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Defining Quality Bulk Tonnage: A Task for Researchers and Policy-Makers

By

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Abstract

The aim of this paper is to propose a set of suitable variables on which a comprehensive definition of quality bulk shipping can be built. The authors of this paper explore the alternatives of quality differentiation in bulk shipping, in view of the methodological and data problems researchers have encountered by the absence of a definition of quality for traditional bulk tonnage that goes beyond catch-all indicators such as the age of the vessel. The lack of appropriate available data for the otherwise extensively, yet not necessarily systematically documented, bulk shipping markets, calls for concerted action on the part of researchers and policy makers to compile such databases and make them publicly (widely) available.

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1. Introduction

Research in the first decade after the introduction of the Oil Pollution Act 1990, has examined the implications of the increasing importance of quality in bulk shipping, especially for freight rate formation. This line of research investigated the potential for the existence of a two-tier tanker market (Strandenes, 1994), the existence of a quality-segmented market for medium and large size tankers based on data for the period immediately prior and after the introduction of the US 1990 Oil Pollution Act (Tamvakis, 1995) and the existence of a two-tier quality-segmented market for Panamax and Capesize[1] dry bulk carriers

(Tamvakis and Thanopoulou, 1998); the investigation of non-linearity of parameters in the formation of crude oil tanker 1996 freight rates was the most recent piece of research[2] in this area at the time around the introduction of the International Safety Management (ISM) Code in shipping (van Dijk, Haralambides and Veenstra, 1998).

The issues identified by these researchers are of a critical importance for the future of traditional bulk shipping markets. Among them, a central issue, is that of a workable definition for quality. Defining quality of tonnage is nevertheless, a *conditio sine qua non* for any assessment of market segmentation. All the authors involved in the investigation of quality in bulk shipping to date have resorted to functional rather than elaborate definitions of quality bulk tonnage. This has not necessarily been the result of choice but rather of the constraints inherent in the exploratory nature of the research undertaken and of the lack of available data.

Research in the area of the impact of quality on the structure of the bulk markets has focused on the existence of or on the potential for a two-tier market in one or other of the traditional bulk segments: dry bulk carriers and tankers. The methodology followed has not been identical; however, the findings of these studies have been similar. All concluded that no clear-cut quality segmentation has yet been confirmed or can be deemed to be sustainable in the long-run. The main limitation on any research of this nature, especially in terms of the validity of results, is precisely the methodology used. Methodology selection, however, has so far proved[3] to be more of a function of the definitions used than of unforced choice between alternative approaches. In this way, the question of the definition of quality in bulk shipping becomes central to all such research.

This paper assesses first the increasing importance quality has acquired for bulk shipping market structure and provides an overview of the results of existing research in the area of bulk market segmentation. The authors delve into the methodologies used by researchers to date and point to the limitations the sets of data used have created for defining quality of tonnage and also for choosing the methodology. As a result, they propose a full set of vessel and fixture attributes as the basis for a comprehensive definition of quality in bulk shipping. However, as the assumption of full availability of detailed information is relaxed, the authors highlight the importance of concerted action by researchers and policy-makers for a more systematic approach to quality measurement in bulk shipping.

2. The issue of quality in competitive markets: the case of bulk shipping

Quality of product/service becomes an important market attribute as soon as we depart from the fully competitive market structure. Purely competitive markets are not necessarily deprived of quality characteristics *per se*; yet competition is not based on the perception of different characteristics of product varieties,

buyers perceiving available alternatives as homogeneous being one of the fundamental conditions for perfect competition. In this context, quality may exist - or not - but it is definitely not promoted by internal market forces.

The case of liner shipping is easily identifiable with non-purely competitive market structures, despite the proliferation and the increased diversity of new entrants in the post-containerisation period[4]. When looking into post-war liner shipping, product differentiation emerges clearly as a key feature of competition strategies; this was either by the introduction of highly differentiated services (container tonnage vs. traditional general cargo ships), slight variations in the quality of service (vessel speed and gear) and more recently by the provision of total logistics solutions.

When turning, however, away from the liner market, to what constitutes the majority of the world fleet, that is, about 70% (LMIS, 1997)[5], the picture that emerges is drastically different. Bulk shipping, at least as far as its traditional and more well-known segments i.e. oil tankers and bulk carriers, are concerned, can claim without prejudice a place in economics textbooks next to the traditional examples of perfect competition such as - a variety of - agricultural products[6]. Shipping services are bought and sold on the assumption of each vessel of similar size and type being a perfect substitute for all others[7]. Freight rates for shipping services have up to now been undifferentiated in terms of vessel characteristics with individual shipping firms being a clear example of price takers. The number of firms, while not perhaps comparable with the agricultural sector, is definitely large[8] and becomes less of an issue in the absence of strong barriers to entry. The large share of small bulk shipping enterprises[9] confirm empirically that either through synergy or abundant finance (Thanopoulou, 1998), traditional bulk shipping has historically been without significant barriers to entry. Despite objections that could be raised in the case of specialised shipping markets[10], competition in traditional bulk shipping markets has traditionally assumed the form of a least-cost strategy, as sellers have tried to survive in cyclical markets which have been more than suspect of behaving in a typical cobweb manner; bulk shipping claims in this regard the right to be cited once more as a textbook example along with typical cobweb examples from the agricultural sector. Although the tanker market continues to present *paradoxes* in this context such as a certain degree of interdependence between buyers and sellers for tankship services[11] and hence between demand and supply, deviating thus from the conditions necessary for the cobweb theorem to hold (Ezekiel, 1938), the lack of realisation of the mutual interdependence of sellers[12] remains impressive[13].

