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A retrospective review of the average period of ship ownership with implications for the potential payback period for retrofitted equipment

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Abstract

Knowledge of the behaviour of ship operators relating to their investment in retrofitted equipment or systems is of fundamental importance to those engaged in designing and developing products. Evaluation of product offerings is often undertaken on the basis of return on investment over its full life but this may not be convincing to buyers for existing ships who may only expect to own the ship to which the equipment is fitted for a limited period, not its full life. Knowledge of the typical period of ship ownership then becomes important to enable a realistic payback period to be taken into account in the evaluation of developments. Whilst many involved in shipping will give an anecdotal opinion of the typical length of ship ownership there is an absence of research to give any precision to such anecdotal opinions or even to confirm them. This paper uses secondary sources to present a retrospective analysis of the average period of ship ownership for that portion of the fleet that was approaching the end of its economic life at the time the study was undertaken. The results question the widely held view of speculation being the prime motivator in ship sale and purchase. The pattern of behaviour of owners is found to vary significantly between the first and subsequent owners, with the first owner keeping the vessel for considerably longer than subsequent owners and with the influence of speculation increasing as the owner number increases. Rational values are proposed for what constituted short term and long term in relation to ownership periods for the vessels reviewed and further analysis is recommended to investigate how these values may vary as the market changes.

Keywords

Marine equipment, retrofit, shipping, buyer behaviour, payback

Introduction and background

The significance of retrofit

Ship owners and operators are under increasing pressure, due in no large degree to mandates from the International Maritime Organization (IMO), to improve safety and reduce pollution in all its forms, perhaps most significantly to reduce the carbon output from shipping¹. The IMO has adopted measures to promote the technical and operational improvement of energy efficiency of ships, and in the case of technical measures this may be implemented “*by improving ship hardware equipment*”¹, which in turn requires investment in that equipment. There are two points at which the investment could be made: on a new ship at the original build stage or as a retrofit to an existing vessel whilst in service. Improvements in the carbon efficiency of new ships are being promoted by IMO through the implementation of the “Energy Efficiency Design Index (EEDI)”. Investment in existing ships is being promoted by IMO through a measure known as the “Ship Energy Efficiency Management Plan (SEEMP)”, which provides a mechanism whereby ship owners can assess their vessels’ carbon efficiency in an objective manner and plan to make significant improvements¹.

The potential for investment in technologies to be fitted at the newbuild stage is clearly determined by the rate at which the shipping industry will order new ships and this potential has been adversely affected by the development of the fleet in the shipbuilding boom that lasted between for ten years up to 2012, with a peak in demand for ordering of new ships in 2008. The rate of contracting of new tonnage, and thereby the opportunity to reduce carbon emissions through the EEDI, has declined significantly since the peak, as illustrated in Figure 1.

Figure 1: Monthly contracting of new ships (Source: statistics from Clarkson Research²)

The downturn in ordering is a consequence of a surplus in the fleet that has caused ship owners' earnings to fall, which in turn has been caused by an unprecedented peak in shipbuilding output. Figure 2 shows how shipbuilding output has developed over the past fifty years, clearly showing the magnitude of the recent peak and the downturn in expected deliveries from the current orderbook.

Figure 2: Shipbuilding output (Source: statistics from Lloyd's Register and Clarkson Research)

The effect of this peak has been to reduce the average age of the fleet dramatically. Taking the larger ocean-going fleet above 5,000 gross tons (GT), at February 2013 the Sea-Web database lists 28,952 ships in service with a total capacity of 1.6 billion GT and a further 3,512 ships (12% of the fleet in service) and 235 million GT (15% of the fleet capacity in service) due for delivery in the next two years. The overall average age of this fleet is 10.2 years³. The details of the distribution of the

age of ships, however, provide a more meaningful picture than the mean alone of the youthful nature of the fleet and the implications of this for investment in technology to reduce carbon output. In this sector of the fleet, 43% of all ships (51% of all tonnage) are under five years old, with an average age of just 1.7 years. 61% of all ships (70% of all tonnage) are under ten years old, with an average age of just 3.3 years. Set against an average economic life expectancy for a ship of about 25 years⁴ this implies that over 60% of the ocean-going fleet will be sailing for the next 15 years at least and over 40% for the next 20 years at least. This further implies that retrofitting in the context of the SEEMP could potentially play a key role in the goal of reducing emissions from shipping in the short to medium term, in particular given the downturn in ordering that is restricting the potential for EEDI improvements.

