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Behavioural Chartering Strategies

By

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Abstract

This study aims for a small contribution to the knowledge base of the age-old ship chartering business. Generally, people are well aware about the theories of human behaviours, but face difficulties to incorporate these theories in their business strategies. In this study attempt has been made to quantify these behavioural elements and use them in the process of decision making for the ship's employment purposes. One of such theorems is "People do not consider costs as losses, but an investment". On the basis of this theorem, risk- return trade-off can be charted out for an individual using MA-portfolio theory. Using the combination of person's optimism and apprehensions, best trade-off can be chosen from the available set.

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1. Introduction

1.1 Background

Unlike the subject of physics, business and economics have remarkably few “natural laws” which leaves the scope for human psychology to step in and manipulate the science to the advantage of a chosen few. There are numerous examples to back this claim, the most recent and catastrophic one being the 2009 financial crisis. The obvious cause of this chronic phenomenon was the sophisticated financial instruments engineered to siphon off the money from the pockets of the vulnerable into the hands of the creators of these instruments. In short, any kind of business has an inseparable factor of human behaviour involved in it. There is the “fear” of losing money, there is the “hope” of making money, and then there is a “greed” for making extra money. These are the very same elements which behavioural economists are attempting to fathom in order to integrate them into mainstream Economics in order to uncover more meaningful principles and theories, as well as to bridge the gap between theoretical solutions and actual outcomes.

Ship chartering activities are no different to any other businesses. It works on a similar theme of risks, returns and market share. From a broader perspective, the ship owner takes the risk of investing huge capital in purchasing a ship with the hope of earning money when the ship is employed for the purpose she was built for. Part of this earning is paid back to the bank towards mortgage premiums or distributed to shareholders, and the remaining amount is held back as a profit. Over the period, the greed for a larger market share and thus more profit sets in, making the ship owner purchase more ships. This simple structure of shipping business portrays the essence of basic human behaviour; an extensive study would reveal more of these traits such as disposition effect, overconfidence etcetera. At this point, one would ask “Are you suggesting doing business without getting influenced by these traits?” My answer would be “NO”, there can be no business without these elements, and if this question really came to readers' minds - implying agreement with my argument- then I shall assume that I am moving in the right direction.

The primary source of revenues for the ship owner is the freights earned by chartering out their ships, whether these ships are fully owned or partly owned or chartered in from another ship owner. At the same time, the ship owner incurs a cost for running his ships. In general, cost components are more predictable than the revenue, owing to volatility of freight rates. Thus, the ship owner’s income is largely dependent upon the decision they make while chartering out/in ships. This study aims to suggest an alternative way of mitigating the freight rate volatility risks by involving human behaviour. Although, the work will be carried out from the ship owner’s perspective, views can be easily transferred to Commodity traders and Oil Majors benefits. Without being specific, the author aims to maintain generality in the scope of application to all shipping segments. However, a case study of a bulker company would be undertaken for the purpose of explanation.

1.2 Objectives

A ship owner making his ship available in the market for the service of sea transport of commodities has various options open to him; contracts of affreightment, bare boat charter, long-term time charter, spot charter and a hedging instrument in the form of Freight derivatives. All these instruments are means of revenue for the ship owner and can be treated as an investment with associated gains (and losses). By employing his ships under different terms of agreement, the ship owner is said to have a portfolio of investments – just like a financial portfolio of securities and bonds. On this note, the author aims to suggest strategies for having an efficient charter mix in order to attain the maximum gain for a given risk acceptance. Thus, the research question is formed:

How to attain the efficient charter mix for a given risk acceptance of the ship owner?

In the course of exploring the viable reasoning for the main research questions, the author aims to seek the following objectives:

- Briefly explain various shipping segments
- Assess sources of revenues and costs available to the ship owner
- Explain various types of shipping contracts
- Investigate the mechanism of mental accounting portfolio theory
- Study the application of MA portfolio theory in the chartering business
- Give concluding remarks of the case study

1.3 Thesis Outline

Section 2 explores related work in-line with the aimed study, and this is followed by Section 3 which explains the methodology that will be followed to conduct the study. In Section 4, detailed assessments will be carried out of costs and revenue from the point of view of the ship owner, as well as an explanation of various shipping contracts, risks involved in shipping business and shipping derivatives. Section 5 is on the behavioural decision-making theories and gives an introduction to the mental-accounting portfolio theory. A case study would be conducted in Section 6. Finally, a conclusion of the whole thesis will be covered in Section 7.

2. Literature Review

Taylor (1982) used a system dynamics approach to tackle the decision dilemma of an efficient charter mix. His study surrounds the methodology of the ship owner's reaction to developing freight rates and their inclination to charter out the ship for the long term when freight rates are favourable. He simulated the earnings for three different chartering policies: reactive, conscious, and a combination of first two. In his concluding remarks he prefers the third policy, wherein the ship owner can fetch good returns overall - in the short term by following a reactive approach and in the long term by being conscious.

Cullinane (1995) utilised Markowitz's mean-variance portfolio optimisation theory for choosing an optimal charter mix in what he referred to as "hedging strategies in dry bulk shipping". In doing so, he used a combination of Time charter, voyage charter and Freight futures contracts to derive a set of optimal charter mix, fetching the highest possible returns for a given minimised risk. Keeping in mind the satisfaction level of the ship owner, he used an indifference curve to arrive at the most efficient charter mix. Although he found the results of his study logical, he acknowledged the short comings of the mean-variance theory when it comes to an application in the shipping industry.

Berg-Andreassen (1998) approached the study from the context of a wealth-multiplying effect of the ship owner's initial capital, and used MVT to advocate the best strategies to increase a ship owner's wealth by chartering out, as well as chartering in, ships for various markets. He analysed ten different dry-bulk routes and, using his model, he suggested the routes where the ship owner could contract in his own tonnage on a voyage charter, time charter, or hire in the same for the purpose of speculation or fulfilling his commitment. From the context of its stable cash flow, Berg-Andreassen (1998) refers to time-charter earnings as risk-free instruments – similar to government bonds in the financial market – whereas Cullinane (1995) has a different view.

Wang (2011) views time-charter earnings somewhat similarly to that of Berg-Andreassen. In her work, Wang argues the case that, by going long on time-charter contracts, when spot charter rates are high, oil companies save the freight payable to the shipping companies. On this idea, she develops her study and, using MVT, suggests the optimal chartering strategies for oil companies.

Ansari (2006), and Shen and Vogiatzis (2004), had a similar perspective for the shipping asset optimisation and used MVT in their study.

3. Methodology

Considering the different chartering contract types and associated hedging instruments available to the ship owner as profit-generating assets, an efficient portfolio of investment can be created, which is nothing but an optimum charter mix meeting the ship owner's desired goal for returns on his investments. Using this philosophy as a core of the research, the quantitative study will be conducted using the empirical data of freight rates collected from the Clarkson shipping intelligence network. Further explanation of the concept will be done using a hypothetical case study of a ship owner with twenty capesizevessels.

There can be numerous combinations of the ship sizes, the routes and charter mix as alternatives for investment from the point of view of a ship owner. However, for the sake of simplicity, only the capesize bulk-carriers will be considered for the study. Further simplification and more relevance will be achieved by involving only the five most liquid routes with high weightage on the Baltic Capesize Index.

As Kahneman and Tversky (1979) mention that, "Individuals do not consider costs as losses, but an investment". Based on this philosophy, the time series of a return can be generated for the period under consideration. In other words, the ship owner's percentage of daily net earnings over his daily total costs can be considered as his percentage returns for his investments. Investment options that will be included for study are the daily returns on: spot charter, 1-year time charter, 3-year time charter, and FFA fixtures. Due to its over-the-counter private dealings, there is scarcity of information about the FFA fixtures in the public domain. To aid the inclusion of FFA for the study, reference is made to the work of Kavussanos and Visvikis (2004), wherein they found a lead-lag relationship between the spot market rates and FFA rates on pacific voyages, especially those which are more liquid. Hence, a two-month older spot rate is considered as the present FFA rate.

After having generated the time-series of returns for all the combinations, the variance-covariance matrix will be generated in order to identify volatilities and co-movements of the different returns. Using the MA portfolio optimisation theory, as devised by Das et al. (2010), the frontier of the optimised portfolio will be generated by considering the range of different risk-aversion factors. Lorange and Norman (1973) studied the decision-making behaviour of Scandinavian ship owners and concluded that they are risk-loving in the times of economic prosperity and risk-averse otherwise. Since the large part of period under consideration, the year 2005, was economically promising, risk-aversion factors ranging from 1.3 through 3 will be utilised for generating the efficient frontier. Logic behind choosing the value being; closer the risk aversion factor to zero more risk-loving the individual is.

Descriptive statistics will be assessed to determine the distribution and volatility of returns for the whole period under consideration. The main assumption of the MA theory is that the returns are normally distributed. The time series of observations in the study is that of a daily returns on the ship owner's investments, the returns for such small intervals are found to be normal, which meets the assumption of the theory.

After having determined the frontier of the efficient portfolios, the most efficient portfolio will be chosen using the ship owner's intended goal of reaching a particular target for a given risk – mentioned in terms of the probability of not reaching the target.

Though this approach gives a satisfactory solution to the ship owner's chartering dilemma, its short-selling assumption does pose some questions, especially when we have alternatives like period charters, wherein the ship owner cannot opt out from his obligations to meet his income goals.

4. The Shipping Business and Its Profitability

4.1 Shipping Cycles

Ships are the cheapest mode of transportation of goods available to mankind. This is especially true for larger quantities carried over longer distances. Shipping is a facilitator of trade – moving goods from one place to another – as well a promoter of trade; due to economies of scale, and the low transport cost, shipping has enabled trade between the remotest regions of the world. In other words, shipping is the foundation block of the globalisation phenomenon.

Due to the longer lead times involved, the supply of ships takes a longer time to correct. Relatively, the demand for shipping can change rapidly. With its inherent nature of uncertainties surrounding the supply–demand equation, the shipping industry (Shen&Vogiatzis, 2004) has very rightly termed this market as the world's biggest poker game. It is very difficult to justify and relate this cyclicality and uncertainties with established economic cycle theories such as the Kitchen cycle of 3–4 years short-term duration, the Juglar cycle lasting 6–8 years, or the Kuznets cycle lasting for 20 years.

Zuellig (1942) studied the cycles in shipping and concluded that it is the inability of supply to match the variation in demand that causes cyclicality. Hampton (1987) suggests the presence of two types of cycles. The long-term cycle lasts for 20 years and incorporates a construction phase of 8–12 years, in which the freight rates tend to be high. The correction phase of the long-term cycle lasts for 8–12 years as well, and the freight rates are low and steady during this period. The short-term cycle has a typical duration of 3–4 years. Each phase of the long-term cycle envelops three successive short-term cycles.

Volk (1994) bases his reasoning upon variables, namely: development in freight rates, shipping innovation, and the behavioural aspect of the market players. He argues that cycles in shipbuilding, and thus the shipping business, are mainly the result of variability in the supply of wet- and dry-bulk tonnage. Other shipping sectors do have influence on the business cycles, but not as much as the previous two. His explanation for the effect is that the demand for raw material is stronger than that for finished goods. Volk's argument is evident from Figure-1, wherein a combined share of wet- and dry-bulk carriers has, on average, accounted for more than 70% of the world's fleet.

Ironically though, and in-line with Volk's (1994) findings, Scarsi (2007) cites that under normal market conditions, demand for bulk shipping is independent of the freight rates. However, he is also in agreement with the researchers who argue that the demand for transport becomes elastic when the freight rates are high compared to the value of the cargo.

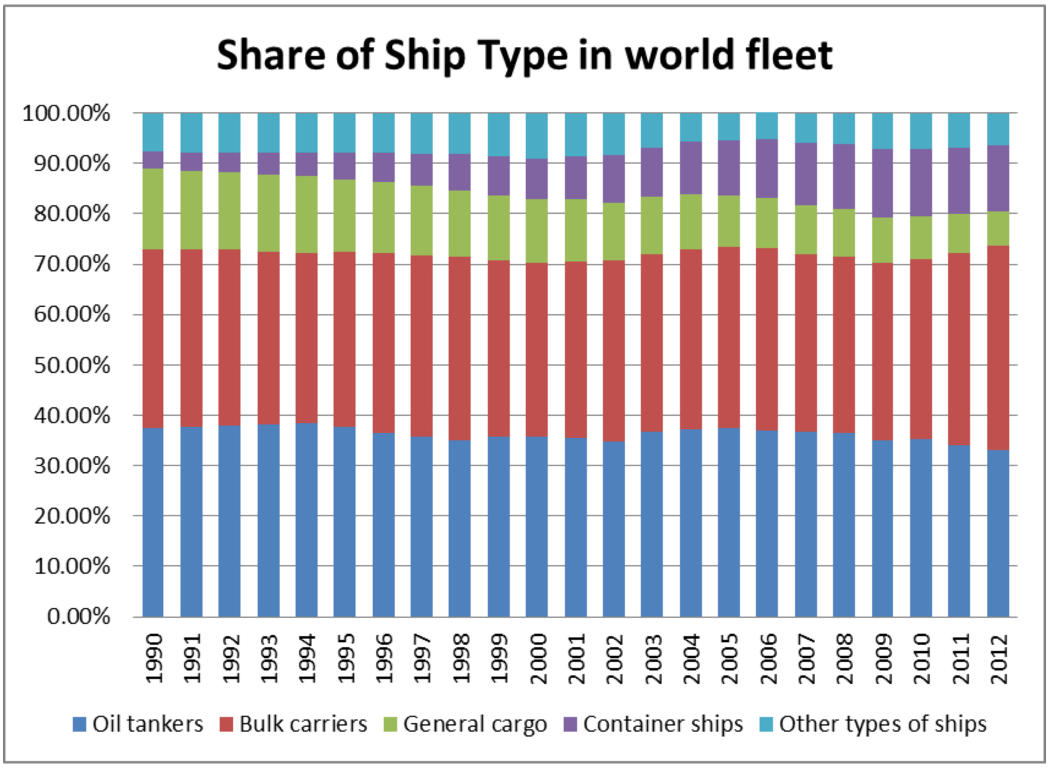

Figure 1, Share of ship types in the world fleet, Source: UNCTAD (July2013)

Authors like Stopford (1997) view the cyclicality phenomenon in shipping as incidental. He suggests that one should not be preoccupied with the length and regularity of these cycles. In agreement with Hampton, he argues that cycles in shipping are a mechanism which coordinates supply and demand, has no fixed timing of occurrence and cannot be formulated for forecasting.

As per Stopford (1997), a complete shipping cycle has four stages:

- Trough – Surplus of tonnage brings the freight rates down below the operating cost, thereby forcing the ship owners to sell, demolish or mothball the tonnage.

- Recovery – Supply/demand moves towards the equilibrium, although it is short lived and thus the freight rates rise over the operating cost.

- Peak – Freight rate peaks and the ship owners make excessive profit. With anticipation of sustained earnings, shipbuilding orders soar.

- Collapse – Supply of tonnage exceeds demand. Steep fall in the freight rates settles down at the trough phase.

Demand for shipping is derived demand. In other words, trade of goods stimulates demand for shipping. From this perspective, in this author's personal view of the mechanism, the Kitchen-cycle theory best describes the cyclicality in the shipping sector, although not the duration. As de Groot and Franses (2012) put it, Kitchen found a pattern of fluctuation lasting 3–4 years. He explained this pattern as occurring after the recession, when the industries have low levels of inventory stocks. In order to bring their stock back to an acceptable level, industries stimulate demand of stocks in the market. Demand increases until the firm realises that they have an over-stock of inventory items. Thus, the firms cut back on the order which, in turn, slows down the economy.

The shipping industry can be broadly classified into three sectors:

- Bulk shipping – Tonnage engaged in transportation of raw materials
- Liner shipping – Dealing in transportation of intermediate or finished goods
- Specialised sector – Those serving oil & gas exploration (offshore industry), the wind-farm industry, seismic survey, and project cargo, etc.

As depicted in the following diagram, bulk shipping is further subdivided into three segments:

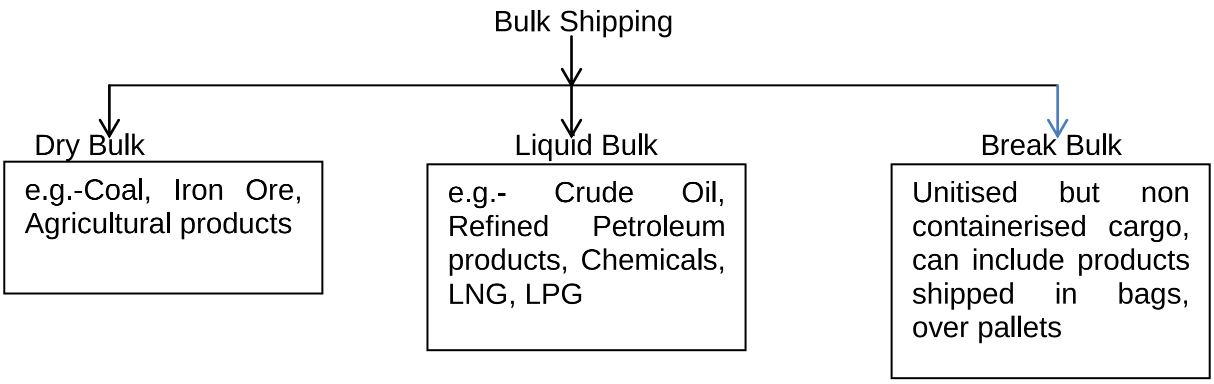

Figure 2, Bulk shipping sub-sectors, Source: Self

Bulk cargo revolves around the principle of "one cargo – one ship". Usually, cargoes carried in bulk are large enough to fill the entire ship and, in most cases, are destined for a single consignee. On the contrary, liner shipping has a theme of the "common carrier". An individual consignment is too small to fill the whole ship, hence the cargo carried on board could be destined for a handful of consignees, to well in excess of hundreds. There is not only a difference between the principles of these two segments, but also in their operation. A liner service operates on a fixed route and on a fixed schedule. Whereas, there is no such fixed route and schedule in bulk shipping, except in the case of CoA where ships ply on a fixed route for a certain duration until an agreed quantity has been fully transported to the destination. Even the markets for these two sectors follow different mechanisms. The bulk market is close to perfectly competitive. The liner market has an oligopolistic nature; few players controlling the major share of the market. As per Alphaliner (Top 100 – Existing fleet in July, 2013), the top 10 carriers in the industry control more than 60% of the operating liner fleet.