In fully competitive and fickle markets like these, with instability built in their fundamentals, shipping companies seek to increase their competitiveness through cost-efficiency and astute cash-flow management. The ability of firms to survive the troughs of the cycles becomes in this context the most critical parameter for commercial success as cost-efficiency can contribute very little in pe-

riods of prolonged idleness of assets encumbered with capital repayment obligations. Cash-flow pressures notwithstanding, however, achieving a low-cost combination of internationally sought and found factors of production constitutes the essence of competitiveness in bulk shipping (Thanopoulou, 1998), a pattern of competitive strategy easily identifiable with highly competitive markets. The theoretical model of perfect competition assumes that buyers perceive the product as undifferentiated; the empirical evidence from the bulk shipping markets seems to validate the theory. Tankers and bulk carriers have been deemed standard in design and operational characteristics with dry and liquid dry-bulk shipping exemplifying a standardised product with buyers trusting that the vessel is "seaworthy", externalities not being of a particular concern to the buyer of shipping services but a risk to be assumed by the insurers.

However, in recent years, the concern of the international community, as represented by a variety of governmental and intergovernmental bodies, about safety and the environment, has shifted the focus onto the *quality* of shipping services. Although published freight rate indices continue to be undifferentiated by quality or any vessel-specific characteristic other than size in the dry- bulk sector, by the early 90s they were becoming common in the case of tankers[14]. The passing of the Oil Pollution Act 1990 in the USA became the watershed for the industry. As the Act introduced unlimited liability for environmental damages and with already a record multi-billion dollar fines, bulk shipping services to the US became *quasi*-uninsurable[15].

Within a short-period of time the dry-bulk sector came under the quality spotlight; along with the entry into force of the International Safety Management Code which affected about 6000 bulk carriers a number of dry-bulk specific measures were introduced by a variety of organisations. In 1997 IMO passed retroactive legislation on dry bulk carriers with the addition of a new Chapter XII to the SOLAS convention. The structural modifications required by the amendment, with a view to improve bulk carrier safety standards followed similar measures introduced by the main classification societies in late 1996 and added to the enhanced special surveys introduced by the latter in 1993[16].

The extent and the pace of the aforementioned regulatory developments regarding safety and quality in bulk shipping resulted naturally in stimulating the interest of researchers in the potential changes in the nature of the bulk markets concerned. Research into the area of quality segmentation of the main bulk markets started from the tanker segment. In the first half of the current decade Strandenes investigated the potential for a two-tier tanker market (Strandenes, 1994). Remarkably enough, this approach, as well as all others that followed adopt the same, although not always as the sole criterion for differentiating between quality/non-quality tonnage, namely the age of the vessel. Less remarkably perhaps,

either as a working assumption (Strandenes, 1994), (Tamvakis, 1995), (Tamvakis and Thanopoulou, 1998) or as a result indicated by the statistical tests (van Dijk, Haralambides and Veenstra, 1998) the cut-off value for assigning vessels of different age into the "quality" and the "non-quality" segment has been invariably the same. The question that arises at this point precedes, however, the question of the validity of this figure or indeed of the adoption of age as a sole quality criterion; the precursor issue is whether the results of existing research are conclusive about bulk shipping quality segmentation and whether the methodology adopted on the basis of data availability allows the results of existing research to hold. The definition of quality *pe se* emerges throughout, however, as a core part of the methodologies adopted.

3. Alternative approaches of quality differentiation in the bulk markets

The first attempt by Strandenes to approach quality differentiation in the largest of the bulk markets, namely in the tanker segment, dwelled little on the selection of both the quality criterion adopted and the value assigned to it; Tankers under 15 years of age were considered as quality tonnage, with adequate maintenance of the vessel being considered as a fixed assumption. However, the importance of the definition of quality is not ignored by the author and the difficulty in assessing tanker quality is acknowledged[17].

The pioneering research by Strandenes focused on examining the potential for the existence of a two-tier quality segmented freight market for tankers on the basis of a simulation model of the international transport of oil by sea. The results obtained suggest that a two-tier market in tankers is possible on the condition that demand for quality tonnage, stemming from areas requiring quality tonnage due to regulation, would become substantially higher. According to the research this could take place either by an increase in US oil imports or by an extension of OPA 90 type of regulation to the European area, which is second in importance today for oil imports[18]. The rate of increase required would be about 33% in the first scenario while in the second case the re-allocation of demand between the quality and non-quality market segments is deemed to have a similar result, i.e. 30%, in terms of the increase in demand for quality tonnage[19]. The most interesting among the study's conclusions was, however, that the eventual two-tier market created in any of these ways would not be sustainable for more than 3 to 5 years, as the difference in rates obtained would result in an accelerated replacement of older vessels by new ones conforming to the newly demanded standards; the time horizon for the market to become homogeneous again was deemed to depend on the degree of capacity utilisation in the shipbuilding industry.