The motivation for conducting this desk-based study was related to questions of the economics of retrofitted devices or systems to improve the carbon efficiency of ships, within the context of the SEEMP. Such an investment is, at least for the present, discretionary on the part of the owner and the attitude to investment will therefore be different in comparison to, say, a mandatory investment to fulfil regulatory requirements. A ship owner investing in carbon reduction technology is likely to seek a return on that investment through reduced fuel costs during their period of ownership and, hopefully, a premium on the sale of the vessel reflecting its improved performance. Given that ship prices are volatile, or in plain English fluctuate in an unpredictable manner⁵, this latter gain is subject to risk and the expectation of benefit during the period of ownership of the vessel is likely to predominate in the investment decision. This in turn will set a ceiling on expected payback period of the investment and thereby on the amount of investment that could be justified. Investigation of the bounds of investment in this context clearly requires knowledge of how long ship owners are typically likely to retain ownership of the vessel. This investigation requires some clarity of the purchasing and selling behaviour of ship owners, investigation of which is the subject of this paper.

The marketing context

Knowledge of the behaviour of prospective buyers is of fundamental importance to engineers and businesses developing new products and systems. The importance of attention to the needs of the buyer in this context has been long recognised and is contained in what is, arguably, the earliest statement of the role of marketing in manufacturing, by Adam Smith in his work “An Inquiry into the Nature and Causes of the Wealth of Nations”, published in 1776, where he states: *“Consumption is the sole end and purpose of production and the interest of the producer ought to be attended to only so far as it may be necessary for promoting that of the consumer”*⁶. The essential nature of focus on the needs of the buyer provides the justification for product development being generally regarded in modern industry as a part of marketing activity. This is expressed in the modern context by Lancaster and Massingham as follows: *“A key element in strategic marketing planning is an understanding of the buyer behaviour of individuals and organisations in the market”*⁷. For businesses involved in the development of marine equipment the implication is that this must be done taking into account the likely behaviour of the end user in the shipping industry. Most involved in shipping have a view of the behaviour of ship owners but in one key aspect, the length of time a ship owner typically keeps the vessel before selling it on, the evidence underpinning these views is difficult to find and precision with respect to buyer behaviour is missing. The default assumption is normally to analyse the economics of products on a full life basis⁸ but this assumption is not reliable for the sale of retrofitted equipment and systems, where the buyer may be making their decision on the basis of performance over the period for which they will own the ship, not necessarily its full life.

The nature of ship owners

The archetypal view of a ship owner, defined perhaps in the 1960s by Aristotle Onassis⁹, involves an individual who makes a substantial fortune through astutely trading in ships, with the operation of the vessel taking secondary importance to the ultimate goal of the asset trade. This archetype colours the view of many industry analysts as to the underlying nature of the business. This underlying perception is summed up by Thanopoulou as follows: *“It is a well established perception in*

the shipping community that the money in shipping, especially bulk shipping, is not in shipping operations but in speculation on ships"⁵. The general perception also suggests that investment in ships is relatively short term and this in turn implies that owners are likely to be investment-averse when considering retrofit, which is not good news for the industries trying to sell equipment. But how well does this general perception stand up to scrutiny?