In broader terms, ships in the specialised sector are positioned to, or engaged in, serving a single client at a time. In some cases, like project cargo, the ships are purposely built to transport a certain cargo for a specific client.

4.1.1 The Bulk market

Several definitions of the term “bulk cargo / shipping” are available in the literature. As per UNCTAD, homogeneous physical properties of certain commodities lend themselves to be handled in bulk, hence the carriage of such commodities can be said to fall under the segment of bulk shipping. From the context of transport economics, (Stopford 1997) describes bulk shipping as sea transport on “one cargo/one ship” basis or quantity sufficient enough to fill an entire ship to reduce unit transport cost. However, under the definition, as (Stopford 1997) points out, goods such as bananas, live animals, and cars can be classified as bulk cargoes because they are transported in ship loads, which is true to the extent of their carriage, but fails to distinguish their specialist nature of carriage. Another definition of bulk transport available in the literature is “carriage of goods in unpacked form, subdivided according to the physical properties of the cargo”. All the above definitions are correct in their perspective, but fall short of justifying and differentiating the segment. However, there is one classic distinction as (Gratsos, Thanopoulou et al. 2012) puts it “any transport of goods, where time and route have not been dictated by the ship owning / operating company can be considered to be in the realm of bulk shipping”. This truly differentiates dry bulk shipping from other trades.

Dry-bulk shipping

As the name suggests, dry bulk cargoes are carried in the “Dry” state, enclosed in the watertight holds with controlled ventilation to avoid moisture build-up. Any contact with water can cause substantial damage to these commodities and in certain cases may render them futile and make the ship owner liable to claims. There are numerous grades of commodities which are carried in bulk. Historically, grain and coal have retained their position among the top three commodities carried in bulk (Gratsos et al. 2012). The oil discovery and re-industrialisation of Western countries after WW-II had created a tremendous demand for sea transport of iron ore. Till date, the three mentioned commodities contribute the largest share in the dry bulk shipping. In fact, the list of five main dry bulk cargoes has remained unchanged, with the last two being bauxite and alumina, especially phosphate rock. The commodities have been so dominant that special bulk carriers have been built to cater to the specific demands of sea transport of these commodities. To benefit from the economies of scale, at the same time meeting operational restrictions on these routes, “Chinamaxes” are being built to facilitate the discharging of iron ore in Chinese ports, whereas for bauxite trade, “Kamsarmax”, a larger panamax for loading in Guinean ports, is being utilised. The introduction of these bespoke ships implies changing trends in the supply of the bulk shipping tonnage to adapt demand patterns pertaining to specific routes and commodity. The prototype vessel sizes have increased in recent years, as is evident from Table 1.

Table 1, Modern dry bulk ship sizes

Term	Deadweight (Tons)
Handysize	30,000
Supramax	50,000—60,000
Panamax	60,000—80,000
Kamsarmax	80,000—82,977
Capesize	>100,000
Chinamax	300,000—388,000
Very large ore carrier (VLOC)	388,000

Source: (Gratsos et al.2012)

Although the ship sizes have increased in the recent past, the basic structure of these ships has not changed. In fact, they largely remained unsophisticated, compared to other segments; single deck cargo holds with or without gears. Owing to the voluminous quantity involved, ports handling bigger vessels have superior cargo handling equipment to expedite the loading / discharging operations and reduce port time. Hence, the majority of bigger ships are gearless i.e. without their own cranes. On the contrary, almost all smaller bulk carriers have their own gears. Their small sizes and own gears make these vessels flexible and attractive for coastal trades, as they can reach ports deep inside the rivers or canals without established handling facilities. Needless to say, smaller vessels are also routinely employed in international trade for carrying smaller parcels of specialist dry commodities.

From the context of time efficiency, the physical characteristics of dry cargoes present certain limitations in handling and land transport as compared to, say, liquid bulk. Hence, these cargoes require intermediate storage, mostly in port premises, before they reach their destination. Quite obviously, ports receiving bigger volumes tend to have a larger storage space to accommodate and facilitate the entire operation in a timely fashion. The recent trend in the commercialisation of ports has not left dry bulk ports untouched. The ports following the “Landlord” model lease out the port premises to private players, while keeping the overarching policy making and administrative rights to themselves. Similarly, there are other management models entitling private players to have some control in port operations. With private players increasingly becoming active in ports, operations have become efficient and systematic. It serves the interests of both the parties, ship owners and private players who in most cases are exporters or importers of cargo. With increased port productivity, ships spend less time in port and more time sailing. After all, ships earn more money when they are sailing out at sea. In the case of exporter/importer, larger control in the port operation helps in cutting down on operational costs and having a more transparent and reliable supply chain.

Another interesting factor in dry bulk shipping, common to wet bulk as well, is the less number of office staff required ashore for technical and commercial management. Although there are many ship owners, small and big, potential customers are comparatively less. Hence, bulk ship operators do not have dedicated sales and marketing department as in liner shipping. These factors reduce the firm level operating cost by saving on office space, staff and communication costs.

Liquid Bulk Shipping

(Stopford 1997) defines liquid bulk cargo as "bulk cargoes that can be transported in tanks and handled by pumping system". Of all the sea-borne transport volumes, wet bulk has consistently had the largest share, and thus the largest tonnage is available in this segment. As shown in Figure 2, liquid bulk trade can be further segmented as per the characteristics of the cargoes being transported.

Dirty Trade – dedicated to transportation of fresh crude oil extracted from oil wells in raw form. It also includes the transport of waxy petroleum products, such as HFO, usually the products produced in the final stages of refining process. The cargoes traded in this segment are mostly black in colour and sticky, hence the name "Dirty". Quantity nominated for carriage can be big enough to fill the entire ship with a single grade. There can be times when the ships are loaded with cargoes originating from different oil wells which require segregation. The segment often falls into downstream section of the Oil major's supply chain network.

Clean Products - The fuel products produced in the initial and middle stages of refining are carried in under this segment. These products are lighter in density, can be colourless or have a lighter colour and do not leave behind any residues in the storage space. The products have a superior quality and are highly reactive when in contact with other grades; a small puddle of previous cargo in the tank may render the entire cargo in the tank futile. Hence, strict tank preparation prior loading and a complete segregation with other grades are required during the transit. The ships in this trade can carry multiple grades, but not more than 3 or 4 types. They may fall into a downstream or upstream section of the oil majors supply chain network.

Chemical Trade – In this segment exclusive grades ranging from few hundred tons to few thousand tons are carried in small parcels. The ships are usually smaller, but highly sophisticated and specialised. It is normal to carry multiple products inside a single ship and they could range from 2-32 grades.

LPG Trade – Liquefied petroleum gas, ammonia and few chemical gases are traded in this segment. These gaseous products are carried in a liquid form by keeping them pressurised in the tanks build to withstand such pressure or by cooling down vapours released from the products and keeping the tank temperature within limits specified for the grade. Then there are ships which use a combination of the previous two theories'/technologies called "Semi-pressurised" ships. Pressure type ships are usually of a smaller size and can carry few thousand tons of cargo. Refrigerated ships can be as big as capesize bulk carriers. Owing to advanced technologies involved, ships are highly sophisticated. Unlike dry bulk trade, there are very few players involved in this segment.

LNG Trade - with the ever growing environmental concerns and consequential search for newer technologies and environmentally sustainable fuel, LNG trade has grown multi-fold in the past few decades. Liquefied natural gas is a compressed form of natural gas or methane, which is a by-product released in the process of oil extraction from wells. Before the advent of newer technologies, natural gas was flared off in the atmosphere as a waste. The depleting levels of conventional fuel resources and increasing demand for energy resulted in the integration of natural gas into the energy generation mechanism. The need for the transport of natural gas over longer distances and an inaccessible geographical stretch between the source and receiver led to development of LNG ships/technology as a mode of sea transport of natural gas in a liquefied state. Ships are normally bigger in size and are highly specialised. Both the LNG ships and the terminals handling these ships are highly capital-intensive. Hence, until the last decade it was a normal practice to fetch a long-term time charter of up to 15-20 years, before these ships were built, thereby, guaranteeing employment for ships and a source of supply for terminals/nearby energy generation plants. However, in modern times volumes of natural gas being traded in spot markets led to the demand of LNG ships on voyage contracts.

Land transport of liquid bulk is much more time-efficient than dry bulk. The land transport system usually involves extensive pipeline grids, rail transport and road transport. In the oil segment, the sea transport is an inseparable part of the supply chain, as per (Lyridis, Zacharioudakis 2012) 59% of oil produced was transported over sea.

As to the market structure of the wet bulk shipping, many transport service providers are available in the market with fleet size ranging from few to few hundreds, but the proportion of ship owners owning a large fleet size is negligible in comparison to the world tanker fleet, implying a lack of concentration. There is free entry and exit for ship owners, all these characteristics are of the perfectly competitive markets. On the other hand, consumers of these services are a handful of influential oil majors, commodity traders and national oil companies. Owing to their position in the market, it is quite humanly on the part of these powerful consumers to exploit the market and dictate the terms of contracts and freight rates. Hence, the market can be said to follow a monopolistic nature, but has never been realised (Lyridis, Zacharioudakis 2012).

Since the last few decades an interesting development has been happening in the tanker industry, as noted by market watchers. As per (Lyridis, Zacharioudakis 2012), the global fleet is being taken over by oil producing countries. In this author's view, the reasons behind this could be twofold. One, quite obviously, is the intention of providing a total supply chain solution by integrating vertically, thereby having control over their business in terms of costs, reliability and customer relations. The second is to decouple their business from the international market. For example, with so many international sanctions in place, countries like Iran still continue to carry on with their oil exporting activities with little difficulties. This would not have been possible had they relied on international tonnage for their sea transport demand.

4.1.2 The Liner Shipping

The liner shipping refers to the sea transportation service provided by a ship owner or a consortium of ship owners, with common business interests, by utilising a ship, on a shorter route, or a fleet of ships, for longer routes, on a fixed route on a pre-determined schedule for the carriage of unitised goods. Units of package are container boxes of standard maritime sizes; 20 feet equivalent units (TEU), 40 feet equivalent units (FEU). There can be variation in the dimensions and constructions of these boxes as per their intended use. For example; “High cubes” boxes are used for carrying low density and high stowage factor cargoes, and Open top/sides containers are used to carry over-sized cargoes. The “Tank containers” are used to transport liquid cargoes. Apart from these minor variations in maritime containers, there can be containers built especially for carriage within national or regional boundaries. The 45’ feet containers are widely used in the US to benefit from scale economies in the longer rail transport within the US. Same is true for the containers built for road transport within EU limits, with a small movable section in the front for the safety of the trucks carrying them. For the sake of harmonisation to facilitate handling, these regional containers are not carried on ships, unless the ship is purposefully built to serve the domestic market.

The cargoes carried in the containers are usually of high value, intermediate or finished goods. The diversity of cargoes which can be carried in the containers can be astonishing; from silicon chips to food products to clothing. Generally, shippers avoid using sea transport for expensive goods to avoid a build-up of pipeline inventory and thus the inventory costs. Same is true for time sensitive goods. However, the strategic objectives and the nature of business the firm is involved in determine their policies towards using particular modes for transport, the study of which is out of the scope of this research.

Evolution of unitised or containerised trade was based upon the following benefits it bought to the market players,

- Higher port productivity and thus less port time
- Smaller number of labour required in port for handling
- Ease of handling and securing for the maritime transport
- Time efficient handling operations
- Lower likelihood of damage or pilferage

All these benefits led to reduction in operational costs and product claims and thus within a span of 5 decades the container shipping has carved a niche for itself in the thousands of years old sea transport industry.

Trade analysts consider container shipping the main facilitator of globalisation. The liner trade has also changed the sourcing strategies of the multinational companies, developed a global production network and reshaped the global supply chain practices, as (Notteboom 2012) mentions in his study.

Despite the consistent year-on-year growth in the liner sector, the operators of the liner fleet have been having a hard time surviving financially. First of all, the container shipping operations are capital-intensive: For example, to run a weekly service from the Far East to Europe, operators have to deploy as many as 8-9 ships, a higher man power requirement at the firm level, a higher cost of communications as part of customer service, advanced IT software used in scheduling and routing the ships can cost as much as the price 5 year old feeder vessel, marketing costs and most importantly, the port handlings costs. Owing to their nature of scheduled or on-time delivery concept, the ships depart from ports even if the slots are empty. As in airline industry, the yield management practices are quite religiously followed in the liner shipping. To exploit such practices, if the shipper is waiting till the last moment to book the slot they might get offered a tariff equal to a marginal cost of carrying one container rather than keeping the slot empty. This marginal-cost-only approach can eventually lower the overall tariff structure for the particular route (Haralambides 2013). All these factors add high volatilities in revenues for operators. To overcome these difficulties, operators used to have the “Liner conference” in the past, wherein they discussed and united against all the issues and policies of concern. In recent times, with the “Anti-trust” institution forbidding such conferences and excess capacity as a result of hasty decisions regarding the asset base in the past, operators are facing financial difficulties even in recovering their operating costs.

With these lingering business implications, operators have resorted to other alternatives in order to lower their operating costs. This is by providing a total supply chain solution by vertical integration, slot sharing agreements with fellow operators and building larger ships to benefit from scale economies. The real beneficiaries of the container revolutions have been the market players providing the total supply chain solution (Door to Door concept) without investing in physical assets such as UPS, Kunhe-Nagel and other similar Non vessel operating container carrier (NVOCC). These NVOCCs have less operational costs, more liquidity and comparatively more stable revenues. In order to mirror their success, the liner operators have also started integrating vertically for providing these services. Big operators such as the Maersk line have entered into terminal management to cut down port handling costs and increase vessel productivity in ports, thereby reducing the cost further. For the sake of financial survivability, the operators who used to compete for a market share are entering into a slot sharing agreement. Under such agreement, the operator allows another operator to use the empty slot on their vessel in exchange for the right to use a similar number of slots in other operator's ship. With this kind of agreement, if the operator does not have a substantial market share on a particular route, they can still continue to offer the transport service on this route by using other operator's ship till the time they develop a substantial market presence which justifies using their own ship profitably for the said service. Another trend, which is also true for the dry bulk segment, is increasing sizes of container ships. With increased fuel efficiency being a call of the day and the operator's unending quest to reduce fixed costs, bigger and bigger technologically advanced and fuel-efficient ships are being built and put into service. The latest are the 18,000 TEU Maersk “E-Class” vessels, and there are 20000 TEU ships in design stage. Not to mention, due to their flexibility and ease in handling and stowage Reefer containers are becoming more and more a serious competition to the specialised reefer trade.

4.1.3 Specialised Sector

In the specialised sector, the ships offer varied and technologically advanced services which can include transport, storage, engineering, inspection and testing, surveying, safety support and salvage, among many. With depleting levels of oil reserves in onshore and offshore regions, demand for deep water oil exploration and extraction has gained momentum in the last few decades. Following are few vessel types which are engaged in providing these services:

Drilling Rigs – These units are positioned over the potential oil reserves deep into oceans, for drilling and oil extraction purposes. Normally these are towed to the desired location, however these can be self-propelled as well. Oil rigs are stationed in the oil field for the duration of a life cycle of oil reserves in the particular field.

Storage units (FPSO/FSO) – Extracted oil from the seabed is stored in the floating storage tanks for further offloading to sea-going ships. The floating storage tanks are nothing but an older oil tanker tonnage big enough to store a daily oil production capacity of an oil rig. Additionally, some space is kept aside for settling and lead days before the arrival of an export ship.

PSV/ AHT vessel - These are smaller boats with powerful engines and advanced navigation and manoeuvrability. These can utilised for multiple purposes; for transport of stores and personnel to and from land bases, safety support, position monitoring, moorings of rigs and FPSOs. Additionally, these can be further modified for use in an offshore wind turbine installation process.

Diving support vessel, Seismic survey vessel, Cable layers – These smaller ships with advanced manoeuvrability, sophisticated navigation system and highly technical engineering systems on-board are used for the facilitation of subsea activities.

Apart from the offshore sector as mentioned above, there are certain other ship types which are dedicated for the carriage of goods which cannot be transported by ships falling under bulk or liner shipping.

Heavy Lift vessels - These are bespoke ships built for the carriage of project cargoes. Project cargoes are known for their oversized dimensions and weight. These ships can carry a single unit big enough to occupy the whole deck of the ship or a single heavy unit which can sink the ship to its marks, but still leaving most of the deck empty. These are comparatively smaller ships with open decks and lower freeboard. Cargo unit is carried on an open deck. These ships have at least one crane installed to handle the cargo loads. However, during normal loading/unloading operations there are multiple shore cranes involved. This segment is niche, involving special expertise in handling and operating the ships. There are few ship owners operating these ships.

Livestock carriers – These are meant to carry live animals. The construction resembles that of a car carrier, with the bays for securing animals. These ships are found to ply on certain fixed routes, especially on Australia to Middle-East routes. Live stock market is comparatively very small, supposedly not exciting enough for big players in bulk or liner trades except for few exceptions.

All the fixtures in the above sub-sectors are on a period charter basis. In case of Rigs and FPSO contract, the period could last for the project's duration. However, in the case of Heavy-lift and Livestock carrier, there could be a fixture for a voyage charter.

4.2 Demand of the Shipping Tonnage

As mentioned earlier, the demand for shipping is derived demand. Unarguably, the primary driver for this demand is the seaborne commodity trade. However, seaborne trade itself is affected by other variables. As per Stopford (1997), five factors that influence demand for shipping are:

- The world economy
- Seaborne commodity trades
- Average hauls
- Political events
- Transport costs

The principle determinant of seaborne commodity trade, and thus the demand for shipping, is the world economy. A growth in economic indicators implies higher industrial production and consumer purchasing power. A prosperous consumer's basic needs transforms into desirability for different tastes of the same product, which acts as multiplier for industrial production. A compounded effect of these variables results in the increased demand for sea transport. Figure 3 shows the trend and close relationship of world GDP and demand for seaborne transport.