To date, despite the intentions of the European Commission to enhance safety and quality controls of tonnage reaching its ports[20] and despite the increased awareness of the quality issue well manifested by the interest of the European media in externalities caused by - mainly bulk - shipping activities, no "EurOPA" has been introduced. With the hindsight of available trade data one can, however, contrast the current situation with the market conditions used as the basis for calibrating the simulation model. Regardless of the range of assumptions used[21], the figures suggested by existing data are lower than the 33% condition for the segmentation of the market resulting from the Strandenes simulation and closer to the 10% US oil trade increase hypothesis which the models suggests would fail to produce any freight rate differentiation. However, at least nominally, the difference between rates seems to have increased. In the autumn of 1991 the difference in rates for old and new vessels was of the order of 15% (data: Clarkson Research) and can be deemed as indicative of the 1991 second semester conditions which served to calibrate the Strandenes model. In the autumn of 1997, the respective freight rate difference was 24.7% (data: Clarkson) while the respective figure for 1996 was of the order of 40% (see Table 1A). Higher differences could, of course be blamed on different states of the market; however, this interpretation is not necessarily corroborated by the actual data[22].

The comparison of the model predictions with the actual trade figures and freight rate differences does not necessarily refute the results of the simulations. While on the technical side of any potential criticisms, demand data used for this purpose should be comparable with those used for the simulation[23], the focus on quality can also be deemed to have developed in a way that can be compared to the extension of tougher regulations in other geographical areas. However, what the model provides little insight into is the essence of product differentiation itself: the required difference in the rates of return to declare the market quality segmented. When turning to the cost side of the vessel, maintenance and operational cost differences[24] are definitely age related. Different patterns and lengths of exploitation of tonnage have also to be considered and any use of discounted future revenues has to take this into account[25], the problem becomes, however, rather circular if we are to assume that rates - and hence revenues - for modern and old tonnage may differ substantially, even if this is suggested to last for only 3 to 5 years, i.e. up to a quarter of the assumed economic life of an existing vessel.

TABLE 1A

Differences in Earnings of Older and Modern 250,000 dwt Crude Oil Tankers, Arabian Gulf/West, 1996-1997

MONTH	New rate-Old rate
Jan-96	6100
Feb-96	5700
Mar-96	6200
Apr-96	5900
May-96	5700
Jun-96	5400
July-96	5700
Aug-96	5800
Sep-96	6200
Oct-96	6900
Nov-96	6400
Dec-96	6100
Jan-97	6400
Feb-97	5800
Mar-97	5500
Apr-97	5200
May-97	5700
Jun-97	5800
July-97	5800
Aug-97	6800
Sep-97	6500
Oct-97	7200
Nov-97	7700
Dec-97	5400
AVG.96-97	6079

Source: Data in Jacobs, World Oil Tanker Trends December 1997 and calculations from Jacobs data.

Age becomes thus the recurrent theme in practically all aspects of the discussion of quality segmentation; the question that arises is whether its use as the sole criterion of quality is the result of data related constraints or a sufficient approximation of quality. Tamvakis (1995), also adopted the age criterion in his research into tanker freight differentiation and although neither Strandenes or Tamvakis were aware of each other's work[26] the same cut-off age, fifteen years, was chosen by both. The focus of the Tamvakis research was the impact of OPA 90 on the freight rates for US bound voyages which was investigated through a series of t-tests on freight rate data for crude oil tankers. Although premia were found in some cases,

freight rate differences were found to be more significant for tankers undertaking the risk of unlimited liability by accepting cargoes for the US than they were for higher quality vessels. Tamvakis, however, introduced also the potential impact of modern tanker design as a potential variable in freight rate determination for individual vessels[27] (see Table 2). Subsequent work by van Dijk, Haralambides and Veenstra into crude oil tanker rates researched into the impact of fixture/vessel specific characteristics, such as vessel size, distance of carriage and year of build of the vessel on freight rate levels based on Worldscale data. The aim[28] of the authors was to show that there are non-linear relations between freight rates and their determinants; one of the main conclusions of the research was that non-linearity is clearly evident in the way the age of the vessel is linked with the level of earnings. The cut-off point[29] indicated by the results of the modelling exercise emerged again to be the same vessel age: fifteen years, the same age adopted *ex ante* by Tamvakis and Thanopoulou (1998) in their investigation of freight rate differentiation in the Panamax and Capesize dry bulk markets; however, although they chose to use age as an approximation of quality emerging through industry information and interviews in the City of London, they expressed in their research a number of concerns about how complete a definition of quality can be based on one vessel attribute alone.

TABLE 1B

Correlation between Earnings of Older and Modern Crude Oil Tankers 1996-1997 (Arabian Gulf/West 250,000 dwt)

Correlation: pairs of observations	Result Corr.Coef r =	Avg.WS	Avg. earnings older	Avg. earnings modern	Avg. diff/ce
Old/new average earnings per day 1996/1997	0.997*	55.5 (56)	20171	26250	6079
WS/avg. earnings of older vessels 1996/1997	0.94	”	”	”	”
WS/avg. earnings of modern vessels 1996/1997	0.95	”	20171	26250	”
WS/absolute difference of avg.earnings older/modern 1996/1997	0.57	”	”	”	”
WS/absolute difference of avg.earnings older/modern 1996	-0.32	52 (54)	15492	21500	6008
WS/absolute difference of avg.earnings older/modern 1997	0.84	59 (60)	24850	31000	6150

* The correlation coefficient is so high as to induce questions about the suitability of the data for performing this type of exercise. However, there is little reason to believe that the two markets do not move in parallel and no basis to consider the data as a *priori* biased.