There is no doubt that speculation in ships can generate significant wealth. Stopford, however¹⁰, notes that *"within the bulk and liner shipping industries there are many different types of business, each with its own distinctive organizational structure, commercial aims and strategic objectives"*. Five different types of company are listed, only one of which, the private bulk company, is noted as having a prime motive in the trading of the vessel as an asset, for whom *"...the real profits are made from buying and selling ships rather than from trading them on the charter market"*. For the other four types of owner the utilisation of the ship in providing shipping services is more important. This suggests that the focus on short term trading of the asset may give an incomplete impression of the reality of ship ownership. Strandenes describes the behaviour of the different types of owner in relation to the second hand markets¹¹ noting that *"The main function of the second-hand market is to secure efficient exploitation of the existing capital equipment, i.e. the vessels serving seaborne trade"*. This suggests that the trading of ships is fundamentally about shipping rather than asset speculation, although the author goes on to note additionally that *"investors who purchase and sell vessels in an asset play, enter the second hand market...and contribute to a better functioning of the market"*.

Whilst text books refer to owner behaviour in qualitative terms, a literature search revealed no answers to the question of period of ownership and therefore no data on which modelling or estimates could be based in relation to the potential payback period for investors in carbon reduction technology or other retrofitted marine equipment. Many papers have been written on the strategy and economics of ship sale and purchase¹²⁻¹⁴, which gives an insight into shipowner

buyer behaviour, but generally without quantification of values of length of ownership. Engelen et al in their modelling of ship owner behaviour in the bulk carrier sector, for example, acknowledge uncertainty arising from the motivations of the ship owner: ¹⁵ *“The question may arise, for example, how eager the shareholders are for profit generation in order that they would receive a dividend? Are they focused more on long-term growth or rather on short-term revenues?”* The parameters or boundaries defining long-term or short-term are not defined, however. This is of relevance far beyond the finance question outlined in the previous paragraphs. The trend in maritime economics analysis has been towards the understanding of the behaviour of ‘agents’ as they operate in the economic system and in developing this theme ¹⁶ the authors refer to the ‘*strategic behaviour*’ of agents and identify a simplified system of two basic types of agents in ship ownership: *“short term players, i.e. speculators interested in quick wins...and long term players interested in operational profits from core activities”*. What is not clear, however, is what constitutes short term or long term in any precise sense and how this varies by agent, ship type and over time as the market proceeds through its notorious cycle. Sødal et al suggest that *“an asset play investor has typically a fairly short investment horizon compared to the typical lifetime of a ship of 25 years or more”* ¹⁷ but again without any more precision on what *“fairly short”* actually means.

This paper seeks to review how far, in reality, ship owning conforms to the *“well-established perception”* of the speculative nature of ship ownership as discussed by Thanopoulou and to provide some rational values for the questions relating to what constitutes long and short term in the context of ship ownership. This has been done by reviewing the ownership pattern of a specific set of vessels: those that are currently approaching the end of their economic life and that have by definition, therefore, been through all the changes of ownership they are likely to face.

The analysis is based on the study of information contained in a widely used commercial database of ships’ technical and ownership details. Data has been extracted from the source used through the relatively painstaking task of manually reviewing the commercial history of each vessel in the

sample. It is only relatively recently that this data has been readily and easily available for study and it is hoped that in publishing the methodology and results in this paper that this will encourage others that the effort required is justified by the resulting insight into ship owner behaviour.

It also has to be acknowledged that the research presented herein is at a developing stage and that the conclusions reached from the specific data set created provide only a 'snap shot' of owner behaviour for that specific data set. A number of recommendations for further work are included in the conclusions, including data collection through primary research in the investigation of the psychology of sale and purchase in the ship owning community. The value in publishing work at this inchoate stage, however, is two-fold. Firstly, the conclusions confirm that the "*well-established perception*" is far from adequate in describing buyer behaviour in the ship owning sector, and even at this relatively early stage provides information that is useful for companies seeking to market to that sector. Secondly, it is hoped to stimulate further research in this vital area which has hitherto been somewhat overlooked, or at least dominated by economic analysis alone.

Aims, methodology and economic context of the sample

Aims of the research

The aim of this research has been to investigate the parameters of the length of ship ownership, to develop more reliable assumptions for potential payback period for economic analysis of equipment that may be retrofitted to commercial ships.