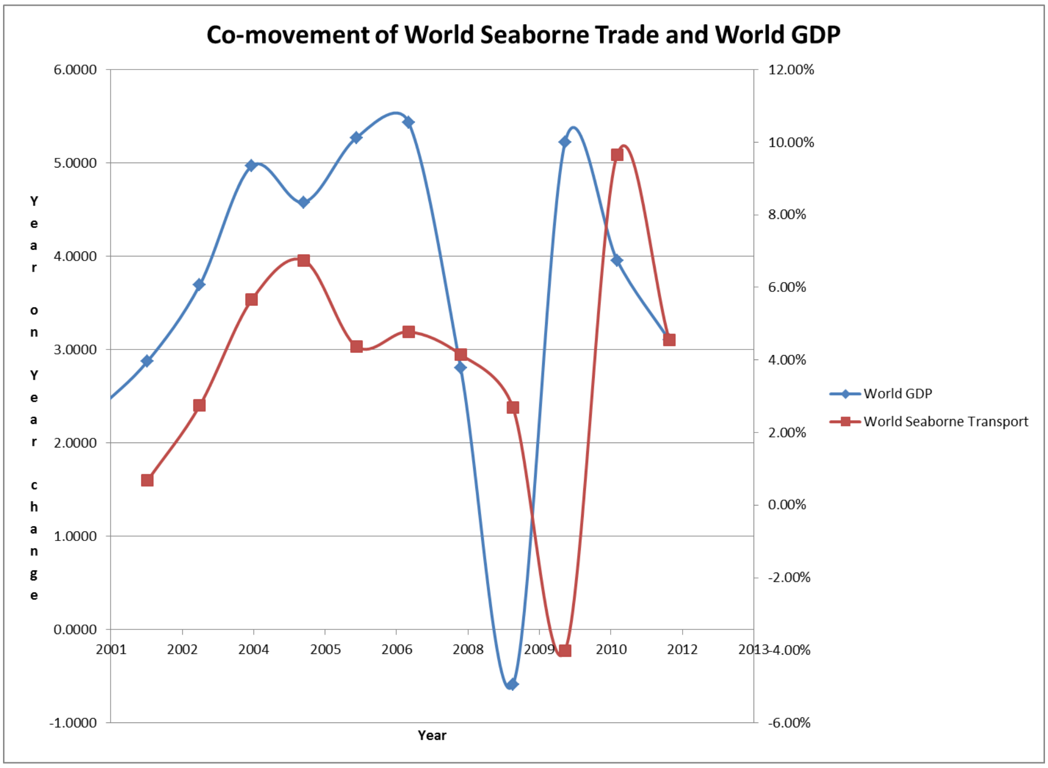

Figure 3, Co-movement of world seaborne trade and GDP, Courtesy: Clarkson SIN, Source: Self

The above figure illustrates a strong correlation between two variables. Therefore, a causal relation between world economic cycles and shipping business cycles is quite obvious.

However, in addition to the world economy, there are certain subtle commercial factors and trends which affect the seaborne commodity trade, namely: trade elasticity, trade inefficiency, and seasonality. Stopford (1997) describes trade elasticity as "the percentage growth of sea trade divided by the percentage growth in industrial production". A positive value indicates that the growth in the sea trade is larger than that of industrial production, a negative value indicates otherwise. A self-reliant country targeting only a domestic market would have negative trade elasticity.

Haralambides (2013) describes trade inefficiency as "the percentage of difference between actual and theoretical commodity flows over the theoretical flows". In other words, lower freight rates enable countries to trade goods with far away countries (actual trade flow), even when the option of trade with a relatively closer country is available (theoretically significant in order to have minimal transport costs).

Seasons, with associated changes in the production and consumption of certain commodities, causes short-term demand fluctuation in the seaborne trade. Political events, institutional and governmental policies, consumer behaviour, and technological advancement shape the long-term trend of shipping demand.

The distance between the source and the point of production is another deciding factor for the demand of tonnage. A consignee requiring a certain amount of raw materials at a regular interval employs more ships for transportation on longer routes than he does on the shorter routes. This phenomenon is captured by the term “ton miles”: the unit of the shipping demand, signifying the quantity of certain goods carried over a particular distance.

With technological advancement, bigger ship sizes have enabled ship owners to benefit from the scale economy. Lower cost-per-unit deadweight has allowed ship owners to reduce the transport cost. Insignificant in comparison to manufacturing cost, the lower transport cost is the true promoter of globalisation and thus the increased demand for shipping.

4.3 Supply of the Shipping Tonnage

The underlying market forces render the supply of tonnage to be distinguished as a “physical supply” and an “effective supply”. As Haralambides (2013) puts it, physical supply is the total tonnage available for service at a given time. The effective supply refers to the actual service provided in terms of quantity and distance in a given period of time.

The physical supply of the world fleet is the time-lagged effect of the prevailing and anticipated market scenarios of the past. Haralambides (2013) mentions that the effective supply of shipping tonnage is the function of fleet productivity. However, in this author’s view, fleet productivity itself is dependent upon the current demand and freight rate. Hence, the effective supply is the measure of the present-day market condition, signifying the amount of cargo transported by the unit deadweight of the average world tonnage.

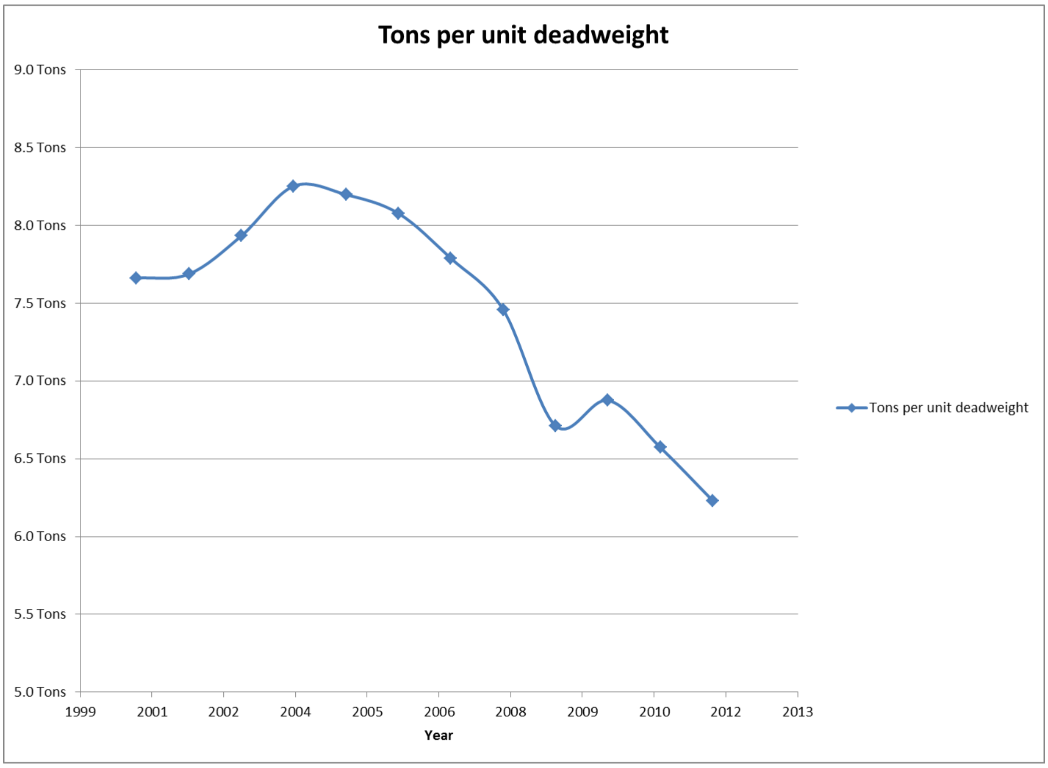

Figure 4, Tons per unit deadweight, Courtesy: Clarkson SIN, Source: Self

Yard deliveries and demolitions in a time period determine the physical tonnage available. Although ship losses chip away at the physical supply, the proportion is insignificant. Figure-4 depicts quantity of cargo carried by the unit deadweight of the world shipping fleet over the past decade. As it can be seen, around year 2003 the fleet utilisation or the effective supply of the tonnage was highest. Considering the 4-5 year lead time for the ship building order book to fructify in physical service, the resulting over-optimistic ship owner's rush to ship building yard is evident in the year 2008.

The theories surrounding the freight rate mechanism and the supply of the shipping tonnage is readily available in text books and every other academic paper related to the shipping business. In line with those theories author concludes that the freight rates are the single most important determinant of the physical supply of shipping tonnage.

4.4 Risks, Uncertainties and Profits

Ship owners have little control over the freight earnings. In this immensely competitive segment, financial performance and sustainability revolves around three key variables as noted by Stopford (1997):

- The revenue received from trading/operating the ship
- The cost of running the ship
- The method of financing the ship

Improper control and execution of these variables may lead to disastrous consequences for the ship owner – the latest example being the well-established names in the oil tanker industries, like GENMAR and the Overseas Shipping Group, filing for Chapter#11 Bankruptcy Protection.

In addition to the above, the author feels there is another key variable which is of some importance:

- The timing of deals pertaining to asset purchase/sale and related mergers and acquisitions

An ill-timed deal can cost a company its fortune. The best example to back this claim is the takeover of the American oil-tanker company OMI Group by the consortium comprising of Teekay Shipping Group and Torm Shipping in 2007, when the shipping markets were at an all-time high. With their deep pockets, Teekay Shipping managed to carry on the burden of excess over-valued tonnage during the 2009 recession. However, as per leading shipping daily, Torm Shipping is still in the doldrums and yet to recover as of the first quarter of 2013.

A decision, be it long-term strategic or short-term operational, makes these variables take upside and downside values, thereby deciding the financial fate of the shipping company. Every decision process involves dealing with uncertainties or a risk over which the ship owner has no control, but he can certainly learn to manage them appropriately. In the following section, an attempt has been made to briefly summarise these risks.

As for any other businesses, the financial performance of the shipping company is prone to the following categories of risks, as noted by Gray (1987), and Kavussanos and Visvikis (2006):

1. Interest-rate risk

It is very rare to see any ship-building or ship sale/purchase transaction which does not involve banks or another lending institution. Equally true is the involvement of outside equity in financing the ship. After all, ship financing is a huge industry in itself and why wouldn't it be? With so much tonnage – sometimes way in excess of demand – floating around the world for trade, it is very difficult to imagine the ship owner financing the ship without any loans or equity raised from these institutions. When considering the interest-rate risk, we shall leave the equity financing aside as it does not involve a regular premium re-payment. Although, the shareholders are entitled for periodic dividends, it is not obligatory and the ship owner is free to decide whether to pay out the dividends or to retain the earning for business expansion purposes. Instead, the financing party is offered a certain percentage of ownership in the company. Shareholder's paramount concern is the multiplication of his terminal wealth, be that in the form of dividends or the value added to his capital by the business expansion. From the context of the bank loan, it is the time of the shipping cycle when the building contract was entered into that greatly determines future cash flows of the ship owners, as it is during the period of gloomy economic conditions that the banks would be willing to finance the projects at a lower interest rate than they would during a prosperous period. After all, the banks are there to do business by lending the money at certain interest rates to earn and multiply their capital. When the economy is flourishing the opportunity cost of their capital is high, hence they would charge higher interest rate. On the contrary, during gloomy period the lack of demand for their financing may make them lend the money at lower rates to the creditworthy customers. Secondly, the terms of the contract also influences the ship owner's annual cash flow. As in frontloaded contracts, banks recover a major portion of the loan amount in the initial phase of the contracts, whereas in the balloon-payment system the banks get a major chunk of the loan at the end of the contract duration.

2. Exchange-rate risk

In the majority of agreements, the ship owner is paid his freight earnings in US dollars. Although all the international transactions are dealt with in US$, there are other important transactions, such as corporate tax, which need to be settled in the domestic currency – the value of which remains in a state of flux against US$.

3. Fuel-price risk

Ships use heavy fuel oil, diesel or gas oil and, to a lesser extent, LNG as a source for their main engine propulsion and other auxiliary purposes. The first two being a by-product of crude oil, their prices move in-line with the price of crude oil. As per Stopford (1997), fuel costs account for a whopping 47% of the total voyage cost. The variables determining the fuel consumptions are; the type of ship, her age and the trading area. Due to higher speed requirement in the liner trade to keep on the schedule, the container ships have higher fuel consumptions than the bulk ship of similar size. With advanced propulsion systems modern ships have better fuel efficiency than their older counterparts. A ship frequenting the area with regular storm onsets or potent sea currents would have higher fuel consumption than the one navigating on normal routes. In the early part of the1970s, when fuel prices were substantially low, the ship owner had little to worry about changes in price. However, in the latter part of the same decade, when oil prices rose by almost 1000 per cent (Stopford, 1997), the whole orientation of ship building and ship operation changed. The following graph shows the variation in the average yearly pricing of gas oil at the port of Rotterdam for the period ending in 2011:

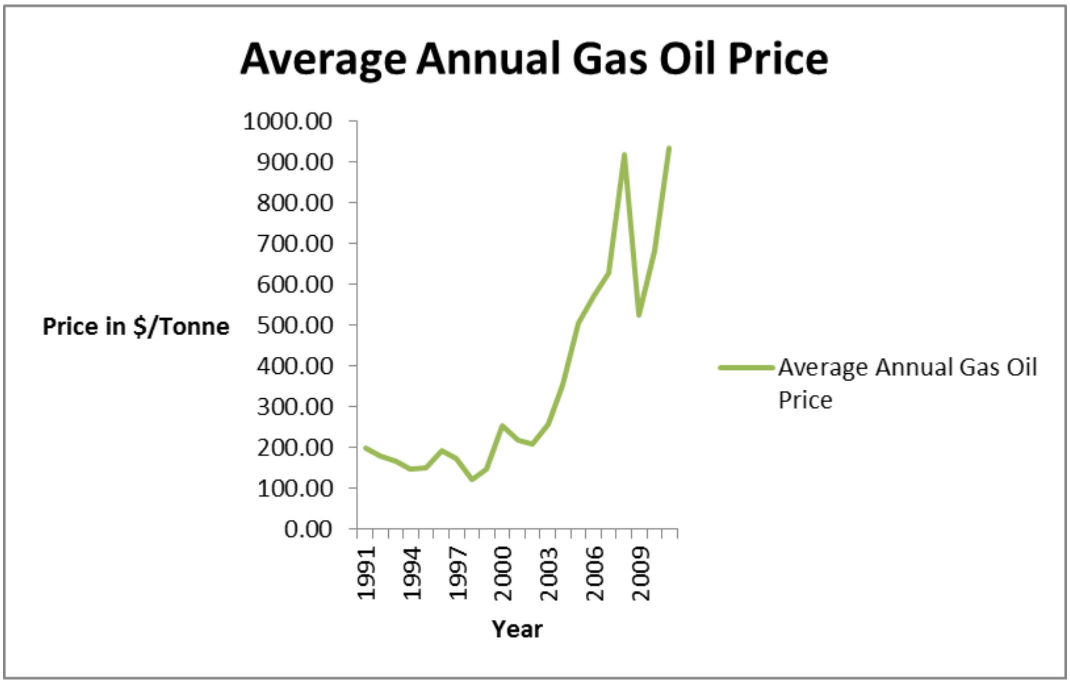

Figure 5, Average annual Gas oil price movement ,1991--2010, Courtesy: Clarkson SIN, Source:Self

Although the ship owner has little control over the price of fuel, he can certainly gain from advancements of technology in fuel-efficient engines or improved hull forms. Another area where ship owners can control the level of fuel consumption is the way the ships are operated.

Even with these controls and technologies in place, the ship owner remains vulnerable to the changing price of fuel, which in adverse conditions can chip away a major share of the operating profits.

4. Market or business risk

From the broader perspective, market risk implies potentials for a loss in earnings. It covers shipping dynamics as well as the world economy as a whole. Sources that affect the earnings are the uncertain freight revenues and the cost of the ship's operation.

As per Gray (1987), this is the most important risk that a ship owner must learn to manage. This is so because the earlier three risks affect the cost, whereas market risk affects the revenues. Hence, even though cost-related risks are equally important, the ship owner must be more watchful for market risks.

6. Default risk

It can be described as the inability of the ship owner to pay back the principle debt and interest rates to the banks in the case of debt finance.

7. Counterparty default risk

This risk is prevalent in the shipping business and becomes more apparent during the periods of financial depression. Every ship owner faces the risk of a counter party defaulting on its due payments or service commitments leading to uncalled costs.

8. Liquidity risk

Being a capital-intensive industry, a major proportion of the ship owner's wealth is invested in physical or real assets – that being the ships themselves. However, this wealth is constantly subjected to liquidity risk, i.e. the inability of the ship owner to sell off the ship at short notice in the times of need or sell out on a promising opportunity.

9. Political risk

The risk pertaining to a loss of business or undue cost, as an effect of a political or institutional ruling. For example- Recent uprising in Middle Eastern and North African countries led to diminishing demand for oil tankers on these routes.

10. Technical or operational risks

Every ship owner's worst nightmare is marine casualty involving his ship. A ship is a floating plant, which is susceptible to any and every kind of risks arising out of operating a machinery. The weather factor amplifies the likelihood of these risks. This is one such risk which cannot be effectively hedged against.

4.5 Cost Involved in Running the Ship

The actual cost incurred in the operation of the ship is the function of the real costs, inflation/deflation, and the aimed intangible brand value in the market and trading area of the ship. Putting it down in the mathematical form,

Let, $C_a = Actual\ Cost$; $C_r = Real\ Cost$; $I_d = Inflation/Deflation$; $B_v = Aimed\ Brand\ value$; $T_a = Trading\ area\ of\ the\ ship$

$$\boldsymbol{C_a = C_r \pm I_d + B_v \pm T_a}$$

The real cost is the absolute value of the services or goods utilised in operating the ship. These real costs are inflated or deflated as per the prevailing rate of inflation or deflation.