Source: Table 1A.

4. Researching on the basis of a workable definition: Candidate parameters and potential complications.

A common characteristic of most[30] pieces of existing academic research on the subject of quality differentiated rates is the retention of just vessel-specific characteristics. This does not necessarily imply that the potential importance of more general "fixture- specific" characteristics has been ignored. Neither does it imply that easily quantifiable vessel attributes were selected by the researchers merely for reasons of statistical convenience. The selection of the criteria to be included in the definition of quality tonnage suggested by individual (or joint) authors might as well correspond to the actual importance given by the market to vessel/fixture specific attributes.

The model by Strandenes was built on conservative hypotheses regarding the number of quality tankers available during the period that served for the calibration of the model. Age was only one of the dimensions adopted by the sole source of published tanker quality assessment at the time[31], the Clarkson survey of the existing VLCC fleet published in the early nineties. As Table 2 shows, the quality criteria adopted by Clarkson (1991) included a variety of vessel characteristics purporting to both management and technical aspects of shipping operations. The vessel profile constructed by Clarkson for each individual VLCC was based on "age and ownership", vessel "operating history", "marketability" of the vessel as an asset, and the ship's "technical appraisal". It has to be mentioned, however, that the age of the ship was the first criterion figuring in the tables providing the detailed ranking assessment of vessels[32]. The aim of the survey undertaken was not at the time to relate freight rate differentiation to vessel/fixture characteristics but to assess the prospects for the VLCC tanker segment in view of the recent or proposed, at the time, regulatory changes, such as OPA 90 and the IMO draft regulations[33]. However, the Clarkson survey was based on a detailed methodology[34] which would satisfy even stringent academic criteria and included management related characteristics of the vessel; it also sought, by choice of methodology, to establish a quality distribution of the VLCC fleet. Apart from the inclusion of criteria which would be more or less predictable, the study based the quality assessment on more general criteria as well. The inclusion of marketability criteria for instance, would seem at first sight to point to the value of the vessel rather than to its quality. However, their inclusion was apparently decided on the basis that vessel marketability will dictate management practices towards the vessel as an asset. They were used in order to establish links between the prospects owners had for the vessels, which would result - or not - in a regular programme of repairs, and the expected quality of vessel performance. However, the 1991 Clarkson survey as well as a subsequent survey, by

the same source, of Capesize tonnage, contain a rich list of potential candidate parameters[35] and is by far richer in this regard than any academic approach to date (see Table 2).

TABLE 2

Proposed Parameters for Evaluating Quality of Tonnage

	Clarkson 1991	Strandenes 1994	Tamvakis 1995	Tamvakis and Thanopoulou 1998	van Dijk, Haralambides & Veenstra, 1998
Vessel attributes					
Age	X	X	X	X	X
Repairs	X				
Size	X				X
Capacity	X				
Safety equip/nt	X				
Speed	X				
Con/ption	X				
Yard of Build	X				
Hull, tank and engine	X		X		
Fixture Attributes					
Distance					X

The classification of the criteria used, however, does not necessarily provide a clear distinction between technical and management characteristics; the importance of the latter for the overall performance of the vessel was nevertheless rather explicitly acknowledged[36]. We classify the ones grouped by Clarkson under "marketability", especially those referring to safety specifications, speed, consumption and yard of build of the vessels under Vessel Attributes (see Table 3), along with age and the whole set of "technical appraisal" criteria (including steelwork, hull/tank protection and engine upgrade). The heading *management* criteria in Table 3 includes ownership, flag and classification which Clarkson included under general vessel characteristics along with age; along the same lines we are inclined to classify the entire set of "operating history" criteria proposed by their survey, such as *incidents*' record, number of ownership changes (recorded in the survey database as *number of sales*), time in *lay-up, trade patterns*, history of *time*

charters, prior use for *storage, original owners* and *repair record*, as vessel history under the more generic category of Management Attributes of Table 3. Size and capacity, which were included by Clarkson in the marketability criteria, are less relevant to quality of vessels and rather irrelevant when researching into freight rate differentiation. However inspired the choice of size and capacity as an indication of ownership intentions towards the vessel might seem, management strategies are not uniform *vis-à-vis* vessels of the same degree of marketability; the perception of a vessel as a less marketable asset does not necessarily imply a lower degree of maintenance in the short-run neither does its selling or scrapping in a long-run perspective. Moreover, both size and capacity are rather poor candidates for the purposes of research into freight rate differentiation and the same applies to distance. Any kind of multivariate analysis including them would have its results blurred by the inclusion of parameters whose influence ought to have been neutralised at the stage of data collection. The essence of market segmentation on the basis of quality lies in differences in rates obtained by vessels *otherwise non-differentiated* but by quality characteristics only.

The relationship of either vessel or management attributes with quality, as shown by the results of correlations run by Clarkson Research, or indeed freight rate differentiation as shown by the results of academic research so far, is not always in the direction one would tend to assume. Some results, however, are hardly surprising when delving into the subtleties of bulk shipping management. That extended periods of lay-up seem to correlate with good-quality owners rather than poor ones as found by Clarkson is not, for example, a paradox[37]. The vessels of quality-avert owners tend to have lower variable costs through neglect of maintenance and repairs and higher fuel consumption of older units is often compensated by the use of very low paid and sometimes poorly qualified as well crews. No indications are provided, however, about the way flag and vessel classification, the two most interesting management attributes (what?).