Methodology

The basis of the methodology has been to examine the changes of ownership of a set of ships approaching the end of their economic life, that is to say between 20 and 26 years old, including vessels constructed between the start of 1987 and the end of 1992. The underlying assumption is that such vessels are likely to be with their final owner at that stage and the pattern of ownership over the vessels' full life can be examined.

The data set was retrieved from Sea-Web¹⁸ and includes 795 records of vessels in the three main commercial ship types: container, tanker and bulk carrier. Larger vessels in what may be regarded as the deep-sea or ocean-going fleets are included with the specific limits and sample sizes being as follows:

Sector	Minimum ship size	Maximum ship size	Sample size
Container	1,000 TEU	4,814 TEU	201 vessels
Bulk carrier	30,000 dwt	322,941 dwt	436 vessels
Tanker	30,000 dwt	304,622 dwt	158 vessels
Total sample size			795 vessels

Table 1: Sample definition

The delivery profile of the sample is presented in Figure 3.

Figure 3: Delivery profile of the sample

The maximum size of container ship appears small in the modern context but it should be kept in mind that post-panamax vessels (above 4,800 TEU) only started to appear in the early 1990s and such larger vessels therefore do not form part of this data set. The sample size for tankers is also relatively small because of the phasing out of single-hull vessels leading to early technical obsolescence.

As a first attempt the number of registered owners listed in the Sea-Web database was simply counted and the average length of ownership for each ship was calculated, assuming that an entry in

the registered owner field in the database indicated a change in ownership. This methodology was found to be flawed for two reasons. Firstly the listing of registered owner in the database includes ambiguous entries, for example indicating a suspicion of change of ownership or that information is awaited for clarification. Such entries are clearly nothing to do with a change in ownership of the vessel. Secondly the ownership of a vessel is a complex matter and the use of 'brass plate' companies as registered owner may mask the true ownership of the vessel. Change of registered ownership may be undertaken for administrative reasons, with the vessel remaining under the operation of the same group company. Such a change is not regarded, within the context of this paper, as a material change of ownership in the life of the ship and is not counted as such within the analysis. A further ambiguity arises where the group company itself changes hands through consolidation and the vessel follows this move, possibly with a consequent change in registered owner. As the vessel remains with the original group owner within the merged company, this too is not counted as a sale of the vessel in the context of this paper.

Such ambiguities are debatable as to what constitutes the sale of a ship. The aim of the rules followed here has been to try to represent a change of ownership as being a change where the specific asset is actually sold and money changes hands in the realisation of the asset. Put another way, a sale is constituted by a change that may require the services of a sale and purchase broker.

The methodology, therefore, involved examining the commercial history of each vessel, paying particular attention to the movement of the ship between operating groups. Further specific rules adopted in the generation of data were as follows:

- Changes in owner before the entry of a vessel into service are not counted, taking the first operating owner as the first owner of the vessel.
- Changes are assumed to happen on the first day of the month indicated by the database.

- Where only a year is indicated against the change in ownership (with month indicated by Sea-Web as 00) additional data is sought to try to clarify the timing of the change. Such information may be, for example, change of name, flag, DOC holder or manager.

Where a change of owner occurs immediately prior to a vessel proceeding to the breakers yard this is not counted as a change of operating owner of the vessel.

The economic context

It is impossible to dissociate sale and purchase activity from the economics of shipping and it is therefore important to give a brief overview of the economic conditions against which the sale and purchase behaviour of this sample of vessels can be viewed.

In the period up to the start of delivery of the sample the shipping industry had proceeded to some degree to recovery following the boom and bust cycle of the late 1970s and early 1980s. Figure 4 presents the Maritime Research General Freight Index for the period 1977 to 1990¹⁹. This is an index of the level of earnings by shippers from the freight markets and the chart in effect presents the scenario of how the shipping world looked to the original buyers of the sample of ships used in this study.