Going by the strategic vision and policy documents of individual ship owners, it suggests that all of them intend to establish themselves as quality-service providers. However, their business strategy does not necessarily match with their vision. This is especially true in the lesser developed parts of the world, where ship owners intend to capture the domestic market. In such scenarios, the ship owner's expenditure budget has a very narrow scope; the bare minimum to meet mandatory regulations, cost-efficient storing, and in some cases re-manufactured spare parts for the ship's machinery and not-so-well-trained crew members. In contrast, the ship owner who aims to position himself as a trend setter in the market and wants his name to be associated with quality would certainly have higher costs than those mentioned in the previous case. In the latter case, the ship owner maintains his ship to the highest standard possible, and this involves a high-standard and costly crew, more frequent replacements of spare parts than what is required under international regulations, and expenses towards research and development, to name a few.

Lastly, the trading area of the ship also affects the actual cost. A ship trading in US or European waters would certainly have higher costs than one trading in, say, S.E. Asian or African waters. This is so because certain developed countries have more stringent safety and environment control regulations than the internationally accepted norm. A ship calling at a port situated in the state of California in the USA needs to change over its propulsion mechanism to gas oil with sulphur content less than 1 ppm, 24 hours prior to its arrival in the port. On the other hand, a ship calling at some Asian ports can continue to operate on heavy fuel oil, thus saving on the expensive gas oil. Similarly, a ship operating on the US coasts has to exchange its ballast water when calling to a port in a neighbouring state, which requires the additional running of auxiliary engines, thus incurring higher fuel costs.

It is equally true that the ship owner providing these superior services demands premium freight rates. However, during times of economic depression they ought to fall back to the market freight rates due to the excess tonnage available in the market.

As per Stopford (1997), the cost involved in running the ship can be classified into five categories:

1. **Operating costs –**

These are fixed costs incurred in the way of the day-to-day operation, irrespective of whether the ship is on-hire or off-hire, which includes

Crew wages

Stores/ Lubricants

Routine maintenance / Repairs

Insurance

Administration

Periodic maintenance costs – Periodic dry-dock and major repairs

2. **Voyage costs -**

These are variable, depending upon the duration of the voyage as well as any other special requirement pertaining to that voyage, which includes,

Fuel costs

Canal dues

Port charges

Agency costs

Extra crew costs for cleaning/preparing the ship’s holds/tanks

Brokerage commission

3. **Capital cost –**

Depends upon the way the ship is financed.

Debt financed – Annual premium paid back to lenders

Equity financed – Dividends paid back to share holders

4. **Cargo handling costs –**

Not of much relevance in bulk trade. Includes the costs of loading, discharging, stowing and lashing of cargo, especially in the liner trade.

The costs discussed above vary with the type, size, area of operation, and age of the ship. Capital costs of an LNG tanker would be higher than all other ship types, whereas operating costs may be similar to other types of ships. Likewise, older ships would have lower capital costs and higher operating costs when compared to newer ships. Whereas, an oil tanker engaged in a lightering operation would have higher periodic maintenance costs compared to an oil tanker doing longer ocean voyages.

Another important determinant of these costs, leaving aside the capital cost, is the level of participation and motivation of the shipboard crew in the company's earnings. After all, these are the people who are working on the site, and sometimes, their casual approach leads to higher than expected annual costs and thus less profits.

4.6 Freight Rate and Its Determinants

A non-storable underlying asset makes the shipping-freight markets unique in their character. Mirroring the functioning of financial markets, the players in the freight markets come together and agree upon a particular instrument with the intention of making some profit from the deal. The only difference being that the commodity being traded is the service for transporting goods between two locations. The available instruments are the different types of charter parties with their distinct terms and conditions. The choice from these so-called instruments determines the short-term operational margins of an outfit – be that a ship owner or a trader or a non-ship-owning transport service provider. Succession of such choices, or a strategy towards these choices, determines their long term profits or, for that matter, financial survivability.

On broader terms, there are two types of chartering contracts: The demise and Non-demise. The demise or a bareboat charter is the least-utilised contract type in contemporary markets. Non-demise type includes the voyage charters and the period charters. The rest of the contracts can be called as a hybrid contract, as they are an amalgamation of certain features of voyage and period charter. Most of the terms and conditions are common in these contracts. The distinguishing elements are the period of the agreement and the cost allocation among the parties to the contract. The allocated cost component of the contract determines the function of the concerned parties. For example, in the case of the period charter, the charterer is responsible for defraying the voyage costs, hence it is quite obvious for him to oversee the commercial functions – the routing and bunkering in particular – and let the ship owner take decisions regarding the day-to-day operation of the ship. As long as the ship owner's operational decisions are not hampering the commercial viability of the ship, the charterer would be happy. On the contrary, in the case of a voyage charter, where the ship owner is responsible for the voyage costs, he would oversee the commercial as well as the operational functions. More on these contract types is addressed in the following section-4.7

Koopmans (1939), Hawdon (1978), and Stopford (1997) among others, are in unequivocal agreement over the perfectly competitive market structure of the bulk-shipping segment. In other words, the freight rate is determined by the interaction of the supply and demand for tonnage, elements of which have already been discussed in an earlier section-4.2 and 4.3. Hawdon (1978) views the freight-rate determination in the tanker market as the series of interactions between the market for the tanker services and the market for tankers. He argues that the tanker-market sentiments are closely emulated in the dry-bulk market. The demand for, and the supply of, bulk-shipping services has a price that is inelastic in the short term, thus any variation in either the demand or the supply, greatly affects the freight rates. In the long term, the present and expected freight rates, anticipated seaborne trade, ship-building cost, and other relevant variables, determine the supply of the ship and thus the freight rates.

On the macroeconomic front, the determinants of freight rates are:

- Industrial production – demand for sea transport of raw materials for production of goods and upon production, subsequent demand for sea transport of finished or intermediate goods, thus deriving a demand for shipping.

- Commodity Prices - leaving aside the seasonal fluctuation, Commodity prices can be good indication of overall health of shipping business. Higher commodity prices indicating higher consumption and better economy, thus higher freight rates.

- Bunker prices – Although not significantly, a higher bunker price would append the freight rates in voyage markets and put downward pressure on the time-charter market.

- Available tonnage and it’s utilisation in the market – Higher availability of tonnage would reduce the freight rates and the opposite in cases of scarcity. More importantly, it is the utilisation of the available fleet which determines the freight rate. Higher availability with higher utilisation is a good sign for a market as compared to high availability with lower utilisation. Generally, during stronger period utilisation can reach up to 90 %, but it never touches 100%.

Apart from these macroeconomic variables, there are some other microeconomic determinants of the freight rates:

- Ship’s age - With ever growing sensitivity towards environment and cost consciousness, modern ships are preferred over their older counterparts. Newer vessels need to be compensated for higher capital cost paid by their owners, especially in the times of uncertain cash flows. These underlying factors make newer freight earn more freight than the older counterparts. Köhn and Thanopoulou (2011), in their study, verified this claim. In addition to high capital cost, they argue that new ships built during peaks of economic cycles, as was seen in the last decade, have lower operating margins compared to older ships which were built at a lower price. Thus, the owner of the new ship would demand higher freight as compared to the older ships. However, it is not common to contract newer ships at better rates than the older ones on voyage charters. But, certainly the newer ships have better employability in the market and thus, a superior revenue generation prospects which can be taken as a proxy for better freights. In period charter, fuel efficient modern ships do command better rates than their older sisters.

- Geographic location or trade route – A higher compliance standard required for trading on certain routes, as well as highly liquid routes, have higher freight rates.

- Geographic availability – Level of availability of tonnage in a particular area is also an important determinant of freight rate. For example, in the recent pre-crisis period, huge demand for Iron ore in the Far East countries induced the demand for the capers on the pacific routes at exorbitant rates. This made the ship owners position their ships in the Asian markets, leaving the Atlantic market in a vacuum. Consequently, the charterers had to match the freight rates offered by their Asian counterparts to meet their transport demand.

- Size of the vessel - Normally, the smaller size ships are engaged in carrying relatively higher value cargoes, most of the times requiring extra care and superior operational standards as compared to carrying pure raw materials. In the voyage charter, the freight is paid in $ per ton, with the economies of scale in ship size reducing the cost of carriage and the relatively lower value cargo carriage might reflect on the freight being offered to these ships. In contrast, in time charter the ships are hired on a per-day basis, thus pragmatically, the cost of hiring a bigger ship would be greater than that of a smaller ship. Hence, superficially, the time-charter rate appears to be higher for bigger ships than that for smaller ships on absolute terms only.

- Cargo size in relation to the ships capacity – In voyage charters, freight is paid per-ton of the cargo carried by the ship. Due to shallow depths at the port, or some other operational restrictions, it is quite normal that on some trade routes the ships are not utilised to their full capacity. To compensate for the lost revenues, the ship owners could demand a premium over the normal freight earnings. The charterers prefer paying this premium over the dead-freight dues.

- Cost of running the ship – Like every other business, a ship owner would charge higher freight when costs involved are higher.

- Price of Newbuilding / Secondhand / Scrapping – The price of ships, new/ secondhand, and its residual value are interlinked with the freight rates. It can be said that, freight rate determines these prices and these prices determines freight rates. For example- When the utilisation of available tonnage is higher, fully booked ship yards and consequent shortage of tonnage supply would jack up the freight rates.

Freight rates are also determined by the conditions of the contract (a low load or dis speed often only introduced to avoid demurrage accruing and to earn dispatch)

4.7 Charter Parties

Charter parties are contracts for the transportation of cargoes by ship or to hire ships. The intended utilisation of a particular charter can differ from contract to contract. Either of the cargo seller(s) or buyer(s), as per their sale/purchase agreement, may contract the ship to transport the intended cargo from place A to B. Then, as in every other market, there are market speculators, who hire the ship only to sub-charter to the third party at a higher rate. Finally, there are “non-vessel owner transport service providers” – more commonly known as the freight forwarders – who provide the service of goods transportation without being party to the title of the goods or of the ship. However, the basic purpose of any hire remains the transportation of goods.

The contract is an agreement between two parties, namely the charterer and the ship owner. In reality, there are more than two players involved in concluding the deal. The charterer, supposedly looking out for a suitable ship to transport his goods, delegates the task to his broker. In the meantime, the ship owner, with his ship open for employment, approaches his broker. Both the brokers – representing the interests of the charterer and the ship owner – assess the suitability and negotiate the terms of the fixture before the offer is made mutually concrete. This is a most-simplified depiction of a contract fixture procedure, which becomes more and more complex as the ships and contract offers increase in number. Thankfully, modern communication facilities and, more importantly, the internet, have come in handy to facilitate this, otherwise, dilatory process. In fact, some of the brokerage houses have even started e-chartering. With considerable capital invested into it’s infrastructure, success of e-chartering is still questionable.

There are quite a few types of mutually agreed arrangement between the ship owner and the hirer. But, every such agreement revolves around three common interests: the ship particulars, the trade particulars, and the time period. To evaluate the suitability of the ship for the cargo parcel, and to suffice his commercial interest, the charterer needs the particulars of the ship, which includes the ship’s design particulars as well as its operational capability. As the charterer is interested in the particulars of the ship, so the ship owner is interested in the particulars of the trade to ascertain his commercial and operational interests. The information may include the cargo description quantity, the loading/discharging port(s), the intended routing, and other relevant details. Lastly, it is the duration of hire and related silent features that determine the type of contract.

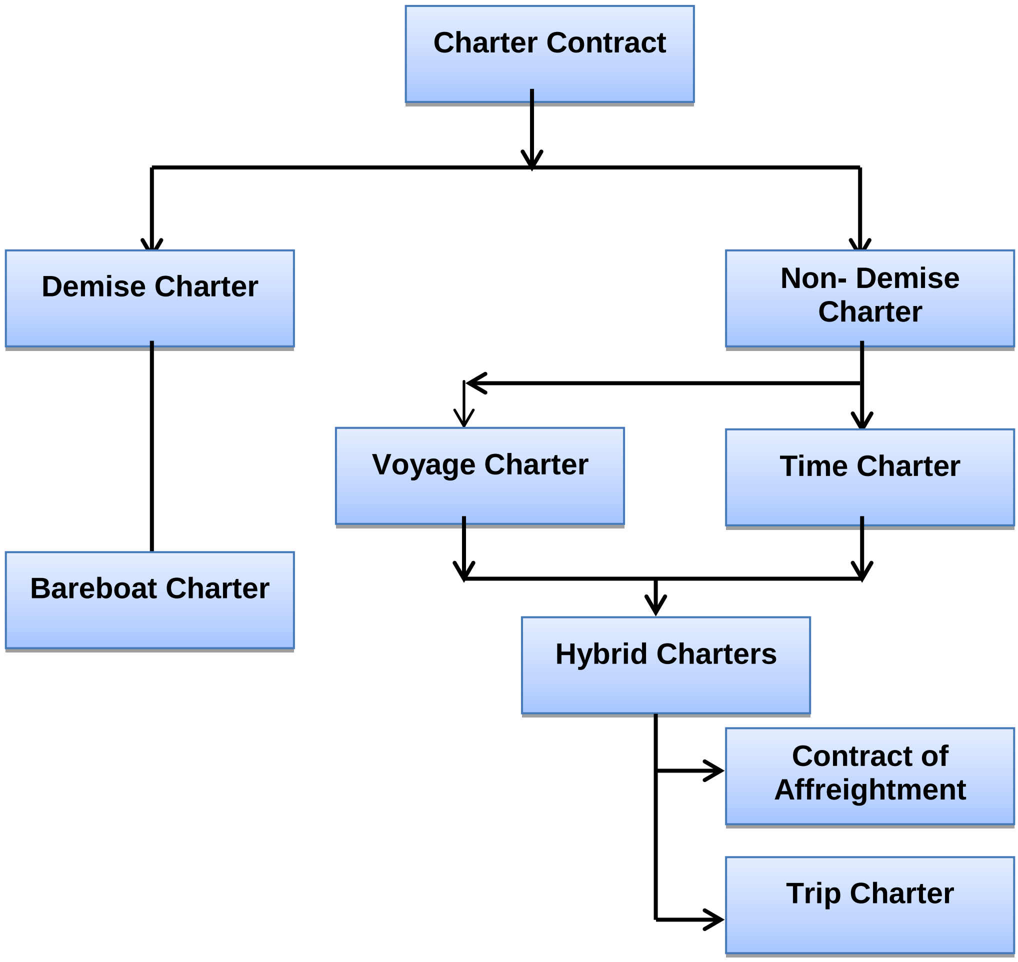

Figure 6, Hire contracts types, Source: Self

As can be seen from Figure 6, the charter can be broadly categorised into two types; the “demise” and the “non-demise” charter. Although the demise charter is not common nowadays, there are quite a few ships which are being chartered out on a similar concept called the “bareboat charter”. The majority of contract agreements entered into are the non-demise types, the voyage charters and the time charters. Then there are hybrid charters that are an amalgam of certain features of both the time and voyage charters. For example, CoA, Trip charter, space charter, etc.

Bareboat Charter

As the name suggests, in this kind of charter the ship owner puts his bare ship at the disposal of the charterer. By “bare” it means without any crew, consumables and fuel. Thus, the charterer acts and performs the function of a ship owner except for paying the capital costs and the hull and machinery insurance premiums. It is seldom that the bareboat-charter agreements are meant for the purpose of carriage of goods. These agreements are part of the “sale/purchase agreement” of a ship, requiring complex financing. For example, the lending institution financing the purchase of the ship could choose to retain the ownership of the ship and charter the ship out on bareboat to the borrower till the time it gets its dues back. This serves two purposes: (1) In addition to receiving its cost of capital, the lending institution makes profit by chartering out the ship, and (2) It escapes any liabilities arising out of actual operation of the ship. Other reasons for following the bareboat charter agreement could be taxation and employment. A ship owner from a not-so-tax-friendly country could charter out the ship on bareboat to its subsidiary registered somewhere in tax haven. By doing so, his tax liability is limited only towards the freight earned from chartering out the ship. Crew wages form the major proportion of the daily operating cost of the ship. A ship owner intending to take the benefit of the flag of convenience without changing the registry of his ship – which may make it mandatory to employ local crew – could charter his ship out on bareboat to its subsidiary registered in a more relaxed environment.

Voyage Chartering

A typical voyage charter involves a single voyage for transporting a large parcel of cargo, big enough to fill the entire ship, from point A to point B. The freights are paid per ton of cargo carried on board the ship. Under this charter the ship owner is responsible for all the costs incurred towards operating the ship. In return he is paid the freight.

The reason behind mentioning the cargo size being large enough to fill the entire ship is the freight structure under this contract. If the charterer is not able to fill the entire ship, then he is liable to pay for “dead-freight”, an instrument to safeguard the owner’s interests. The dead-freight is a compensation, to which the ship owner is entitled, for the revenue lost due to the inability of the charterer to fill the ship. Due to the nature of the freight structure involved, the operations related to the cargo, and to the ship itself, are time sensitive. It begins with the ship presenting herself for loading at the load port and ends with her departure for the discharge port. As the age old adage goes “time is money”, and to account for the delays before, after and during the cargo operations, voyage charter has a “demurrage and dispatch” clause. If there is any delay in relation to cargo operation caused on the part of the charterer, the ship owner is entitled to get compensation for time lost under the demurrage clause. At the same time, if the charterer arranges to free the vessel of her obligation ahead of the agreed duration, he is entitled to be rewarded under the dispatch clause for the time saved.

Then, there is a clause pertaining to the cancellation of the contract. The ship owner and the charterer agree to a certain time duration within which the ship owner is obliged to present the ship at the load port ready, in all respects, to load the agreed cargo. If the ship owner fails to do so, then the charterer is under no obligation to continue with the contract. The said period is called a “laycan” (Laydays and Cancelling). To explain the importance of the laycan, let us consider an example of a charterer who intends to have a certain quantity of iron ore shipped from Dampier, Australia, to his steel plant somewhere near Nagoya, Japan. He needs this quantity shipped to his Nagoya plant by 16th of September at the latest; any further delay may involve huge consequential damage: (1) Due to a lack of raw material he will have to shut down the plant, which requires a significant amount of time and uncalled expenses to bring it back online. (2) He might lose the potential customer. After accounting for the land transport he reckons that, if he has the cargo at Nagoya port by 15th of September at the latest, it will suffice for his purpose. After having considered four days of port time and ten days of weather-adjusted sea passage, he decides to have the ship ready for loading in Dampier by 1st of September. It is quite unlikely that the charterer would find the ship readily available at the port of Dampier, but he would surely find plentiful options in the region. To account for this repositioning of passage to the port of Dampier, he would put the clause in the fixture requesting the ship in the port of Dampier ready for loading within the time duration starting from 31st of August to 1st of September. If the ship arrives beyond this period then he is not liable to abide by the contract terms.