TABLE 3

Candidate Parameters for Researching into Quality Segmentation of Traditional Bulk Shipping Markets

	Used in acad. research	**Market ranking**	**Quantifi-able**	**Information availability**		**Database suitability**	**Result**
Vessel attributes				Access	Cost		
Age	Yes*	High	Yes	Yes	Medium	Yes	inconclusive
Technical condition	No*	High	% Ranking	No	Very High	Process	N/A
Design	Yes*	-	Dummy	Yes	Medium	Yes	inconclusive
Speed & cons/on	No*	-	Yes	No (1)	High	Yes	N/A
Managem/t attributes							
Flag	(No) (a) *	Low	No	Yes	Medium	Yes	N/A
Ownership	No*	Medium	No	Yes	High	Process	N/A
Class. soc.	(No)	High	No	Yes	Medium	Yes	N/A
Manage/nt	(No)	High	No	No	Very high	Process	N/A
Vessel history	No*	High	Yes	Yes	Medium	Yes	N/A
Crew cha-rac/tics	No	Low	Dummy	No	Very High	Process	N/A
Fixture specific							
Nature of charterer	No	-	Dummy	Yes	Low	Yes	N/A
Geographical area	No (b)	-	Dummy	Yes	Low	Yes	N/A

* The asterisk denotes use of these parameters in the Clarkson surveys for deriving an overall evaluation of vessel quality. More than indicated were initially, among the one figuring in the Table, but were not included in the evaluation.

(a) Brackets denote use by Talley (1998), in order to assess the degree of resilience of vessels in the case of incidents. (b) See text.

(1) Data can easily be found for design speed and consumption but sources of actual s&c can be provided only through companies and class.societies.

It would be almost impossible for any market report to reach conclusions or divulge results on the more sensitive issues. The breach of "class confidentiality" would inevitably render all future co-operation between owners and classification societies impossible; flag states are also very sensitive to market criticism from any outside source, for the industry to venture into divulging potentially sensitive correlations. Academics, however, are deemed to enjoy a relative immunity, and they are the origin of successful recent attempts to investigate the essence of quality in bulk shipping, i.e. the avoidance of externalities through the avoidance of incidents (Talley, 1998). Academics, however, never enjoyed any free or unobstructed access to market information which, as they have to process in a scrutinised way, might at the end prove unworkable as part of a quality definition. The award-winning[38] investigation of the determinants of seaworthiness was made possible in an accident perspective, *ex-post* not *ex-ante*, based on data for a decade, 1981-1991, of accidents that occurred in US jurisdiction areas and were investigated by the US Coast Guard. The problem, however, of seaworthiness and eventually of quality shipping is broader, especially when it comes to freight rate differentiation. Policy makers are interested in the way vessel and management attributes relate to the degree of damage to lives and the environment, through the ability of the vessel to successfully sustain incidents; charterers are interested in avoiding complications due to vessel/management unsuitability. Charterers have not so far been directly affected by the extent of externalities[39]; they can be affected, however, by poor vessel performance and poor management mainly through delivery delays and cancellations and through their potential public exposure following an accident.

In this context, it is interesting to investigate what elements charterers consider when accepting a vessel. Although the list of candidate parameters for evaluating the quality of the vessel, as they figure in Table 3, could logically be longer, according to information by a number of major brokers and in-house brokers of shipping companies only very few of these parameters have been identified as having played a role in chartering negotiations; the market ranking of the importance of these features is provided, where applicable, under the Market Rating heading in Table 3[40].

Technical condition/ history of the vessel, age and classification society were the only parameters that were given any consistently significant rating on a Likert scale from 0 to 5 by all respondents. Management and ownership proved of extremely varying importance, from rather insignificant to highly significant; management, however, scored very high among brokers. Flag was given modest or low ratings. The lowest scoring parameter, ironically for a period where human error has been identified as a common cause of various major shipping accidents, was the manning parameter, crew nationality, qualifications and crew homoge-

neity being given grades of 0 to maximum 2, denoting nil or very low interest on behalf of charterers in these aspects of the vessel.

Unfortunately, the Clarkson exercises of 1991 and 1994, which included a wide range of criteria, were performed in a different context, that of the identification of replacement requirements and the prospects of supply/demand balance; targeting freight rate differentiation was outside the scope of the exercise. The various parameters were correlated as a rule with the number of incidents in which vessels had been involved in the past and not with the level of their earnings. Thus it is difficult to compare the results of the surveys regarding the role of e.g. age, which proved to have a significant relation with incidents in the case of Capesize bulk carriers but not in the case of VLCCs[41], with the results of academic research in the same area. The same applies for Talley's assessment of what he defines as seaworthiness of vessels, which consists essentially of the assessment of the degree of resilience of vessels in case of an incident taking place; his results reveal that the average age of ships involved in incidents is 15.4 years[42]. Where the use of parameters can be tested against results (see Table 3) is in the case of Tamvakis (1995) and of the two pieces of research in 1998 in the area of dry bulk and tanker shipping. However, the significance of parameters is not of a canonical nature; in all these attempts the aim of the researchers was to assess the degree to which freight rate differentiation could be linked with specific attributes. If the result suggest no relation between rate and a specific attribute, this does not necessarily imply a genuine lack of link of the characteristic involved with quality; if a link is not identified this could be explained by the indifference of charterers to the specific characteristic which, however, may have a closer relation to quality of shipping than what the charterers' own perceptions may suggest.