Figure 4: Maritime Research General Freight Index to 1990 (year-end values)

The market reached its nadir in 1986 and the sample was delivered into a market that remained subdued but that was distanced from the very difficult period following the peak in the late 1970s. The health of the shipping markets in the period since the sample was delivered is represented by the “Clarksea Index”, being a weighted average of the daily earnings of tankers, bulk carriers, container ships and gas carriers². This is presented in Figure 5.

Figure 5: Clarksea index of shipping earnings

Roughly speaking the sample has lived through most of a complete shipping cycle. It can be clearly seen from figure 5 that for the first decade of the sample's life, up to 2002, with the exception of a brief rally around 2001 earnings were relatively poor and returns low. Following this, from 2003, shipping entered a boom period lasting a short but highly profitable five years before returning to the low returns following the 2008 financial crisis. Returns are now low primarily due to over-supply of tonnage ordered during the boom period causing an imbalance in the freight markets and having a seriously adverse effect on freight rates.

Ship values over the same period, represented by Clarkson Research indices for new and second hand ship prices are presented in Figure 6.

Figure 6: Clarkson Research indices for newbuilding prices (1984 = 100) and second hand prices (1988 = 100)

It can be seen from Figure 6 that newbuilding prices fell in the period up to 2003, predominantly in response to the major expansion of capacity in the price leading South Korean shipbuilding industry at that time and, following 1997, in response to the dramatic weakening of the Won associated with the Asian financial crisis. The link between newbuilding prices and earnings then re-asserted itself in the boom period from 2003 to 2008. Changes in second hand ship values followed the performance of shipping earnings more closely, at relatively low levels up to 2003 and following the shipping boom thereafter.

Results

Number of owners

The average number of owners for all vessels in the sample was 2.8 over their lifetime. As may be intuitively expected the container fleet was found to have had slightly fewer than the average number of owners and the bulk carrier fleet slightly more, as follows:

Ship type	Overall average number of owners	Size Category	Average number of owners
Bulk Carrier	3.0	Handy	2.9
		Panamax	3.3
		Capesize	2.7
Container	2.5	Sub-panamax	2.6
		Panamax	2.3
Tanker	2.8	Handy	3.0
		Panamax	1.8
		Large	2.7
Overall average	2.8		

Table 2: Average number of owners over the vessels' lives

Panamax bulk carriers were found to be the most often traded and Panamax tankers the least often, although the sample size for panamax tanker sales was small and this latter factor may or may not be significant.

The distribution of the number of owners for each ship type and for the fleet as a whole is presented in Figure 7.

Figure 7: distribution of the number of owners in the sample

The peak value for the whole sample and for the two bulk ship types was three owners whilst for container ships the mode was fewer at two. It can be seen from the charts in Figure 7 that the

distribution for tankers tails off quickly after the peak value and for container ships after the three owner category. The tail-off is slower for dry bulk carriers, reflecting the more heavily traded nature of that ship type. This feature of the sample is further confirmed by statistics in Table 3 that record the proportion of the sample having three owners or fewer.

Ship type	Proportion of sample having three owners or fewer
Bulk Carrier	64%
Container	82%
Tanker	75%
All ships	71%

Table 3: Proportion of the sample with three owners or fewer

It can be seen that dry bulk carriers were traded significantly more than the average whilst container ships were traded significantly less.

Around one in five vessels was found to remain with the original owner for the entire period of the sample, with this varying surprisingly little by ship type. The likelihood of retention for the remaining period of the life of the vessel increases with owner number, as described in Table 4.

Ship type	Owner number					
	1	2	3	4	5	6
Bulk Carrier	20%	27%	39%	54%	68%	87%
Container	21%	42%	62%	69%	73%	100%
Tanker	22%	31%	53%	50%	75%	60%
All ships	20%	32%	47%	56%	70%	84%

Table 4: Proportion of ships retained for the remaining life of the vessel

The rate of retention of container ships is significantly higher than the average whilst for dry bulk carriers it is significantly lower.