The above example is for illustration purposes only and in no way mirrors the actual planning procedure being followed by the charterers, which is way more complicated. However, one interesting point to discuss from this methodology of forward planning on the part of charterer is the relation between the freight rates and the laycan time. It is uncommon to find a charterer fixing contracts a few days before the loading dates. Continuing with the above example, for the said voyage, the charterer might fix a contract in August or even earlier. If the freight rates are high and the charterer anticipates the upward trend of the freight rates to continue, he might fix a contract a couple of months in advance using FFAs. However, with such a large lead time and associated uncertainties involved with the ships sailing schedules, the charterer would agree to the longer laycan in order to extend some flexibility to the ship owner as well as to capitalise on the opportunity of fixing the charter on lower rates. On the contrary, if the freight rates are lower and the charter anticipates the downward trend to continue, he would wait till the end to fix the charter at the lowest price. In this scenario, the time gap between the fixture date and the actual loading date is small. The ship owner and the charterer are certain about the ship's sailing schedule, and hence the laycan duration could be shorter.

Time Charter

Under a time charter, the charterer hires a ship for a certain duration which could range from a few months to a few years. The ship owner still provides for the capital costs and the operational costs, while the charterer bears the voyage costs. The hire charges are on a per-day basis, paid in advance every fortnight or month as per the agreement. The commercial management of the ship is with the charterer, under which the charterer utilises the ship for transportation of goods between ports on consecutive voyages. The voyages do not necessarily have to be fixed, but are bound to be within the geographical region agreed to in the contract.

The demurrage/despatch and laycan clauses are not that relevant under the time charter, but the agreed voyage speed, fuel consumption and port productivity are the few factors, amongst others, of prime importance. Any underperformance in relation to these factors makes the charterer entitled to compensation from the ship owner. The ship is expected to be seaworthy and ready for cargo operation throughout the contracted period, except for certain allowances which are made for routine maintenance. Beyond this period, any intended or unintended maintenance and/or deficiency leaving the ship unseaworthy leads to the ship being put on "off-hire". The hire charges are deducted on the pro-rata basis for the off-hire period.

There are some distinguishing features in the time-charter contracts which are not normally available in voyage contracts. For example, with respect to the freight structure, the parties may follow the profit-sharing instruments. Under profit sharing, in addition to a pre-agreed fixed daily-hire rate, the ship owner is entitled to profit from a floating rate. A floating rate is a certain proportion of the difference between the fixed rate and the market benchmark, which the charter pays to the ship owner when the prevailing spot rates are higher than the agreed fixed rate. Another variation in the hire charges structure of the time charter is "Ballast bonus", wherein the ship owner is paid a lump sum amount as a compensation on ballast leg before delivery, while the loaded passage has normal freight structure.

The motive behind entering into the time charter contrasts from different perspectives. For the charterer, it could be hedging against an anticipated spot-market adversary i.e. higher freight rates, or for more reliability in his logistics operations. For a ship owner it could be hedging against falling spot markets, or when they have cargo contracts which they are not able fulfil with their present fleet of ships.

Hybrid Charter Contracts
Apart from the voyage- and time-charter contracts, there are hybrid contract types which combine some aspects of the two. The contract of affreightment (CoA) is similar to a voyage charter, however, the ship is not contracted for a single voyage but for a certain duration within which the ship makes multiple and/or consecutive voyages. The cost allocations are similar to a voyage charter. The freight structure may be fixed or floating. In the trip charter, the ship is hired for a single voyage, or consecutive voyages, but the freight is paid on the basis of the duration of the voyage performed rather than the quantity carried, which is similar to the time charter contracts. It can also be called as short term time charter. Then there are the slot- or space-sharing agreements which are prevalent in the liner and specialised trade. Under the slot-sharing agreement, the operator of the ship allows the other operators to utilise the empty space in his ship on a particular route in return for a same number space allocation in the ship operated by other operators.

4.8 Risk management in shipping

As discussed in section 4.4, the shipping business is characterised as capital-intensive, extremely volatile, highly cyclical and uncertain. These typical characteristics of the business could take the ship owners to riches within a short period of time or could push them to penury even faster. There is a freight rate volatility risk, a bunker price fluctuation risk and an exchange rate risk, amongst many. Not only the ship owners but the other market players face these risks equally. Most of these risks are overlapping and are effectively managed by the market players, related to shipping, in the finance industry. This section aims to address the available hedging instruments for the most potent risk, the freight rate volatility. Although other risks are equally important, the freight rate fluctuation is the risk which, if not managed carefully, can put the ship owners' business in doldrums.

It would not be wise to conclude risk management as a new concept. In fact, there are two types of risk management techniques; the traditional and the modern. The traditional type of risk management involved physical hedging such as the time charter contracts. The duration of such contract could vary anywhere between a single voyage to a 5-year period. Although these contracts give surety of income, their inflexibility in terms of pre-agreed terms and fixed freight rates proves hindrance in effective revenue management. The modern risk management technique involves the utilisation of sophisticated freight derivatives: Freight futures, Freight options and Forward Freight agreements.

Freight Futures Agreement
The trading in the derivatives' futures started with the establishment of The Baltic International Freight Futures Exchange (BIFFEX) contract in 1985. This derivative had the Baltic Freight Index as an underlying asset. The charterer anticipating the upwards trend of the spot price would buy the BIFFEX contract from the ship owner

who has opposite views about the future market trend. On the date of settlement, the deals were closed with reference to the prevailing BFI level. To capture the various segments of the dry bulk trade, numbers of sub-indices were introduced. Thus, the Baltic Panamax Index (BPI), The Baltic Capesize Index (BCI), the Baltic Handymax Index (BHMI) and the Baltic Supramax Index (BSI) were created. On the same line, indices were devised for the tanker industry. These indices are the weighted average of the highly liquid routes relevant in the particular segment. The chosen routes are assigned certain weightage and the "basket" of such routes determines the particular index, which reflects the daily movement in rates of the spot and time charter. However, their methodology of combining multiple routes in the determination of the index was the reason behind the decline of the BIFFEX market. For example, the ship owner and the trader fixing a short pacific route did not want to settle the deal linked to an index which is a basket of routes around the world**.** These market wide concerns led to the development of the "Freight Future Agreements" (FFA).

The working of the FFA remains the same as that of the BIFFEX, with the only difference being that the contracts are sold and purchased, privately, between the principles. The charterer anticipating an upward trend in the freight rate would advise their brokers about their intension of buying the FFA with required details. Meanwhile, the ship owner who is expecting an opposite, downward trend in the market would like to sell the FFA at the prevailing price and would advise their brokers accordingly. Both these brokers negotiate a deal and the transaction takes place. On the fixture date, the difference between the contract price and the average of the preceding 7 days rate, in case of spot charter, and the contract price and the average of last month's rate, for time charter, for the specified voyage are settled amongst the principals, as per their position (Kavussanos, Visvikis 2006)**. T**his mode of dealing is called "over the counter" (OTC) sell/purchase. Owing to its private nature of functioning, the FFA market has largely remained unregulated and secretive. One of the advantages of the market being unregulated is that the market players can freely change the terms of the contracts as per their taste (Kavussanos, Visvikis 2006).

Hybrid FFA

The private dealing of the FFA does not come free of counter party default risks, unless such risks are shared by some large ship brokerage houses, financial institutions or other similar institutions, also called the clearing houses. When the transaction of the FFA takes place through these clearing houses, it is called hybrid FFA. Lately, the involvement of these large clearing houses in the transactions has aided the growth in the FFA derivative markets. One of such widely known clearing houses is the International Maritime Exchange (IMAREX) which, in collaboration with the Norwegian Options and Future clearing house (NOS), facilitates the trading of Freight futures and clearing of the FFAs as well as the Freight futures. Other noted exchanges trading the Freight Futures are the New York Mercantile exchange (NYMEX) and the Singapore exchange (SGX).

Freight Options

Freight options are an alternative derivative instrument available to the market players for the purpose of risk management. Similar to options trading in the financial market, the freight options trading involves the standard Freight put options and the Freight call options with certain expiry dates**.** Unlike the FFA, the options contract gives the buyer the right, but not an obligation, to buy (call option) or sell (put option) the underlying asset at a future date. The main advantage of buying the freight option is that the loss from the deal is limited to the premium paid towards the options (FFA Options/FIS). A principal buying a call option would benefit from it when the freight rate is on an upward trend, whereas the principal who is selling a call option would earn profits when the freight prices are falling. Similarly, in order to make profits a principal buying a put option has an anticipation of a downward trend in the freight market. On the contrary, the seller of the put option would have anticipated an upward trend in the freight markets. The options are transacted through the brokers of both parties. It can be negotiated principal to principal, over the counter (OTC), or through the clearing houses, same as the hybrid FFA. The brokers of the principle agree on the contract price and negotiate on the premium to be paid for the right to buy or sell the underlying asset, being the freight rate in this case. The premiums are quoted in $ per day for the time charter contracts and in $ per ton for voyage contracts (FFA Options/FIS).

5. Behavioural Theories

5.1 Behavioural Decision Making

Over the years, behavioural economists have been involved in studying the logic behind human decision making and choices. Why does a particular person invest in one stock and not the other? Why are some people regular visitors to casinos while others refrain from gambling? Or for that matter, why does one ship owner concentrate on one shipping sector while the other diversifies into a number of them?

Historically, various descriptive and normative theories have been developed relating to human psychology. A descriptive theory establishes the functioning: how things are done. A normative theory advises how it should be done. One such theory, and the first of its kind established to capture the human behavioural element in decision making under risk, was that of the "expected value". Mathematically described, the expected value of an outcome is its payoff multiplied by the probability of its occurrence. An optimistic person would bet on the event with maximum payoff, whereas the conservative person would base his decision on the worst case payoff. But, different people have different weightage for the expected value of the same outcome.

Daniel Bernoulli was the first to propose modification to the expected-value theory. In 1738 (McDermot, 2001), using a coin-tossing game, Bernoulli demonstrated the limitation of expected-value theory. He argued that the value a person attaches to an outcome does not entirely depend upon its expected value, but the probability of winning or losing, and other emotions equally define the utility or subjective value of an outcome. Using this principle, Bernoulli devised the well-known theory of "expected utility". Expected utility is the concave and subjective evaluation of an outcome. The concave shape of the function implies a decreasing marginal utility. In other words, a person attaches less value to the marginal changes as it moves away from the origin of the curve, or a wealthier person attaches less utility as compared to a poor person for same amount of change. For example, an increase of $2 in the price of the milk costing $2 dollars is a cause of concern for a customer, but he wouldn't mind the increase of $2 in the price of a wristwatch costing $1000. The other aspect of the concave function can be seen from the risk-aversion context. A wealthier person is less risk averse compared to the poorer one. Bernoulli also emphasises that a person prefers surety over a gamble for the same utility value.

Bernoulli's Expected-Value Utility Function

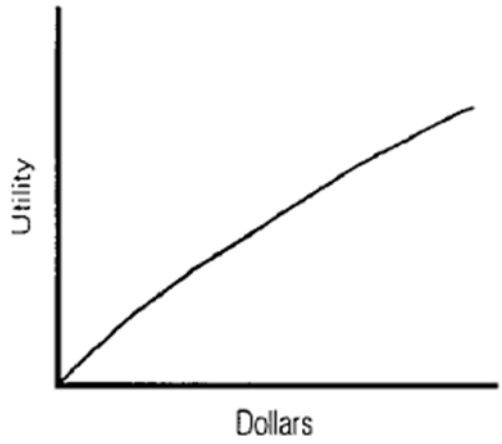

Figure 7, Expected-Value Utility function, Source: (Shefrin& Statman,2000)

It was Von Neumann and Morgenstern that redesigned and revolutionised the expected-utility theory with "revealed preferences". Bernoulli's model assumes that a person chooses the option with the highest utility, whereas the Von Neumann and Morgenstern model describes a person's preference for the utility values of the choices.

Freidman and Savage had a parallel concept, but with a marked difference; in their solution to the insurance and lottery puzzle, the duo claim that a person's attitude towards risk is not a concave function as suggested by Bernoulli. In fact, it is mix of a concave and a convex function. The attitude of the person purchasing the insurance policy would be consistent with the concave part, while that of buying a lottery ticket would resemble the convex part.

In contrast, the "prospect theory" disputed the claims made by the expected utility theory. Kahneman&Tversky (1979) define decision making under risk as a choice between prospects or gambling. Under prospect theory, people make decisions in-line with their value function. The values are assigned to changes in wealth or welfare rather than the final state of wealth. In other words, people make choices on the basis of involved losses or gains with respect to a reference point rather than the final value of an asset. The reference point mentioned could be different for different people. The value function is an S-shaped curve. It is concave for gains and convex for losses. The slope of the curve signifies sensitivity for change, being highest near the reference point, as shown in Figure-8 .The curve is steeper for losses than for gains, displaying the human psychology of more aggravation for losses than the pleasure from gains.

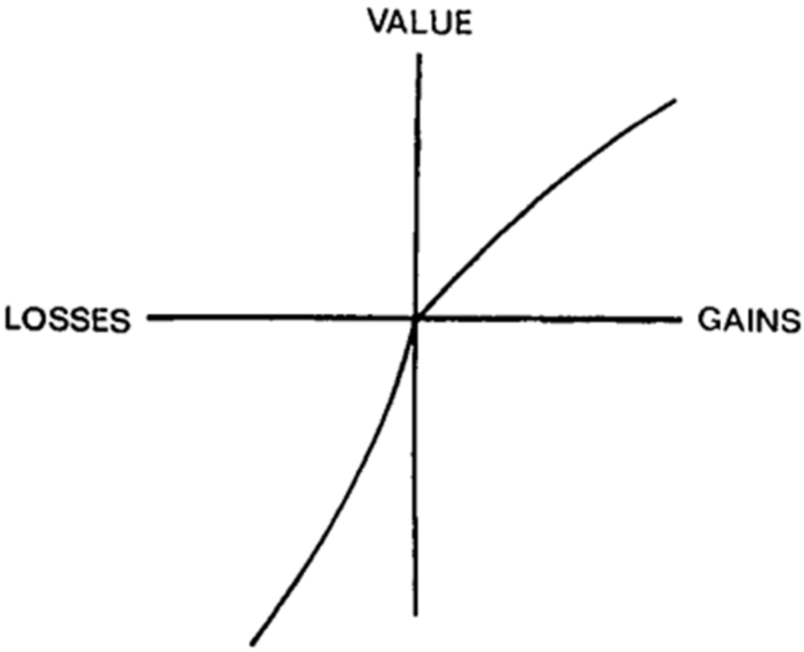

Figure 8, Prospect Theory Utility function, Source: (Kahneman&Tversky, 1979)

The second component of the prospect theory is the “weighing function”. Under the theory, each outcome is multiplied by the decision weight inferred from the choices between prospects. However, these weights are not probabilities as in the case of subjective expected-utility function, wherein they serve as the measure of perceived likelihood of an outcome. The decision weights are a descriptive feature of people’s choices. An important feature of the weighing function is its inconsistency at the extreme positions, implying the limited ability of the person to comprehend and evaluate – people may treat a highly likely (but uncertain) event as certain, or a highly unlikely event as impossible. In other words, the extremes – certainty and uncertainty – receive higher or no weights at all than the intermediate event. The second important feature of the weighing function suggests that people tend to over-value lower probability events compared to higher probability. For instance, the shipping fraternity considers oil pollution more damaging than the pollution by ballast-water discharges; to a certain extent it is, but considering the quantity of the ballast-water discharges around the world, the opposite is true. Figure-9 depicts the weighing function.

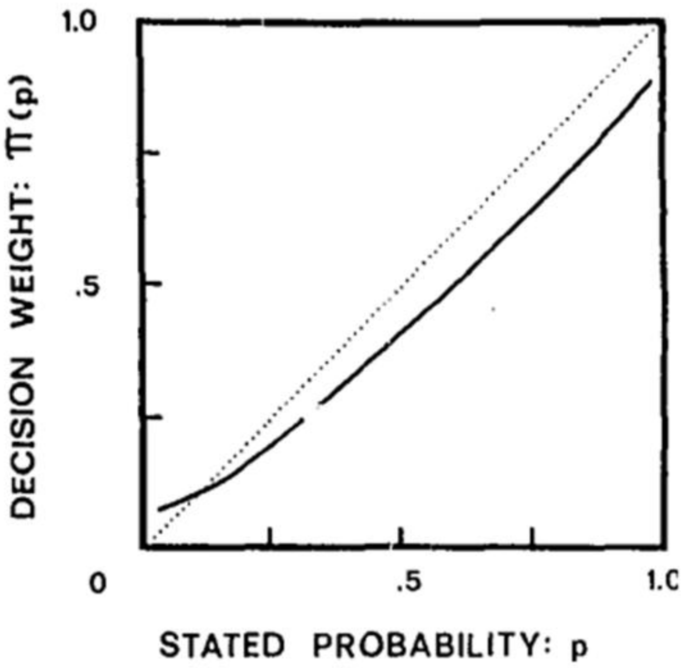

Figure 9, Prospect Theory decision weights, Source: (Kahneman&Tversky, 1979)

5.2. Mental Accounting

- In May, 2012, I decided to cross-train myself in the commercial side of shipping and pursue the MEL program at the Erasmus University. Apart from being deprived of my pay cheque, I had to bear the tuition fees and living expenses. Investment was high and so was the uncertainty of payback time, but in return I was presenting myself with different career options.