The problems related with including the appropriate parameters are, however, multifold. They include a major issue in shipping research, that of data cost and especially of access to data which are regarded confidential by companies and classification societies, the only potential providers of data on crews and on the technical condition of ships. The other major problem, in the context of research into freight rate differentiation, is that of data suitability for statistical inference purposes. An indication of the nature of candidate parameters and of problems related to the inclusion of relevant data in models is provided under the heading "Quantifiable" in Table 3. Levels of freight rate differences for vessels varying in quality can be assessed for different types of charter, (spot, trip, time) and could be compared and contrasted after being investigated separately. Geographical area, especially in terms of loading areas where charterers may be taken "hostage" as a consequence of a vessel defaulting in port control is an evolving variable; it depends on a variety of factors ranging from changing port state control policies to varying trade union strength in particular areas.

While this research is still exploratory, so is the market; in this context, allowing for changes in the importance of parameters, it is critical for the research framework to follow successfully changing market attitudes. Twenty years ago it would be unthinkable to raise the question of quality differentiated rates and even that of quality in bulk shipping. Any drastic change in attitudes could, of course, create additional problems as the non-linearity in parameters could make the processing of time-series data extremely complicated. However, access to data is the precondition for any subsequent choice of alternative methodologies and emerges as the main constraint for prospective research in the area. Data availability is a complex issue: it involves access to publicly available information, included as the first element of data availability in Table 3 and the cost for obtaining the data where the information is not freely available. A related problem is that of database suitability, indicating the amount of processing of collected information before it becomes meaningful in a database environment. Data availability, when taking account of all its dimensions, becomes thus of critical importance. In the absence of access, Table 3 invariably points to a high cost for obtaining the related information. However, in this exploratory phase of research the priority for researchers is to widen the range of candidate parameters in order to propose valid models for assessing the degree of market segmentation according to quality.

5. Conclusions and scope for further research

Definitive conclusions at present would be premature. However, during this phase of intense questioning about the appropriate attributes for market segmentation on the basis of quality, suggestions regarding the steps that have to be taken for further research can stimulate academic discussion.

The first step towards improving knowledge about what are the *actual* parameters related to quality in a freight differentiation perspective is be that of continuously monitoring market attitudes. The market ranking of these attributes has to be widely assessed[43] for both the dry and liquid bulk markets bearing in mind that attitudes evolve. Assuming that charterers would be willing to provide relevant information is perhaps optimistic but not impossible or requiring the effort that research into other factors impacting on freight differentiation might be. On the basis of the existing knowledge of the bulk shipping markets it is not irrational to suggest that freight rate differentiation might vary or even disappear in extreme states of the market[44]. On the one hand, in periods of full employment charterers may be find themselves in a sellers' market where their preference - or not - for quality becomes subservient to the need for immediate transport the demand for which is price inelastic. On the other hand, markets in

deep recession may result in charterers being able to suppress any trend towards higher rates demanded by owners of quality tonnage in the context of a buyers' market. Thus, only extensive research into the evolution of freight rate differentiation can provide any accurate basis for isolating the impact of the state of the market on freight rate differentiation from that of quality[45].

A second step towards a better assessment of the relationship between returns from chartering vessels and the quality of ships and their management would be to relate not only price (in the form of the freight rate) to quality but also employment of vessels to quality. Although price and employment of vessels cannot be deemed to be unrelated[46], any employment bias related to the quality characteristics discussed in this paper would have an immediate impact on the profitability and thus on the returns from shipping operations. If vessels "open" to charter are found to be systematically rejected by brokers and charterers because of specific quality related characteristics, time spent in ballast or in port bearing full operational costs directly reduces *ceteris paribus* profitability. The theoretical complications and the cost implications of extending current research in this direction are, however, daunting. On the one hand, lay-up of vessels cannot be a suitable proxy for time spent in lack of employment in this context as lay-up of different vessels can vary according to their economic costs and not necessarily to their quality characteristics. On the other hand, information on employment patterns and time spent in waiting can be assessed only through industry information. Again, the issue of accessibility of data emerges as the prime constraint for research into the impact of quality on market fundamentals.

The attempts made to date to assess the degree to which the market shows a preference for quality are more the result of data related constraints than of choice. As such they will always be scrutinised, regardless of how valid they might prove with hindsight if ever the full sets of required data become available. Bypassing class confidentiality, flag state reticence and the industry's own secretive nature is beyond the resources and the mission of researchers. It seems that if the current interest of regulatory and international bodies, such as the EU Commission or the IMO, into quality shipping is to be sustained, quality research has to be sustained equally. A systematic approach to quality shipping will become feasible only through dedicating and co-ordinating resources that are presently scattered among industry, academia, research institutes and the regulatory bodies themselves.

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Notes

1. Panamax are vessels between 50,000 and 80,000 deadweight tons while the Capesize segment includes larger vessels essentially of a tonnage above 90,000 dwt. Segment definitions vary significantly in both the industry and in academic work.