Period of ownership

The average number of years an owner in the sample retained a vessel prior to sale was found to reduce as the number of the owner increased. The overall average for all ships in the sample is presented in Figure 8.

Figure 8: Average period of ownership prior to sale (all ship types)

Clearly the first owner was found to retain the vessel, for the four out of five that did not remain with the first owner, for considerably longer than the subsequent owners. The variation in this factor by ship type is presented in Table 5.

Ship type	Owner number					
	1	2	3	4	5	6
Bulk Carrier	10.2	5.6	4.3	3.3	3.1	1.3
Container	11.3	6.0	3.2	2.6	3.9	NA
Tanker	10.9	6.0	4.0	3.2	3.6	2.3
All ships	10.6	5.8	4.1	3.2	3.3	1.7

Table 5: Average period of retention (years) prior to sale

Characteristics of the first sale

The most frequently occurring age of vessel at first sale was found to be thirteen years, with a pronounced spike in the data at this age. Apart from this spike the data was found to show a relatively flat distribution but with secondary peaks at between 8 and 10 years old and at 15 years old. The distribution for all ships is presented in figure 9.

Figure 9: Distribution of vessel age at first sale for all ship types

The sale and purchase of ships is undoubtedly influenced by market conditions but given that the sample was delivered over a 6 year period and that the 13 year point will therefore also be spread over a six year period, between 2000 and 2005 when significant market fluctuations occurred as can be seen in Figure 5, market influence alone cannot account for the distribution shown in Figure 9. Examination of the pattern of number of first sales over time suggests that other factors may have had greater influence on selling decisions in this sample of ships. The number of first sales by year is presented in Figure 10, which shows also the time periods at ten years from the delivery of the sample and fifteen years from delivery.

Figure 10: Time series of number of first sales (showing also the periods 10 and 15 years from the delivery of the sample)

By inspection it can be seen clearly that the pattern of first sales bears little relation to market performance shown in Figure 5 and little relation to second hand values shown in Figure 6. The characteristics of first sale were found to show no significant correlation with either what might be termed the 'seasonal' characteristics of shipping profitability, generated by the economic cycle, or to an over-riding influence of speculation in sale and purchase activity at this stage of ownership. This remained true even if the data were split into specific periods in the development of the market over time, for example examining only the period up to 2001 or after 2001, or with smaller time intervals than this. It is hypothesized that the pattern of classification special surveys may have a more significant influence on the age of ship at first sale. Special surveys occur every five years and the cost for the vessel owner increases as the vessel ages. The peaks of the distribution may be clustered in some relation to the second and third special survey periods at 10 and 15 years. Further research is needed to investigate this link to confirm or discount this hypothesis and the mechanisms involved. Other reasons for sale typically include where the vessel is no longer suitable for the owner's shipping requirements, where the vessel is for some reasons less attractive to charterers or just to cash in on the profit on the asset.

The profiles of age at first sale vary significantly between the different ship types, as shown in Figure 11.

Figure 11 - Distribution of vessel age at first sale by ship type

Following the hypothesis linking first sale to the pattern of special surveys it is concluded from the data in figure 7 that for bulk carriers the peak is around the second special survey at ten years, for tankers around the third special survey at fifteen years and for container ships at thirteen years, between the two.

Characteristics of the second and subsequent sales

Analysis of age at sale for transactions subsequent to the first would reveal little, with the age of ship inevitably increasing with the number of owner. Of significance, however, are the profiles of number of sales and the period of ownership over time. The profile of number of sales over time is presented in Figure 12, with the profile of first sales and the total number of sales included for comparison.