- In 2012, prior to arriving at Rotterdam to attend the MEL program, a market-savvy friend of mine had transferred the money, denominated in rupees, from India to a local bank in the Netherlands. The amount transferred was well in excess of his needs for the intended stay of one year. His justification for the act was his confidence in the anticipated fall of the Indian rupee against the Euro.

- Before proceeding to Rotterdam for my studies, to survive through the severe cold weather, I had purchased warm clothing back in India. My intention was to save on the bloated prices of clothing in the Netherlands. Although, later on I realised the quality of material I purchased was not appropriate to shield me against the excruciating chills.

The cognitive processes in the preceding anecdotes are called “mental accounting”. Each person has different MA for his individual goals. A person in his early thirties might have one MA for his retirement goal, one for his kid’s education and another one to pacify his speculative desire, etc. It is similar to financial accounting, in the sense that both have the ultimate aim of meeting the set target. However, financial accounting is guided by the principles of set rules or codes, whereas it is a person's individual behaviour that characterises the MA.

Thaler (1999) writes: "mental account is a frame for evolution describing the entire process of coding losses and gains, categorizing and evaluating the outcomes". When it comes to the framing of accounts, Kahneman&Tversky (1984) categorise it as:

- Minimal account – Evaluates the difference between two choices, disregarding their commonalities. For example, a person going to the grocery store to purchase apples and finds orange juice on sale would use this account for making the decision to purchase one or the other.

- Topical account – Determines the loss/gain with respect to a reference point as a consequence of a decision. For instance, a person intending to buy a pocket calculator and a computer in an electronic store across the street, would be willing to drive down to the store 15 minutes away that is offering a $10 dollar discount on the pocket calculator worth $15. But, in the case of a $10 discount on the computer, costing $1000, he would prefer to buy it from the store across the street, instead of going to the distant store. In case of a pocket calculator reference point is $15 and corresponding discount accounts for 67% savings. In case of a computer, reference point is $1000 and the discount amounts to just 1 % gain.

- Comprehensive account – Considers all other factors, including current wealth, future earnings, and outcomes from other investments or events etc. When using the comprehensive account, the same customer might be willing to drive down to the distant store to purchase the computer with a $10 discount, if the store has offered to buy back his old printer for $40.

As can be seen from the above, account framing does influence people's choices and people take decisions piecemeal.

Thaler (1999) argues that MA is a topical account. However, in order to evaluate the joint outcomes of the multiple events or hedonic framing, to maximise utility, he advocates the following principles:

- Segregate gain (because gain function is concave)

- Integrate losses (because loss function is convex)

- Integrate smaller losses with larger gains (to offset loss aversion)

- Segregate smaller gains from larger losses (because gain function is steepest at origin, the utility of a small gain can exceed the utility of slightly reducing a large loss)

In order to adopt the above hedonic principles pragmatically, we can consider the product-marketing division of a particular company. In-line with the first principle, the company would attract more customers if it gives out discounts on two or more products compared with when it gives an aggregated discount on a single product. The second principle advises that instead of having a price rise on two products, the company is better off having an aggregate price rise on a single product. As per the third principle, instead of a price hike, an alternative of supplying a reduced quantity for the same price could be an option, and lastly, instead of giving a large discount on the product, a relatively small rebate would make the customer equally happy.

Among many, one of the most basic and important revelations made by Thaler (1999), and Kahneman and Tversky (1984), is that people do not consider cost as losses but as an investment, the philosophy on which this study is based.

5.3. Portfolio Optimisation Theories

With hundreds of different investment opportunities to choose from and the acceptance of diversification as risk reducing measure, the financial pundits advocates varied portfolio optimisation theories for the benefit of a lay investor. Notable amongst them are the safety-first theory, the SP/A theory and, widely acknowledged for its practical applicability, the modern portfolio theory (MPT) – also known as the mean-variance theory (MVT). This section aims to briefly highlight the features of each of them.

Modern Portfolio Theory / Mean variance Theory

Often referred to as Markowitz's portfolio theory, this pioneering theory is the most widely acknowledged in the portfolio optimisation domain. The founding theme of the MVT is the facilitation of a reduction in risk by diversifying the investments. The rate of return of the diversified portfolio is the weighted average of returns of individual investments in it, whereas the risk – measured by the variance or standard deviation of the portfolio – is less than the average of the individual investments. The MVT does so by considering the covariance between the individual investments. However, this simplified approach of the MVT has not come without criticism when it comes to real-life application. MVT does not incorporate the human behavioural element when determining the efficient frontier. For example, the person planning for his retirement would not prefer to invest in risky stocks – as suggested by the MVT theory, whereas, in contrast, an optimistic young individual would have a lower weightage for bonds in his portfolio. For a given set of investments, MVT determines an efficient frontier which is the same for every individual irrespective of his goal.

Safety-First Theory

As Shefrin&Statman (2000) put it ,"investors in the safety-first theory have a goal of minimising the probability of ruin". The probability of ruin is the probability of an investor's wealth failing to meet a certain subsistence level, i.e. the investor's aim to minimise $Pr(W < s)$, where W is the investor's terminal wealth and "s" is her subsistence level.

Let us consider P as a hypothetical portfolio with a mean return μ, and σ as the standard deviation of return. In the case where there are no risk-free securities, i.e. σ > 0, and the level of subsistence is low, i.e. μ > s, then for normally distributed returns, minimising the probability of ruin is nothing but the minimising the σ in which the level of subsistence lies below the levels of return. In other words, the investor objective function is to minimise (s-μ)⁄ σ. Even if the returns are not normally distributed, the theory suggests that the objective function remains the same, implying that all the optimum portfolios lie on the mean-variance efficient frontier.

Various authors have modified the theory since its inception. In Telser's model, the investor chooses a portfolio which maximises her wealth W subject to a constraint of the probability of ruin Pr(W<s) that does not exceed a certain safety level. The probability being mentioned here is not a cumulative, but discrete, probability.

SP/A Theory

SP/A theory is a theory of choice under uncertainty without a specific mention of applicability to portfolio choice. The theory is based on emotions S-security, P-potential and A-aspiration. Security is analogous to the emotion of the probability of falling short of a subsistence level – similar to the safety-first theory. Potential refers to a desire of reaching a certain level of wealth. Whereas aspiration implies meeting the goal of not letting the wealth level fall short.

As Shefrin&Statman (2000) put it , in SP/A theory two emotions operate on willingness to take risks; hope and fear. The theory postulates that when operating under fear, people overweight the probability of worst outcomes for computing expected value. On the contrary, with hope, an individual attaches more value to the best outcome. With the combination of hope and fear, the plot of probability transforms into a convex shape.

Behavioural Portfolio Theory

In behavioural portfolio theory, Shefrin and Statman (2000) combine the SP/A theory and mental accounting structure. They devise two types of approach, (1) Single account (BPT/SA), wherein the individual makes a decision by accounting all the outcomes in a single account, and (2) Multiple accounts (BPT/MA), wherein as the name suggests the individual has multiple accounts for each goal.

Both BPT-SA and MVT have a certain commonality; in both the theories investors consider a portfolio as a whole, and they do so by considering the covariance of the investments. However, the efficient frontier of MVT is in {μ,σ} space, whereas it is in $\{E_h(W), P\{W \leq A\}\}$space for BPT-SA .

Where,

μ = Expected return

σ= Standard deviation

$E_h(W)$ = Expected wealth

A = Aspired wealth level

Another similarity between both the theories is that investors prefer the highest μ and $E_h(W)$, and the lowest values of σ and $P\{W \leq A\}$.

In the BPT-MA, investors do not consider a portfolio as a whole, but as segregated into different mental accounts as per the corresponding goal. They do so by overlooking the covariance of the investments.

Portfolio Optimisation with Mental Accounts

This theory by Das et al. (2010) has integrated the features of BPT and MVT into the mental accounting framework. In MA theory, authors define risk as the probability of failing to reach the threshold level and have demonstrated the mathematical equivalence of MA, MVT and risk management using value at risk (VaR) theory. The principle theorem says that the aggregate allocation across MA sub-portfolios is mean-variance efficient with short selling. In other words, when short selling is allowed, the optimal behavioural portfolio lies on the MVT efficient frontier.

The MA theory suggests an alternative mathematical statement to trace out an efficient frontier.

$$\max w'\mu - \frac{\gamma}{2} w'\Sigma w \tag{1}$$

Subject to,

$$w'\mathbf{1} = 1 \tag{2}$$

Where,

"w" is the vector of the portfolio weights for "n" assets, $w = [w_1, w_2, \ldots\ldots w_n]'$

"μ" is the vector of the individual returns for "n" assets , $\mu = [\mu_1, \mu_2, \ldots\ldots u_n]'$

"γ" is the risk aversion coefficient

"Σ"is the *n X n* covariance matrix

$$\mathbf{1} = [1,1, \ldots.1]' \in \mathbb{R}$$

Hence, an efficient frontier can be traced out by maximising equation (1) for different values of risk-aversion coefficient, subject to full invested constraint of (2). The solution to this optimisation can be derived using the equation,

$$w = \frac{1}{\gamma}\Sigma^{-1}\left[\mu - \left(\frac{\mathbf{1}'\Sigma^{-1}\mu - \gamma}{\mathbf{1}'\Sigma^{-1}\mathbf{1}}\right)\mathbf{1}\right] \tag{3}$$

"γ" coefficient of risk aversion quantifies the risk-taking capability of an individual. The closer the value of the risk-aversion coefficient to zero, the more the individual is 'risk seeking'. However, compared to risk aversion, people are more comfortable stating their goal threshold and the probability of reaching that threshold. Assuming that the portfolio returns are normally distributed, the portfolio return threshold level "H" and the probability of failing to reach this level r(p) as α can be expressed in the mathematical statement,

$$H \leq w'\mu + \phi^{-1}\alpha[w'\Sigma w]^{1/2} \tag{4}$$

Where ϕ(.) is the cumulative standard normal distribution function. When the equation (4) is solved for optimality, its inequality sign becomes equality. Using equations (3) and (4) we can solve the investors' implied risk-aversion factor,

$$H \leq w(\gamma)'\mu + \phi^{-1}\alpha[w(\gamma)'\Sigma w(\gamma)]^{0.5} \quad (5)$$

Where,

$$w(\gamma) = \frac{1}{\gamma}\Sigma^{-1}\left[\mu - \left(\frac{\mathbf{1}'\Sigma^{-1}\mu \; - \gamma}{\mathbf{1}'\Sigma^{-1}\mathbf{1}}\right)\mathbf{1}\right] \quad (6)$$

It is not always feasible to have a particular threshold level for a given investment option. The problem would have no feasible solution when,

$$H > w'\mu + \phi^{-1}\alpha[w'\Sigma w]^{1/2} \quad (7)$$

In order to check the feasibility, we can maximise the right-hand side of the equation (7). If it is greater than the threshold level, the problem has the solution, if not then otherwise. In order to maximise the right-hand side of the equation (7), we shall use the value of "w" as obtained by the following equation,

$$w = \frac{1}{\phi^{-1}\alpha[w'\Sigma w]^{1/2}}\Sigma^{-1}\left[\mu - \left(\frac{1'^{\Sigma^{-1}}\mu + \phi^{-1}\alpha[w'\Sigma w]^{-1/2}}{1'\Sigma^{-1}1}\right)1\right] \quad (8)$$

If the problem is not found to be feasible, we can alter the threshold level or the investment options.

6. A Numerical Example

To illustrate the concept pragmatically, we shall consider a hypothetical case of a ship owner with 20 capesize bulk carriers. For the sake of simplification, only five routes were considered for the calculation. The routes under consideration are selected from the published Clarkson routes, which are in close conformity with the Biffex routes. Their high weightage in the calculation of the Baltic cape size freight index – implying the higher volumes of trade on these routes – was the reason behind selecting these routes. In ascertaining the revenues for the period, a "contracts by the book" approach was adopted, i.e. no profit sharing, or delivery at load port with ballast bonus were considered.

Table 2, Case study-Voyages

Route	Commodity	Quantity carried	Distance
Tubarao – Japan	Iron Ore	166,000 MT	11331 NM
Tubarao – Rotterdam	Iron Ore	166,000 MT	5025 NM
Dampier – Japan	Iron Ore	166,000 MT	3470 NM
Queensland – Japan	Coal	157,000 MT	3943 NM
Queensland - Rotterdam	Coal	148,500 MT	13,633 NM

Source: self

The period under evaluation is from January, 2005, through to January, 2006 – supposedly a small portion of the heydays of the shipping industry. The required data was acquired from the Clarkson Shipping Intelligence Network. The ships performing these voyages are modern capesize bulkers, built around the year 2000 with summer deadweight of 170,000 MT. Instead of using their designed deadweight for calculation of freight revenues, the author is using the deadweight mentioned in the table above. The reason behind doing so is: (1) Part of the designed deadweight is utilised for consumables like fuel, water and stores, (2) It is quite normal to have two adjacent berths with different specifications. In other words, even if the ports are the same, the berth dedicated for loading/unloading the iron ore might have a different depth at the berth or some other restriction than the one dedicated for the coal, (3) most importantly; it is the stowage factor and density of the cargo which determines the quantity that can be loaded for a particular voyage. Typically, high density cargoes like Iron ore occupy less space in the cargo holds, hence entire available deadweight for cargo can be fully utilised for loading. On the contrary, relatively low density cargoes like, the coal in this case, would occupy the entire space available for cargo, but would weigh less. Moreover, the quantities mentioned above are similar to those used in the calculation of the Clarkson capsize daily earning index.

Although the two commodities are composed of different elements and structure, from the context of transportation they are compatible. Said differently, the cargo spaces of the ship can be prepared for receiving the chosen commodity with minimal cleaning by the on-board crew, without any necessity to involve specialised crew from ashore, and thus avoids delays. The ships are assumed to be performing continuous voyages and are fully employed with 15 days of off-hire per annum. Technically, the ships employed on voyage contracts do not earn freights on ballast passage – also known as the repositioning passage; however, the cost involved in repositioning the ships are accounted for in the freight determination for the voyage.

Ship design specifications are that of a standard ship of similar size and type available in the market. The following ship performance variables, for a capesize bulk carrier, were used for calculation,

Ship's speed (Laden) – 14.5 Nautical miles / hour

Ship's speed (Ballast) – 15 Nautical miles / hour

HFO consumption at sea (Laden) – 58 tons / day

HFO consumption at sea (Ballast) – 50 tons / day

HFO consumption in port – 3.5 tons / day (Considering HFO sulphur contentment < 1 ppm)

DO consumption at sea – Nil

DO consumption in port – Nil

Apart from the ship's performance, a sea margin of 5 % for the ship's speed was accounted for in determining the amount of voyage days, where the sea margin is the weather factor affecting the ships performance in the rough seas.

Different organisations follow different cost-accounting procedures. In the absence of harmonisation of cost structures, the author aims to follow the cost classifications as mentioned in Stopford (1997). All the costs involved were classified into three classes: capital cost, operational cost and voyage costs. Various assumptions were made for deducing the daily capital costs, including the 60% debt financing, the age of the ship being 5 years, and a 4% opportunity cost of capital investment – all adding up to $14,000 per day. For operational cost, all the expenses towards the sources mentioned in the earlier section-4.4.2 on the operational cost were reckoned to be $5,000 per day. Both these fixed costs, capital and operational, were kept uniform in the fleet. The voyage costs were determined using the monthly bunker prices and the distance to be covered for the particular voyage. In addition to this, the turn time, the port time and the canal-transit time were also accounted for.

For voyage and FFA contracts, revenues were ascertained using the freight rates per ton of cargo carried. Since the freight rates for period charter are quoted in $ per day, to facilitate the comparison they were converted into a voyage-rate equivalent in $ per ton using the following equation,

$$VCE = \frac{(TCR \times VD) + VC}{Q}$$

Where,

VCE = Voyage-charter equivalent in $/ton,

TCR = Time-charter rate in $/day,

VD = Total voyage days

VC = Total voyage costs in $

Q = Quantity of cargo carried in metric tons

Once the time-charter rates are ascertained in a voyage equivalent of $ per day, for deducing the earnings, the revenues from the time charter could be treated in the same way as that of the voyage contracts. Hence, the earnings for different contract types are gross revenue, net voyage, operational and capital costs.