2. We would like to thank all these authors for providing us with drafts or off-prints of published, unpublished and in-print work at the time of the writing. Research in this area was then in its early stages. The article is a 2002 edited version of the paper presented in SIG-2, Genoa, in July 2000 retaining only information and literature available at the time. The proposal the authors developed can be deemed still part of the debate on quality definition in bulk markets. In the course of the decade since, transparency has increased and the creation of the Equasis database has been critical in this respect. For a review of shipping quality literature since that date, the reader can consult, Cheng, T.C.E. and Choy, P.W.C. 2013. A study of the relationship between quality management practices and organizational performance in the shipping industry. Maritime Economics and Logistics 15, pp. 1-31. Also Kohn, S. and Thanopoulou, H.A. 2011. Transportation Research Part E: Logistics and Transportation Review, 47, pp.709-721.

3. As extensively discussed in Tamvakis and Thanopoulou, 1998.

4. Although the long theoretical debate on the contestability of the liner markets has shifted the focus beyond the neoclassical approach of market structures, it is likely that the current wave of mergers and acquisitions in the industry will consolidate the oligopolistic characteristics of the market, which implies open rather than pure competition.

5. The exact figure is 67.3% of the world fleet in terms of grt, the remaining being liner cargo and passenger vessels with 5% of tonnage in the non-cargo (or passenger) carrying capacity category (Data: LMIS, December 1997).

6. The issue of whether bulk shipping (or indeed agricultural products) is an entirely free market or whether it is subject to a variety of non-market interventions (in the form of subsidies etc.) is definitely of interest, yet it does not affect the essence of market structure identification. For a recent discussion of the market structure of traditional bulk shipping markets see Thanopoulou, 1998.

7. Minor complications such as political embargoes are the only potential constraint which could result in vessels being eventually differentiated by their - easy to change - registration.

8. According to data in Lloyd's Register (1998), Register of International Shipowning Groups April-July 1998, there were more than 5000 identifiable companies in shipping. This figure does not include vessel specific companies which are created and used by parent companies as tax/management instruments.

9. As revealed by studies of the world's largest owned fleet, the fleets owned by Greeks (Theotokas, 1997).

10. Specialised bulk shipping markets may very well be different in this regard and a variety of different classifications of niche segments have pointed to the impact of factors such as economies

of scale at fleet level and close customer contacts (Wijnolst and Wergeland, 1996). While the conspicuous absence of advertising for tankers or dry bulkers is a clear confirmation of the nature of the traditional bulk shipping market, this is not necessarily the case for other markets such as for example reefers which empirical research would probably prove as falling more into the case of monopolistic competition (Thanopoulou and Theotokas, 1997).

11. Zannetos (1966) has clearly described the deviations from the standard cobweb conditions. Today, although more empirical research is required, there remains a degree of interdependence between buyers and sellers in tanker shipping evident in the way alliances are formed between the oil majors and shipping companies.

12. No analogies can be directly drawn with the situation on the demand side in the absence of recent research. Extending the argument "even more strongly", as Zannetos did, to the behaviour of buyers serves the purposes of the authors but does not necessarily reflect the current situation.

13. Planned and actual supply differences may equally be found in the case of orders of new capacity in bulk shipping (Zannetos, 1966) and the issue of the nature of expectations has not really been resolved. However, the assimilation in general of the fluctuations in the bulk shipping markets to the cobweb diagram has held its appeal when overviewing shipping cycles (Stopford, 1988).

14. See the various market reports such as Drewry Monthly. Before the middle of the 90s age premia resulted in age differentiated charter reports, indices and graphs.

15. The major oil companies were quick to adapt to the new situation disentangling themselves from what had served them only as a safety-net against them being taken hostage by the independent shipowners in times of a tonnage shortage: namely their fleets of industrial carriers. Alliances and joint-ventures with shipping companies, emerged as the modern response of shippers anxious to avoid being taken hostage by the media; vessel names/fleet pre-fixes vanished in an attempt to disassociate eventual disasters from the company's brand-name. A process that had already started in the 70s as the oil majors realised that oversupply was "there to stay" and as oil traders replaced them in part as major buyers of tanker services, as rightfully brought to the attention of the authors by Siri Strandenes.

16. It has to be noted, however, as mentioned in Tamvakis and Thanopoulou (1998), that enhanced surveys had in the case of some accidents preceded total vessel loss only by a year or so.

17. See Strandenes, op.cit. p. 17. There was at the time little, if any, theoretical interest in the question of quality, yet market agents responded quickly.

18. Western Europe may be assumed currently, on the basis of 1997 data, to have a 23.5% share in oil imports (BP, 1998) of which only marginal quantities are not traded by sea.

19. See Strandenes op.cit. pp. 16-19.

20. See http:/europa.eu.int/en/comm/dg0//press/ip96222.htm, May 1998. The 1999 Erika and the 2002 Prestige accidents triggered EU measures in this respect.

21. Between 1991 and 1997, US oil imports increased by 27.2%; the five-year increase between 1991 and 1996 was of a similar order (Data: BP, 1998). The actual rate of increase of US seaborne oil imports for both years, however, was lower. When the decline of the long-haul Middle East loading area in favour of the rise in the short-haul crude oil US imports is considered (Data: Clarkson, 1998), with tonne-mile data for the North American area increased by less than 8% between 1991 and 1996 the latest year for which regional trade data are available (Fearnleys, 1998), including Canada and Mexico both net oil exporters. Data refer to importing areas of crude oil so they can be more or less assimilated to US imports.