Figure 12: Time series of number of sales

The profile of second and subsequent sales is clearly very different to that of first sales and follows more closely the fluctuations in profitability of the shipping market as described in Figure 5. From 1996 the number of sales built up steadily to a plateau after 2004, peaking in coincidence with the shipping market in 2008. The correlation with shipping market conditions can clearly not be perfect, however, with the number of sales not falling significantly after 2008 as market conditions have declined (see Figure 5). In the growth period up to the collapse, however, the correlation between market performance and second and subsequent sales was found to be significant. Figure 13 presents the correlation between the number of second and subsequent sales and the average Clarksea Index of shipping earnings (Figure 5) for the year of sale for the period 1995 (when second and subsequent sales started to increase) to 2008 (the market peak), with a good correlation ($r^2 = 84\%$) between market performance and second and subsequent sales found for that period.

Figure 13: Correlation between the number of second and subsequent sales and shipping earnings between 1995 and 2008 ($r^2 = 84\%$)

Whilst a good correlation was found between number of sales and shipping earnings the correlation between the number of sales and the second hand values of ships (Figure 6) was found be relatively poor. The ratio of newbuild to second hand price and the rate of change of market conditions and prices were also tested but also found to show relatively poor correlation with number of sales. Individual correlations between market conditions and sales for individual ship types are likely to be closer than the overall average shown here.

The average length of ownership at second and subsequent sale is presented in Figure 14. This time series commences at 1995 because the small number of second and subsequent sales prior to that time is not regarded as significant.

Figure 14: Average period of ownership at sale by second and subsequent owners

The average period of ownership by the second and subsequent owner is remarkably constant in the ten years between 1999 and 2009 at four to five years. Profits on the trading of the asset at this period were significant. It is interesting to note that for sales following the market peak in 2008 the average period of ownership has increased. These owners are likely to have made significant profits on the operation of their vessels and may be able to profitably accept low prices at sale. The increase may simply indicate that in a very poor market it can be difficult or even impossible to find a buyer. It is also interesting to note that the period of ownership of second and subsequent owners does not correlate with the gradient of the second hand price shown in Figure 6. Prices rose fastest between 2004 and 2006 but no variation in the average period of ownership was seen at that time.

Conclusions and discussion

The demographics of the fleet strongly suggest that retrofitting of new technologies to existing ships can play a pivotal role in reducing shipping's carbon footprint in the next 15 to 20 years.

Development of technologies for retrofit requires knowledge of buyer behaviour in relation to investment in such technology, not only to inform the technical attributes of the product but also to enable economic analysis of the benefit of the product developed. Of importance is knowledge of the likely length of ownership of a vessel and the potential payback period that this implies in relation to the investment. Whilst many in the industry will anecdotally provide an opinion on

period of ship ownership, objective and reliable data on this subject is currently missing from the literature.

A methodology has been established to generate data on ship ownership using information readily available from commercial databases. The analysis of the data set generated for this study promotes a number of conclusions that are important in the understanding of the behaviour of ship owners in the context of the sale and purchase of ships.

1. The “*well established perception*” that the trade in ships is dominated by speculation in the asset itself, as discussed in the introduction to this paper, is far from adequate in explaining the nature of ship sale and purchase.
2. The behaviour of the first owner differs significantly to the behaviour of second and subsequent owners, with the latter category exhibiting speculative behaviour to a far greater degree.
3. Around 1 in 5 owners was found to keep the vessel for its full economic life.
4. The parameters of long term and short term (‘speculative’) ownership, as discussed in the introduction to this paper, were, respectively, on average for the vessels examined in this study 10.6 years and between 1.7 years and 5.8 years, depending on the number of the owner.

That the market for second hand purchase rises and falls in response to the fortunes of the shipping industry will come as a surprise to no-one. That sale and purchase behaviour was found to differ so markedly between first and subsequent owners, however, is notable, as is the hypothesis that the mechanisms prompting sale depend on the owner number, relating to the pattern of special surveys for first owner and market conditions for subsequent owners. Further to this the correlation found between freight rate performance and sale rather than directly between ship value and sale, although the two are clearly linked in a significant way, is worthy of further study to clarify the mechanisms involved.

Also of interest was the relatively constant period of ownership for second and subsequent owner at four to five years, irrespective of changes in market conditions. The recent shipping peak, during which second hand values rose steeply, did not reveal any significant reduction in this period.