As mentioned in the earlier section on behavioural decision making – "Individuals do not consider cost as a loss, but an investment". On the basis of this philosophy, rates of return were determined using the following mathematical statement,

$$R = \frac{E}{C} \times 100$$

Where,

R = Percentage rate of return / loss per day

E = Earnings per day

C = Total cost of running the ship per day

Following diagrams depict the rates of return for different contract types on all five routes:

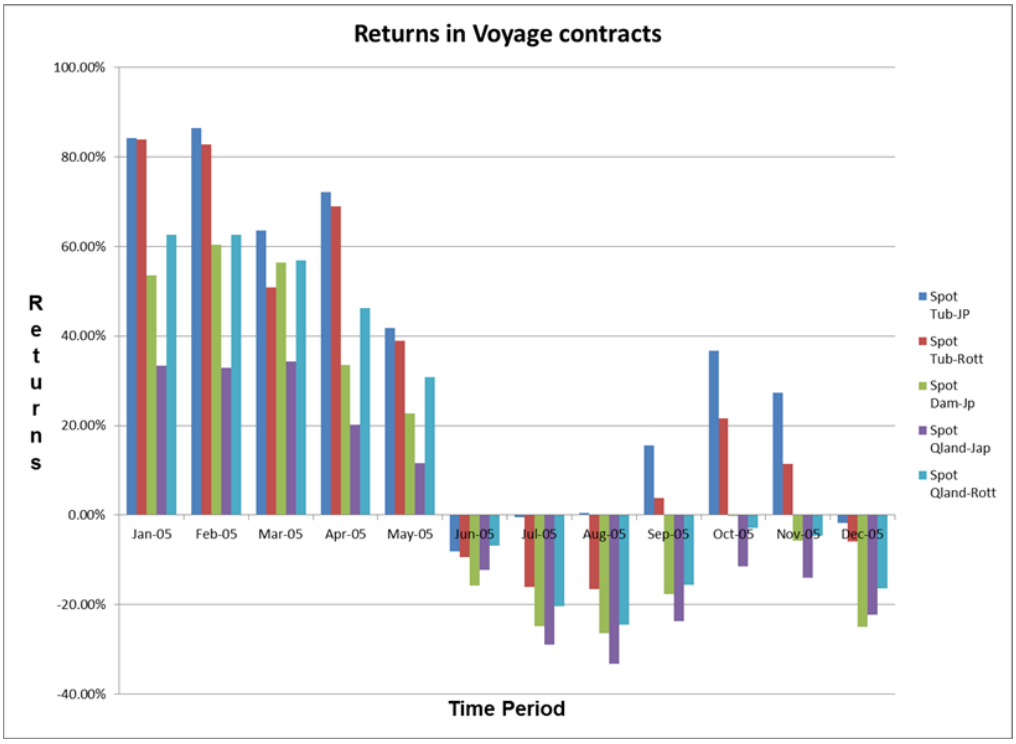

Figure 10, Case study- Returns on voyage contracts, Source: Self

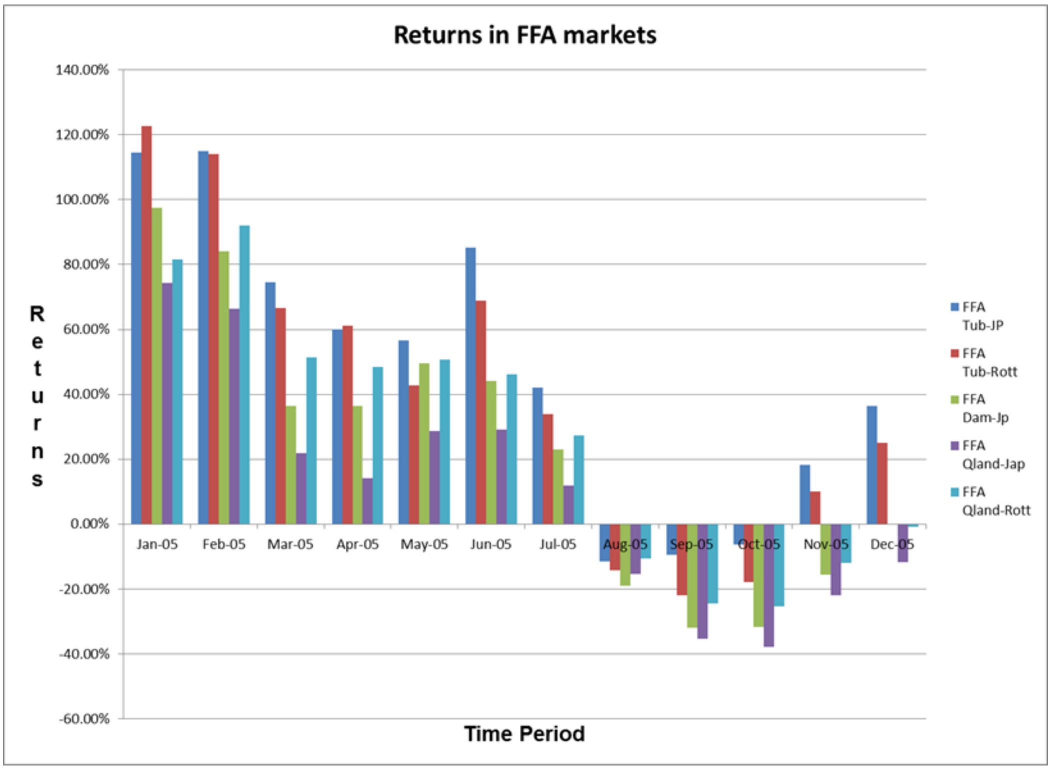

Figure 11, Case study- Returns in FFA fixtres, Source: Self

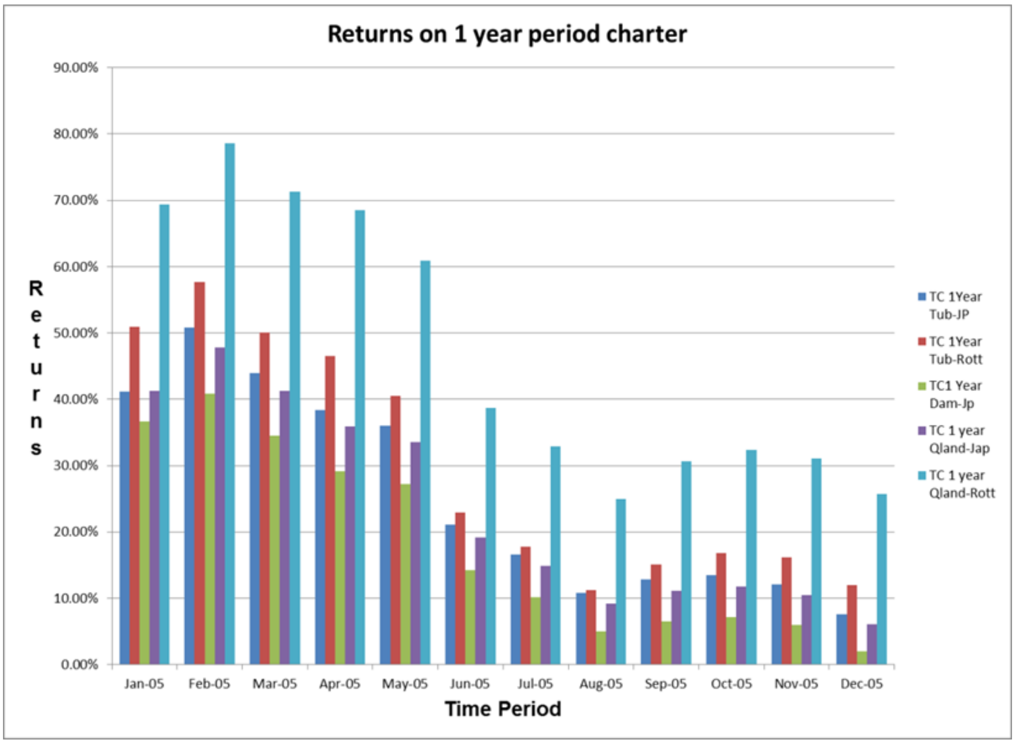

Figure 12, Case study- retuns on 1 year period charter, Source: self

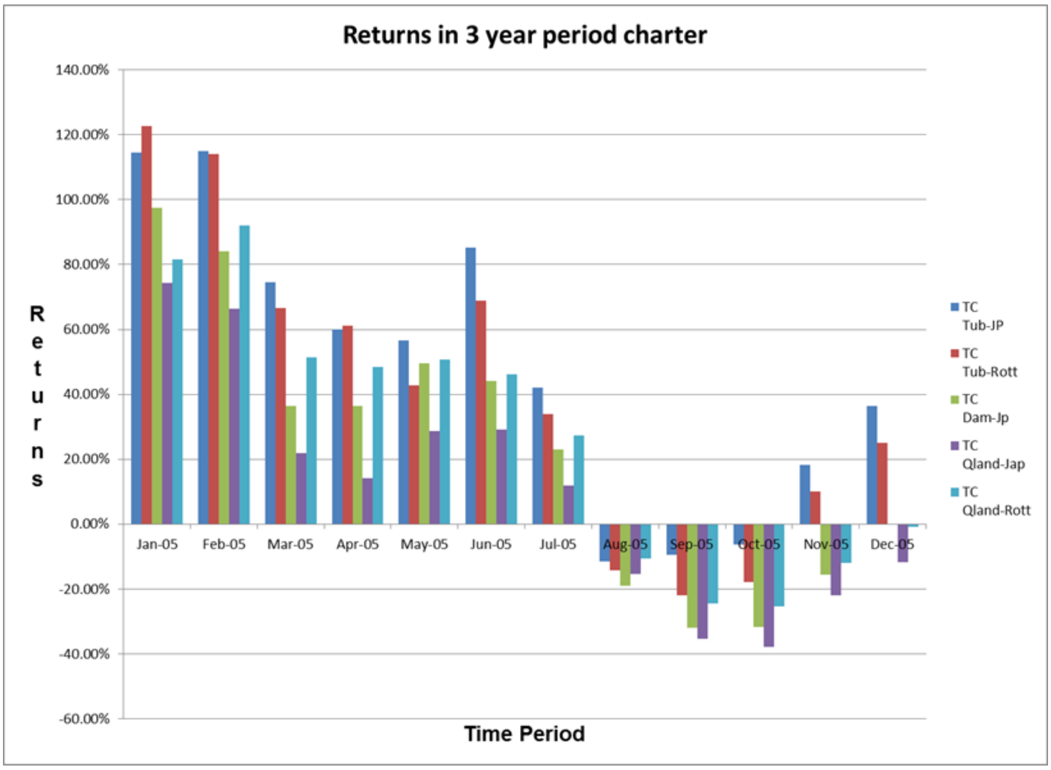

Figure 13, Case study- Returns on 3 year period charter, Source: Self

Figures 10,11,12 and 13, displays the returns a ship owner would generate on daily basis for the rest of year, if he enters into time charter agreement on any given date of a month. Similarly, the mentioned figures shows the returns a ship owner would earn for the duration of the voyage, if he enters into voyage charter agreement on any given date of the month. In the beginning of the year-2005, markets have been promising with daily returns reaching almost 100% of daily costs in a 3-year time charter and FFA markets on certain routes, whereas they are in the range of 70–80% for the remaining contract types on those routes. A ship owner entering into 3-year period agreement would have earned 100% of daily returns throughout the year. The spot market began to get weaker in the month of June, which was replicated in the following months in other contract types due to the lead–lag relationship. This short-term fluctuation was a result of sudden panic in the global market, and more importantly, a not-so-positive outlook about the health of the EU economy. The UK had just published official growth figures which were the lowest in the last 12 years and so was the case in Germany, displaying anomic economic figures. However, markets started recovering in the fourth quarter of the year. An important shortcoming in the above calculation worth mention is; in the beginning of the year profit generated on 3 years' time charter contract is higher than those on other contracts, which cannot be true (unless charterers anticipated an upturn in the market) in practice especially when the markets are good. These superfluous results were due to the scarcity of data about the time charter markets on the mentioned routes. As the data used for the calculation 3 years' time charter return were common for all voyages. Had the real data been used for individual routes, results would have been in compliance with the above argument.

It is quite obvious for the reader to note the fluctuations in returns to ship owners on the time-charter contract. Said differently, if the ship owner has employed his vessel on a 3-year time charter, why would his return vary through the year? An important point to remember here is that this study is the simulation of daily returns to the ship owner if he is to employ his ship on any given day and not the periodic returns of his investment decision in the past.

Table 3, Descriptive statistics

Voyage	Contract Type	Mean	Median	Standard Deviation	Skewness	Kurtosis
Tub-Jap	Voyage	34.8%	32%	34.9%	0.29	-1.49
Tub-Jap	FFA	47.9%	49.4%	44.8%	0.1	-1.09
Tub-Jap	1 Y TC	33.46%	33.55%	4.9%	0.53	-0.76
Tub-Jap	3 Y TC	47.9%	49.4%	44.8%	0.1	-1.09
Tub-Rott	Voyage	26.2%	16.5%	37.8%	0.45	-1.39
Tub-Rott	FFA	40.9%	38.4%	48.2%	0.32	-0.76
Tub-Rott	1 Y TC	38.21%	36.84%	6.19%	1.1	0.48
Tub-Rott	3 Y TC	40.9%	38.4%	48.2%	0.32	-0.76
Dam-Jap	Voyage	9.28%	-2.86%	34.16%	0.49	-1.57
Dam-Jap	FFA	22.7%	29.7%	43.3%	0.29	-0.91
Dam-Jap	1 Y TC	25.37%	25.07%	5.33%	0.96	0.37
Dam-Jap	3 Y TC	22.7%	29.7%	43.3%	0.29	-0.91
Qland-Jap	Voyage	-1.16%	-1.19%	25.9%	0.35	-1.67
Qland-Jap	FFA	10.4%	13%	36.5%	0.41	-0.63
Qland-Jap	1 Y TC	31.35%	31.21%	5.16%	0.76	-0.24
Qland-Jap	3 Y TC	10.4%	13%	36.5%	0.41	-0.63
Qland-Rot	Voyage	14%	-3.07%	34.9%	0.45	-1.77
Qland-Rot	FFA	27%	36.7%	40.8%	0.11	-1.34
Qland-Rot	1 Y TC	57.9%	56.7%	5.6%	1.03	0.36
Qland-Rot	3 Y TC	27%	36.7%	40.8%	0.11	-1.34

Source: self

As can be seen from the above Table-3, observations are logonormally distributed and positively skewed in conformation with our observation of weak markets in the later part of the year. A negative kurtosis on most routes indicates lighter weights in the tail and a higher peak of the distribution than that of symmetric distribution. Another indicator of a short-lived slump in the market is the high standard deviation of returns on all the routes. However, among all the routes, the 1-year time-charter contract has the least volatility and higher returns, indicating a mixed market outlook. In other words, at prevailing market rates, traders are reluctant for long-term commitment, 3 years duration, in the anticipation of lower charter rates in the coming months. At the same time, to meet their demand they intend to fix a medium term period charter, 1 year duration, to avoid paying higher freight rates on a voyage charter.

Having determined the time series of returns for the different contract combination of five routes, a variance–covariance matrix was generated. The variance of the observation measures a degree of variability, or spread of the variable, whereas the covariance between the two observations indicates how closely the two variables move together. The matrix was generated using the following mathematical statement,

$$\sigma_{xy} = \frac{1}{n}\sum_{i=1}^{n}(x_i - x)(y_i - y)$$

Where,

$\sigma_{xy} = Covariances\ between\ variables\ x\ and\ y$

$N = Number\ of\ observations\ in\ each\ time\ series,$

$x, y = Average\ of\ each\ time\ series,$

$x_{i,} y_{i,} = Individual\ observations$

The “n X n” matrix thus generated, as shown in Table-3, has the variance of the variable along the diagonal and the remaining values indicate covariance with other variables.

As Lorange and Norman (1973) suggest, the ship owners are risk-loving during periods of economic prosperity and risk-averse otherwise. In order to construct the optimum portfolio mix representing the risk-loving nature of the ship owner in this good market period under study, the smaller risk-aversion factor was used. The closer the value of the risk-aversion factor to zero, the more risk-loving the individual. Using various values of risk-aversion factors from 1.3 through 3, a series of expected return on the portfolios E(Rp) and the corresponding portfolio standard deviation was generated. The set of portfolios thus generated forms the efficient frontier when plotted on the chart. Any point on this frontier is the optimum portfolio which has the highest possible return for a given standard deviation.

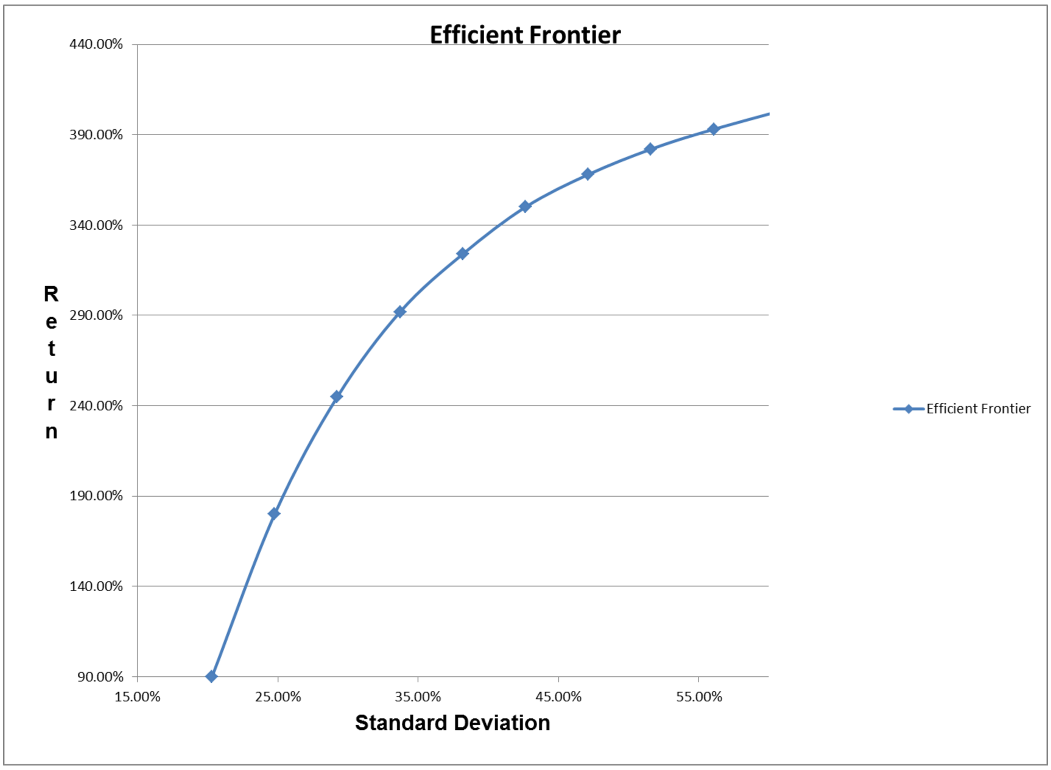

Figure 14, Efficient Frontier, Source: Self

Even after the efficient frontier or the set of efficient charter mix is derived using the expected returns and standard deviation, it is still difficult to choose the best portfolio, the charter mix in our case, from the set which satisfies the ship owner's goal. In order to determine the most optimum charter mix, the shortfall probability vector was utilised.

Assuming that the ship owner wants a daily return of 100% of his investments and he is comfortable with the 5% probability of not reaching this target, which can be represented in mathematical form as,

$$E[R_p] \geq 1 - \Phi^{-1}(0.05)\sigma$$

which is a straight line with the intercept 100% and slop$\Phi^{-1}(0.05)$. Most optimum portfolios or charter mix, would be a point on the efficient frontier where the shortfall probability vector intersects the frontier.

