below. Although, we are in presence of a modest sample of repeated choices from a group of companies of the sector, the applicationcan be considered as an adequate accomplishment because this model gives a satisfactory solution to our problem. All the variables are sufficientlyreliable and the scientific experiment is positive. The T test value is good for the time charter, running cost and risk of the investment. At lower statistical level is the price.

The result of MNL model in the choice of the new ship is not aligned with the CBA. The modeling approach gives also a complete reply about the choice probability (with model predicted probability on 80% of actual) for all two vessel alternative of investments.

The model output evidences a preference for alternative 1 (new ship) with a choice probability of 0.55, and 5 years old with 0.45. In this analysis the time charter with the best T of 1.018 is a relevant variable as in the CBA. At last the application reports also the relevance of investment risk for the shipowner's choice.

The general test of model simulation attests a log likelihood function of about -3.78, Rsqrd= 0.50 andRsqAdj = 0.10, Chi-squared 7.59 .

Tab.5. MNL results model coefficients, std and T

Parameters / Variables	Coefficients	Stderror	b /St.Er	PZ>z
Price	-1.03815291	1.50629794	-.689	.4907
Runningcost	-2.01022902	2.13602434	-.941	.3466
Time charter	.84663617	.83168295	1.018	.3087
Investmentrisk	7.97545658	8.79332896	.907	.3644
A_1	1.33584211	2.89166738	.462	.6441

Log LikelihoodFunction	-3.78			
Rsqrd	.50			
RsqAdj	.10			

Ourelaboration on shipping companies data

Tab6 Direct and cross elasticityasregardattributeprice

Alternatives	Choice 1	Choice 2
Choice1 (newbuil)	1.814	-1.583
Choice 2 (5years)	-1.253	1.295

Ourelaboration

In the applicationitisbeenalsocalculated the elasticity (table 6),in the direct and cross formulas, of demandvarying the way-in vessels. They are computedaveraging over observation of the attributeprice in twochoice and reveal theeffects on changingprobabilities. From the tablewesee the directelasticityeffect of the attributepricethatis high asregardstwo vessel choice. The directelasticityisasregard new shipequal 1,814 respect a cross elasticity of 1.583 in absolutevalue.The twoalternativeshave high elasticityvalues; itmeansthat the pricevariations of the vesselsinfluencetheirdemand. In the secondchoice for directelasticity for secondhand vessel wehave an highervalue of 1.295 asregard cross elasticity of 1.253 (absolutevalue) of new vessel. Consideringboth the elasticity of the new vessel, a reduction of itspricewouldlead tohigherchangingchoiceprobability of investment,asregard of the secondhandships.In effect, the cross elasticitydemand of the new building relative to the price of 5 yearssecondhandisequal to 1.583 and itsignifiesthat a reduction of the price of secondhand vesselitwould be an increasing of choiceprobability for the secondhandship more thanproportionalbutlessthan the previousvalue 1.814 of the new vessel.

5. Conclusions

The model wascalibrated in a temporalarch of time 2015-2020 in a dry bulk volatile demandwith asupply surplus and an overcapacity of hold. A market's negative phase, the collapse,gives the shipowner the chance to implementprofitableinvestmentsgenerated byfavorableconditions of purchasing from shipyards,because of the lowlevels of demand. Itisusualin theseconditionsthatshipyardscame to face with the idea to bidnewlybuiltvesselscommissioned by shipowners, butnotanymorecollectedwith an obviouscut down of prices and,therefore, an edge to thosewhomhave a positive status topurchase. At present, the scenerystillrecords a contrastingmovements, and also the situation of freight rate thatremains in lowlevels casting year 2013 a negative criticalcondition, in which the slightrecovery of demand on new building cannotmanage to reach the progress of supply, thatisrathershowing-off higher and higher.

The model results of the two different methodologies, CBA and MNL, led to different assessments; in effect, the MNL identifies a clear preference for new vessel. It reveals a speculative phenomenon by the owner, in which the vessel is the subject. The behavioral model applied in the context of vessel choice can be considered a valid alternative to cost benefits analysis in the assessment of an investment. It is to state that the random utility approach is more powerful of a traditional CBA as much as it is capable to identify a plurality of variables able to represent the behavior of the ship owner. The data used to test the model is the SP survey in the context of the repeated choice of leading operators in dry bulk market with a modest sample.

   The application of CBA identifies clearly the best investment in purchasing of the second hand vessel. The time charter used in two methodologies derive by owners experience and market statistical data. The reducing of capital recovery period in CBA gives relevant limitation to the application. On the contrary,we have a very significant set of variables to define the behavior of the owner introduced in the functions of utility of the vessel choice. The goodness of statistical fit evidences the scientific relevance of MNL model with some variables like time charter, price, running cost at a good T level. It is so possible to affirm that the number of random variables involved in the analysis and particularly the investment risk define completely the behavior of a ship owner who operates in an international dangerous and volatility market subject to wide oscillations of the time charter variable. In synthesis, the two applications reveal a different result.

   While the CBA analysis reveals a low statistical goodness due to little number years used in the IRR simulation and then the unpredictable of capital recovery after 5 year by reselling; instead, the MNL model consents to use same non quantitative variables as investment risk, fundamental in the analysis.

   Under the methodological aspect, the future research of behavioral models is opened to new fields of application with the possibility to make use of financial variables as equity and loan, leverage, interest rate; furthermore with these models it possible to analyze also the seaport infrastructures problems and choice of port , the expert system technology integrate behavioral approach, etc. At last, they allows to put in some indicators just like those psychometrics which may improve a decision making process of the owner.

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