22. In 1991, the yearly average Worlsdcale for VLCCs Arabian Gulf/Continent via Cape was 60 while for 1997 the respective value was about the same, 59 according to Jacobs data and 60 according to the Drewry average. A more accurate comparison is between the rates prevailing in the second half of 1991 and the ones prevailing over 1997 to avoid the impact of distortions caused by the Gulf war over 1991 rates. We calculated the average for the second semester for 1991 and 1997 to

be 53 and 67 respectively which indicates clearly buoyant conditions in the VLCC market for the second half of 1997 compared with a rather flat market in 1991, as a consequence of the "destocking" phase of the cycle.The 1996 average of WS54 (based on Drewry data) or WS52 seems, however, to indicate that freight rate differentiation can co-exist with less buoyant market conditions Worldscale provides for adjustments in cost changes so that, for a specific size of vessel, comparisons can be made over the level of freight rates both for specific markets and on average. Major periodic changes in its base structure, however, have introduced breaks in the continuity of the data.

23. Not revealed by the author.

24. Deemed to be quite significant according to market information provided to the authors. Strandenes assumes the difference to be less than what a traditional approach of older vessels requiring more maintenance would suggest due to the enhanced maintenance requirements for even the younger vessels. One may comment, however, on this point that although the relative difference might become smaller as maintenance costs increase in this way for both vessels, absolute differences would rather persist as the wear-and-tear basis from on which quality related costs might be added is different for younger compared to older vessels.

25. See Strandenes, op.cit. p. 13. In subsequent clarifications provided it was suggested that the assumption made was that quality new vessels are maintained so as to retain their quality characteristics while older vessels are maintained only to keep them above the minimum requirements of the class for their respective ages, but not to prevent ageing.

26. Both authors agree that none had access to the other's work but that the choice was done on the basis of realistic judgement of market integration.

27. At about the same time as the introduction of OPA 90, a compulsory tanker "double skin" was adopted as the standard design for new-buildings of tankers. The pairs of samples in Tamvakis' research were defined on the basis of geographical discharge areas, age of vessels and vessel construction (single vs. double-hull).

28. A variety of comments may be made regarding this selection, mainly that there is a risk that the distance "neutralisation function" of Worldscale conceived to indicate at the same level equal returns for vessels of identical size and cost structure was ignored. The introduction of loading or discharging areas as dummy variables could prove an alternative choice.

29. In the initial version of the research presented at the 8th WCTR in Antwerp on July 13, 1998, it was indicated that the values of the parameter function cross zero for year of build around 1984. The discussion with the presenter and the indications from the figure accompanying the text indicate that the date is actually around 1981.

30. Tamvakis and Thanopoulou, (1998) included in their field research on freight market differentiation more vessel specific characteristics. Van Dijk, Haralambides and Veenstra included distance and size of the vessel as independent variables in their model. However, the focus of the paper was on assessing the existence of non-linear relations in freight rate determination and no attempt to categorise these variables or indeed supply an interpretation of their relation to freight rates was made by the authors. The model also includes two dummy variables for Middle-East and Caribbean trades but these are interpreted as distance-related features and not as loading-area related ones.

31. Clarkson Research (1991), The VLCC Quality Survey, London classified about 80 million dwt, that is, VLCCs (vessels above 150,000 dwt) in the high quality categories. The age criterion used by Strandenes resulted in limiting the total quality fleet of tankers of much larger segment of the total tanker fleet (vessels over 50,000 dwt) to only 90 million dwt.

32. Annexed to the general findings of the survey.

33. These referred to new design requirements for existing tankers and new-buildings and resulted in the introduction of compulsory double skins for new-constructions and required operational specifications for existing ones.

34. See Clarkson (1991), pp. 1-16.

35. See Clarkson (1994), Capesize Quality Survey, London. The only significantly different parameters taken into account by this second survey include trading flexibility between cargoes, a non-issue for crude carriers, and the use of high tensile steel, a factor which has been partly associated with structural failures of large bulk carriers built during the period when the problem had not been identified or addressed.

36. See Clarkson (1991), p. 16 where an example of attempted correlations allowed by the structure of the database created, recognises the relationship between quality of management and vessel performance through the reference to correlations run between owner type and accident performance.

37. Ibid., p. 121.

38. Talley's presentation won the award of the International Association of Maritime Economists for 1998.

39. Assuming spot charters and time-charters where the charterer can prove easily that their instructions were not at the origin of the incident. The question of bareboat chartering might be more complicated but bareboat charters serve a variety of purposes, usually substituting for a full purchase.

40. We had access to the results of the interviews conducted by Tamvakis and Thanopoulou in 1997 covering the largest brokers of dry bulk tonnage in London and Piraeus. The survey included also a small number of interviews with in-house brokers with Panamax and Capesize tonnage.

41. See Clarkson (1994), p. 121.

42. However, variance or standard deviation are not provided.

43. The market ranking included in Table 3 resulted from interviews with a small number of brokers and in-house brokers, covering, however a significant amount of dry-bulk markets, and market confirmation of the information by other brokers.

44. The Asian crisis for instance seems to have had a negative impact on quality requirements of dry bulk charterers in the area.

45. Also suggested by Tamvakis and Thanopoulou (1998), op.cit.

46. Any high differentiation of freight rates ought to imply, for instance, fewer employment opportunities for vessel of lower quality if charterers' preferences are to be considered consistent.

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