Population Variance/Covariance Matrix																				
	Spot Tub-JP	***Spot Tub-Rott***	***Spot Dam-Jp***	***Spot Qland-Jap***	***Spot Qland-Rott***	***FFA Tub-JP***	***FFA Tub-Rott***	***FFA Dam-Jp***	***FFA Qland-Jap***	***FFA Qland-Rott***	***TC 1Year Tub-JP***	***TC 1Year Tub-Rott***	***TC1 Year Dam-Jp***	***TC 1 year Qland-Jap***	***TC 1 year Qland-Rott***	***TC Tub-JP***	***TC Tub-Rott***	***TC Dam-Jp***	***TC Qland-Jap***	***TC Qland-Rott***
Spot Tub-JP	0.11167	0.11950	0.10453	0.07667	0.10564	0.08593	0.10142	0.08776	0.07104	0.08652	0.04288	0.05113	0.04006	0.04256	0.05940	0.08593	0.10142	0.08776	0.07104	0.08652
Spot Tub-Rott	0.11950	0.13121	0.11352	0.08509	0.11679	0.10584	0.12219	0.10686	0.08617	0.10345	0.04783	0.05709	0.04479	0.04753	0.06625	0.10584	0.12219	0.10686	0.08617	0.10345
Spot Dam-Jp	0.10453	0.11352	0.10694	0.08009	0.10834	0.10251	0.11524	0.10051	0.08252	0.09994	0.04596	0.05368	0.04267	0.04541	0.06231	0.10251	0.11524	0.10051	0.08252	0.09994
Spot Qland-Jap	0.07667	0.08509	0.08009	0.06144	0.08244	0.08351	0.09237	0.08043	0.06526	0.07917	0.03494	0.04094	0.03245	0.03454	0.04757	0.08351	0.09237	0.08043	0.06526	0.07917
Spot Qland-Rott	0.10564	0.11679	0.10834	0.08244	0.11170	0.11154	0.12494	0.10985	0.08956	0.10802	0.04756	0.05575	0.04425	0.04706	0.06474	0.11154	0.12494	0.10985	0.08956	0.10802
FFA Tub-JP	0.08593	0.10584	0.10251	0.08351	0.11154	0.18361	0.19609	0.17178	0.14335	0.16101	0.05188	0.05985	0.04902	0.05162	0.06803	0.18361	0.19609	0.17178	0.14335	0.16101
FFA Tub-Rott	0.10142	0.12219	0.11524	0.09237	0.12494	0.19609	0.21324	0.18636	0.15615	0.17411	0.05702	0.06628	0.05419	0.05694	0.07520	0.19609	0.21324	0.18636	0.15615	0.17411
FFA Dam-Jp	0.08776	0.10686	0.10051	0.08043	0.10985	0.17178	0.18636	0.17162	0.14396	0.15927	0.05189	0.05960	0.04932	0.05182	0.06781	0.17178	0.18636	0.17162	0.14396	0.15927
FFA Qland-Jap	0.07104	0.08617	0.08252	0.06526	0.08956	0.14335	0.15615	0.14396	0.12245	0.13351	0.04293	0.04897	0.04094	0.04292	0.05542	0.14335	0.15615	0.14396	0.12245	0.13351
FFA Qland-Rott	0.08652	0.10345	0.09994	0.07917	0.10802	0.16101	0.17411	0.15927	0.13351	0.15245	0.05208	0.05919	0.04869	0.05154	0.06789	0.16101	0.17411	0.15927	0.13351	0.15245
TC 1Year Tub-JP	0.04288	0.04783	0.04596	0.03494	0.04756	0.05188	0.05702	0.05189	0.04293	0.05208	0.02186	0.02495	0.02011	0.02148	0.02905	0.05188	0.05702	0.05189	0.04293	0.05208
TC 1Year Tub-Rott	0.05113	0.05709	0.05368	0.04094	0.05575	0.05985	0.06628	0.05960	0.04897	0.05919	0.02495	0.02879	0.02306	0.02458	0.03348	0.05985	0.06628	0.05960	0.04897	0.05919
TC1 Year Dam-Jp	0.04006	0.04479	0.04267	0.03245	0.04425	0.04902	0.05419	0.04932	0.04094	0.04869	0.02011	0.02306	0.01865	0.01985	0.02675	0.04902	0.05419	0.04932	0.04094	0.04869
TC 1 year Qland-Jap	0.04256	0.04753	0.04541	0.03454	0.04706	0.05162	0.05694	0.05182	0.04292	0.05154	0.02148	0.02458	0.01985	0.02115	0.02857	0.05162	0.05694	0.05182	0.04292	0.05154
TC 1 year Qland-Rott	0.05940	0.06625	0.06231	0.04757	0.06474	0.06803	0.07520	0.06781	0.05542	0.06789	0.02905	0.03348	0.02675	0.02857	0.03905	0.06803	0.07520	0.06781	0.05542	0.06789
TC Tub-JP	0.08593	0.10584	0.10251	0.08351	0.11154	0.18361	0.19609	0.17178	0.14335	0.16101	0.05188	0.05985	0.04902	0.05162	0.06803	0.18361	0.19609	0.17178	0.14335	0.16101
TC Tub-Rott	0.10142	0.12219	0.11524	0.09237	0.12494	0.19609	0.21324	0.18636	0.15615	0.17411	0.05702	0.06628	0.05419	0.05694	0.07520	0.19609	0.21324	0.18636	0.15615	0.17411
TC Dam-Jp	0.08776	0.10686	0.10051	0.08043	0.10985	0.17178	0.18636	0.17162	0.14396	0.15927	0.05189	0.05960	0.04932	0.05182	0.06781	0.17178	0.18636	0.17162	0.14396	0.15927
TC Qland-Jap	0.07104	0.08617	0.08252	0.06526	0.08956	0.14335	0.15615	0.14396	0.12245	0.13351	0.04293	0.04897	0.04094	0.04292	0.05542	0.14335	0.15615	0.14396	0.12245	0.13351
TC Qland-Rott	0.08652	0.10345	0.09994	0.07917	0.10802	0.16101	0.17411	0.15927	0.13351	0.15245	0.05208	0.05919	0.04869	0.05154	0.06789	0.16101	0.17411	0.15927	0.13351	0.15245

Figure 15, Variance-Covariance matrix, Source: Self

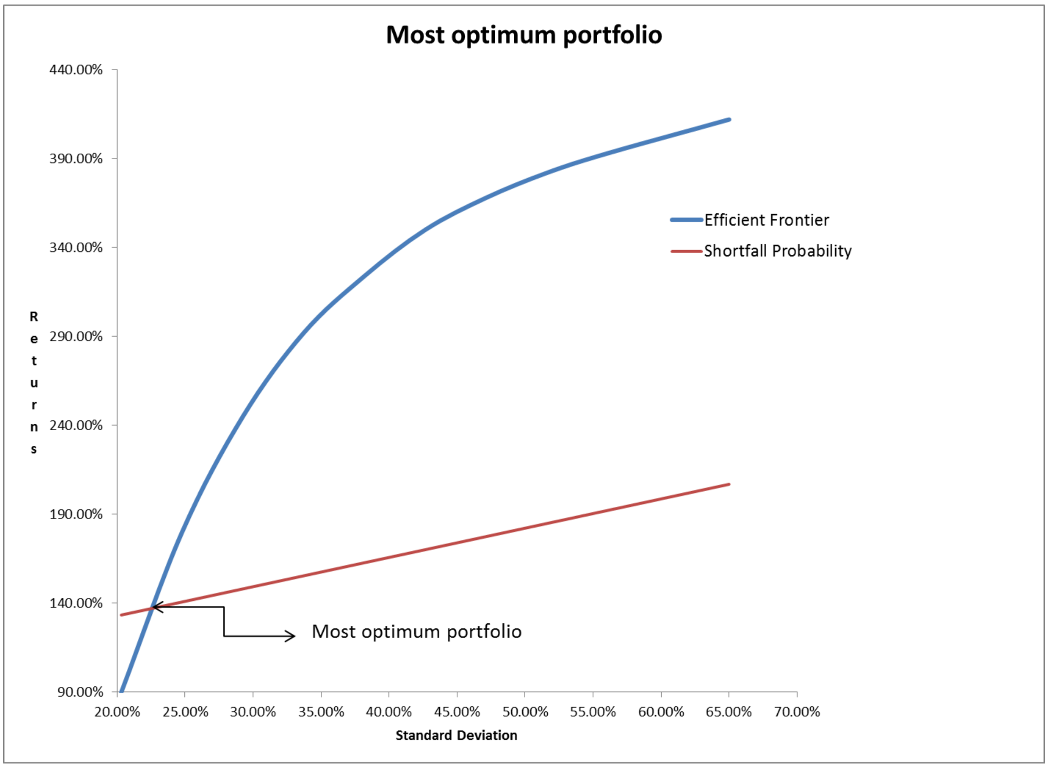

Figure 16, Case study- Short fall probability, Source: Self

As can be seen from the above figure-16, at the most optimal point, if the ship owner adopts the charter mix, he would get 140% daily returns on his investment with the standard deviation of 24.8%. The suggested route and contract combinations are:

Tubarao – Japan Iron Ore, Voyage contract – 30% of the fleet

Tubarao – Japan Iron Ore, FFA contract – 7% of the fleet

Tubarao – Rotterdam Iron Ore, FFA contract – 13% of the fleet

Tubarao – Rotterdam Iron Ore, 1-year Time charter – 10% of the fleet

Dampier – Japan Iron Ore, 1-year Time charter – 13% of the fleet

Queensland – Japan Coal, 1-year Time charter – 11% of the fleet

Queensland – Rotterdam Coal, 1-year Time charter – 12% of the fleet

Tubarao – Japan Iron Ore, 3-year time charter – 1% of the fleet

Tubarao – Rotterdam Iron Ore, 3-year time charter – 3% of the fleet

Although, practically, it will not be possible for the ship owner to employ 1.5 ships on a particular voyage, for mathematical purposes results have been retained.

7.Conclusion

Various authors have utilised the financial optimisation tool called “mean-variance theory” and have been successful, as they claim, in doing so. However, they failed to incorporate the human psychology factor when determining the efficient choices, which made the remaining choices the same for every ship owner out there in the market. In realty though, no two persons are the same and nor is their strategic decision-making ability or business acumen. The aim of this study has been to incorporate behavioural psychology into the chartering decision-making process from the context of a ship owner. Following the mental-accounting theory, and using a range of risk-aversion factors in compliance with the individual’s attitude towards risk, a set of optimum portfolios can be generated which traces a somewhat parabolic path called the efficient frontier. Here, the portfolios are nothing but combinations of different routes and charter mixes chosen as to the ship owner’s liking. No two individuals can have the same frontier, but they can be similar. After having determined the frontier, the most optimum from the set can be chosen using the individual’s strategic target and his risk tolerance measured in terms of the probability of failing to reach his target.

Nevertheless, there are some shortcomings to this approach which need a special mention. First, the short-selling assumption of the mental accounting theory is a pragmatic implication. A ship owner who has committed his ship on a long-term period charter would not be free to terminate his commitment in order to meet his short-term goal and risk losing his important client forever as well as facing a huge claim from the time charterers, especially in a perfectly competitive market like bulk shipping. The second assumption of the mental accounting theory is the normal distribution of returns, which is not very common in business fields. Hence, the results simulated by this theory may not perfectly play out in the real world scenarios. Thirdly, the lead–lag relationship between the FFA fixture prices and the spot prices may prove to be inflated in its credibility from the context of its application in the world-wide freight market. Hence, the result obtained may be erroneous.

Suggestions for future research

One of the short-comings of this study has been the short-selling constraint, which is unlikely to be found in the real world chartering practices. It would be an interesting topic to study the applicability of this theory to ship chartering business when short selling is not allowed.

Bibliography

FFA Options/FIS. Available at: http://www.freightinvestorservices.com/freight/ffa-options [Accessed 2013].

Alphaliner - TOP 100. 2013. Available at: http://www.alphaliner.com/top100/ [Accessed 2013].

Adland, R. and Cullinane, K. 2005. A Time-Varying Risk Premium in the Term Structure of Bulk Shipping Freight Rates. Journal of Transport Economics and Policy, 39 (2), pp. 191-208.

Adland, R. and Strandenes, S. 2006. Market efficiency in the bulk freight market revisited. Maritime Policy & Management, 33 (2), pp. 107-117.

Alizadeh, A. H. and Talley, W. K. 2011. Microeconomic determinants of dry bulk shipping freight rates and contract times. Transportation, 38 (3), pp. 561-579.

Ansari, Z. M., 2006. Portfolio risk management in shipping real assets and shipping security assets. Graduate. Rotterdam: MEL, Erasmus University Rotterdam.

Berg-Andreassen, J., 1998.A portfolio approach to strategic chartering decisions. Maritime Policy & Management, 25 (4), pp. 375-389.

Branch, A. and Stopford, M., 2013.Maritime economics.Routledge.

Clark, A. E. and Oswald, A. J. 1998.Comparison-concave utility and following behaviour in social and economic settings. Journal of Public Economics, 70 (1), pp. 133-155. Available at: http://www.sciencedirect.com/science/article/pii/S0047272798000644 .

Cullinane, K., 1995. A portfolio analysis of market investments in dry bulk shipping Transportation Research Part B: Methodological, 29 (3), pp. 181 <last_page> 200. Available at: http://dx.doi.org/10.1016/0191-2615(94)00032-u .

Das, S., Markowitz, H., Scheid, J. and Statman, M. 2010; 2010. Portfolio Optimization with Mental Accounts Journal of Financial and Quantitative Analysis, 45 (02), pp. 311 <last_page> 334. Available at: http://dx.doi.org/10.1017/s0022109010000141 .

de Groot, B. and Franses, P. H. 2012. Common socio-economic cycle periods. Technological Forecasting and Social Change, 79 (1), pp. 59-68. Available at: http://www.sciencedirect.com/science/article/pii/S0040162511001302 .

Gratsos, A. G., Thanopoulou, H. and Veenstra W.A. 2012.The Dry Bulk Shipping. In: W. K. Talley ed., 2012. The Blackwell Companioin to Maritime Economics. pp. 187-203.

Gray, J. W., 1987. Futures and options for shipping. Colchester: Llyod's of London Press, .

Haralambides, H. E. (unpublished) 2013. Shiipping Economics and Policy. MEL Lectures.

Hawdon, D., 1978. Tanker freight rates in the short and long run. Applied Economics, 10 (3), pp. 203-218.

Kahneman, D. and Tversky, A. 1979. Prospect theory: An analysis of decision under risk. Econometrica: Journal of the Econometric Society, pp. 263-291.

Kahneman, D. and Tversky, A. 1984.Choices, values, and frames. American Psychologist, 39 (4), pp. 341.

Kavussanos, M. G. and Visvikis, I. D. 2004. Market interactions in returns and volatilities between spot and forward shipping freight markets. Journal of Banking & Finance, 28 (8), pp. 2015-2049.

Kavussanos, M. G. and Visvikis, I. D., 2006.Derivatives and Risk Management in shipping. 1. London: Witherbys Publishing.

Kavussanos, M. G., 1996. Comparisons of Volatility in the Dry-Cargo Ship Sector: Spot versus Time Charters, and Smaller versus Larger Vessels. Journal of Transport Economics and Policy, 30 (1), pp. 67-82.

Kavussanos, M. G. and Alizadeh-M, A. H. 2001. Seasonality patterns in dry bulk shipping spot and time charter freight rates. Transportation Research Part E: Logistics and Transportation Review, 37 (6), pp. 443-467. Available at: http://www.sciencedirect.com/science/article/pii/S1366554501000047 .

Kavussanos, M. G. and Visvikis, I. D. 2006. Shipping freight derivatives: a survey of recent evidence. Maritime Policy & Management, 33 (3), pp. 233-255.

Koekebakker, S., Adland, R. and Sødal, S. 2007. Pricing freight rate options. Transportation Research Part E: Logistics and Transportation Review, 43 (5), pp. 535-548.

Köhn, S. and Thanopoulou, H. 2011.A gam assessment of quality premia in the dry bulk time–charter market. Transportation Research Part E: Logistics and Transportation Review, 47 (5), pp. 709-721. Available at: http://www.sciencedirect.com/science/article/pii/S1366554511000068 .

Koopmans, T. C., 1939. Tanker Freight Rates and Tankship Building: An Analysis of Cyclical Fluctuations, by Dr. T. Koopmans. De erven F. Bohn nv.

Körding, K. P. and Wolpert, D. M. 2006. Bayesian decision theory in sensorimotor control. Trends in Cognitive Sciences, 10 (7), pp. 319-326.

Lorange, P. and Norman, V. D. 1973.Risk preference in Scandinavian shipping. Applied Economics, 5 (1), pp. 49.

Lyridis, V. D. and Zacharioudakis, P. 2012. Liquid Bulk Shipping. In: W. K. Talley ed., 2012. Blackwell Companion to Maritime Economics. pp. 205-10.

McDermot, R., 2001. Risk-taking in international politics: Prospect theory in American foreign policy. University of Michigan Press.

Notteboom, T., 2012.The Liner Shipping. In: W. K. Talley ed., 2012. The Blackwell companion to Maritime Economics. pp. 230-30.

Pyle, D. H. and Turnovsky, S. J. 1970.Safety-First and Expected Utility Maximization in Mean-Standard Deviation Portfolio Analysis. The Review of Economics and Statistics, 52 (1), pp. 75-81.

Scarsi, R., 2007. The bulk shipping business: market cycles and shipowners' biases. Maritime Policy & Management, 34 (6), pp. 577-590.

Shefrin, H. and Statman, M. 2000. Bihavioral Portfolio Theory. Journal of Financial and Quantitative Analysis, 35 (2), .

Shen, M. and Vogiatzis, A. 2004.Portfolio risk management in shipping and optimal asset allocation. Graduate. Rotterdam: MEL, Erasmus University Rotterdam.

Singer, N., 2011. Essays on onBehavioral Portfolio Management: Theory and Application. derUniversitat Rostock.

Stopford, M., 1997.Maritime Economics 2E.Routledge.

Taylor, A., 1982. Chartering Strategies for Shipping Companies.The International Journal of Management Science, 10 pp. 25-33.

Thaler, H., 1999. Mental Accounting Matters .

Wang, J. C. C., 2011. Chartering Strategies for Oil Companies. Graduate. Rotterdam: MEL,Erasmus University Rotterdam.