The implications of these conclusions for suppliers of marine equipment are clearly that the first owner, including the 20% that keep the ship for its full life, presents the best target for companies seeking to sell retrofitted equipment. The reason for this is that these owners will have access to the longest potential payback period for their investment and may therefore be willing to invest more to improve their ships' performance. For the second and subsequent owner the window of opportunity to make the investment and to recover the cost is limited and may deter significant investment in retrofit in that sector of the fleet.

Having drawn these conclusions it is tantalising that these parameters cannot with certainty be assigned generally, being derived from a specific set of ships that have passed through a specific set of market conditions. What behaviour would the subsequent set of vessels that are now 15 to 20 years old exhibit, for example? Perhaps most notably, the current set of ships with their first owners were ordered in a boom period and not in a scenario of market recovery as applied to the vessels that make up the sample evaluated in this study. Variation in the prospects of ownership and behaviour of agents as they relate to market conditions is recommended for further study. It should also be kept in mind that the analysis has addressed only larger ships and only the three main commercial ship types. The pattern of ownership will certainly change as the size of vessel reduces and for other more specialist ship types

In terms of the behaviour of agents in the economic system, as described in the introduction to this paper, it is difficult to conclude that the nature of those agents is as straightforward as represented in the simplified system described there and as assumed by many associated with the shipping industry. Possibly, a demarcation by owner number and within the context of market conditions provides a better basis for classification of owners, although other characteristics such as owner

nationality will undoubtedly also be important ⁵. How does the increasingly important Chinese shipowning community view vessel ownership, for example? The commonly held perception in this context suggests that state-owned shipping companies may be more likely to keep vessels for their full economic life. The behaviour of agents in this context is recommended for further study, including studies of the psychology and motivations of the agents to add to the understanding of the data analysis.

In the marketing context buyer behaviour is regarded to be *“like much of human behaviour.. complex and multifaceted”*⁷. To study the subject further there may be value in exploring parallels with other industry sectors. In this context, however, the idiosyncrasies of the industry that mean that *“Shipping economics exist as a separate branch of economics for two reasons: the one is the cyclicity of the shipping markets; the other is the idiosyncratic nature of shipping investment”*⁵ are likely to lead to a unique set of behavioural characteristics. The volatile asset value represented by a ship and the delay between ordering and delivery for a new ship, during which time the market prospects may have changed markedly, will particularly affect the behaviour of buyers. The volatility of ship values and the importance of the “asset play” by ship owners as part of their revenue, that is seeking to buy at a low value and sell at a high value, is particularly significant. Thanopoulou sums this up as follows: *“One has to turn to the stock market or eventually some commodities to find parallels”*⁵.

In seeking parallels for the buyer behaviour of shipowners, behaviour in other transport sectors could be considered in particular fleet cars, trucks and aircraft. In none of these cases, however, does asset value fluctuation play a significant role and these sectors could provide only a partial analogy. As another example the buyer of a new vessel may share some characteristics with the purchasing strategies of buyers of turnkey industrial projects²⁰. The definition assumed in Ahola et al is that *“Turnkey projects involve a delivery of a complete system and extend the timescale of the project backwards to pre-bid activities and forwards beyond the handover stage”* A new ship to a

large degree fits this definition and could be regarded as a specific type of turnkey industrial product and the lag in delivery time between contract and delivery is similar for ships and other industrial enterprises. They both therefore share the risk (and in counter the opportunity) that economic conditions may be different when the 'product' is delivered. Very few, if any, other industrial sectors, however, then share the asset value fluctuation that attends ship ownership. For the second and subsequent buyer the analogy with turnkey industrial projects no longer holds, with ships being traded as used commodities through the ship broking markets.

Further desk research can go some way to clarify some of the questions raised by these results. Because of the complexity of ship ownership, however, further study must necessarily include empirical data collection and analysis, including surveys of buyers, to reach a more complete understanding of this subject.

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