

UNIVERSITY OF PIRAEUS
DEPARTMENT OF MARITIME STUDIES



ISLAMIC FINANCE:
AN ECONOMETRIC MODEL FOR
TANKER DRY-DOCKING COST FINANCING

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΡΠΑ

To Natalia, Helena & Theologos

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LIST OF ABBREVIATIONS

2SLS	2 Stage-Least Squares
AAOIFI	Accounting and Auditing Organization For Islamic Financial Institutions
ABS	Asset Backed Securities
AD	Anno Domini
BC	Before Christ
BCI	Baltic (Exchange) Capesize Index
BNP	Bank National de Paris
BPI	Baltic (Exchange) Panamax Index
EGARCH	Exponential General Autoregressive Conditional Heteroskedasticity
GAAP	Generally Accepted Accounting Principles
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GRT	Gross Registered Tonnage
DJIA	Dow Jones Industrial Average Index
H&M	Hull and Machinery
HFO	Heavy Fuel Oil
HSBC	Hong Kong & Shanghai Bank Corporation
IACS	International Association of Classification Societies
IAME	International Association of Maritime Economists
ICABE	International Conference of Applied Business & Economics
IDB	Islamic Development Bank
IFO	Intermediate Fuel Oil
IMF	International Monetary Fund
IMO	International Maritime Organization
IPO	Initial Public Offer
IRTI	Islamic Research and Training Institute
IV	Instrumental Variables
JEHSI	J.E. Hyde Shipping Index

KPI	Key Performance Indicators
LR	Lloyd's Register
MARPOL	Marine Pollution Convention
MDO	Marine Diesel Oil
MEPC	Marine Environment Protection Committee (IMO)
MISC	Malaysian International Shipping Company
MSC	Maritime Safety Committee (IMO)
MYR	Malaysian Ringgit (currency)
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
OPA	Oil Pollution Act (United states, 1990)
P&I	Protection and Indemnity
RINA	Royal Institution of Naval Architects
SAR	Saudi Arabian Riyal (currency)
SOLAS	Safety of Life at Sea (Convention)
SPV	Special Purpose Vehicle
UK	United Kingdom
ULCC	Ultra Large Crude (oil) Carrier
US	United States of America
VLCC	Very Large Crude (oil) Carrier

LIST OF NOTATIONS

Roman Lettering

B	Vessel breadth (m)
cbm	Volume (cubic meter)
Dwt	Deadweight (tons)
L	Vessel length (m)
r^2	Regression R-square
SHP	Ship horsepower (hp)
T	Draught (m)
V	Service speed (knots)

ABSTRACT

The emerging of Islamic finance as an alternative mode for funding of ships is the trigger of the present thesis.

The thesis, first, investigates the different types of Islamic finance and evaluates the most suitable one for the financing of ship repair and dry-docking.

Later, the current thesis deals with the effects of a vessel's inherent physical parameters, such as type, size and age on her dry-docking cost. Special attention is paid to size and age influence on such costs.

To this end, an investigation for primary data managed to collect approximately eight hundred dry-docking actual bills for a period of four successive years.

Finally, an economic model has been developed correlating a tanker repair and dry-docking cost with a number of ship inherent parameters as well as with shipyard (material & labour) cost and ship employment conditions.

Ship finance is a growing segment of the Islamic finance. Further penetration of funds into the industry requires explicit knowledge of ship operating costs the most unexplored of which is the dry docking cost. The modelling of dry docking cost using primary hand collected data could establishes the necessary link in order to facilitate and strengthen the evolving interdependence between Islamic finance and the shipping industry.

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PhD Thesis

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by Agamemnon Apostolidis

ΠΕΡΙΛΗΨΗ

Η παρούσα διατριβή εξετάζει, για πρώτη φορά, τη συμβολή της Ισλαμικής χρηματοδότησης στην ναυτιλία και ειδικότερα τη χρηματοδότηση κεφαλαίου κίνησης. Η περίπτωση της χρηματοδότησης της δαπάνης δεξαμενισμού, εξετάζεται ως παράδειγμα και για το λόγο αυτό ένα οικονομετρικό μοντέλο δημιουργείται για την ανάλυση της δαπάνης δεξαμενισμού πετρελαιοφόρων πλοίων.

Αρχίζει με μια εισαγωγή στις ρίζες και τις βασικές έννοιες – που απορρέουν από το Κοράνι και την προσέγγιση του Προφήτη Μωάμεθ στα κοινωνικά ζητήματα – όπως η απαγόρευση του τόκου αλλά η αποδοχή του κέρδους. Στην συνέχεια παρουσιάζονται και αναλύονται τα γνωστότερα Ισλαμικά χρηματοοικονομικά προϊόντα με τις Αραβικές ονομασίες τους όπως *Murabaha*, *Miusharakah* και *Istisna*. Με βάση τα δημοσιεύματα στον ειδικό διεθνή ναυτιλιακό τύπο (*Lloyd's List*, *Tradewinds* και *Marine Money*) αποδελτιώνονται και παρουσιάζονται οι Ισλαμικές χρηματοδοτήσεις που έχουν διοχετευθεί στην παγκόσμια ναυτιλία κατά τη δεκαετία 2000 – 2011. Στο σύνολο αγγίζουν τα 10 δις δολάρια. Ξεχωρίζουν η εξαγορά ενός δικτύου λιμενικών σταθμών φορτοεκφόρτωσης εμπορευματοκιβωτίων από την *Dubai Ports World* και η παραγγελία νέων πετρελαιοφόρων μεγέθους 300,000 dwt από την *National Shipping Company of Saudi Arabia (NSCSA)*.

Για το σκοπό της πληρότητας της παρούσας διατριβής επιλέγεται η παρουσίαση μιας χρηματοδοτικής εφαρμογής στη ναυτιλία όπως η χρηματοδότηση για κεφάλαιο κίνησης μιας ναυτιλιακής εταιρείας στην περίπτωση δεξαμενισμού ενός πλοίου της.

Αναλύονται οι λόγοι που υποχρεώνουν έναν πλοιοκτήτη να οδηγεί το πλοίο του κάθε 30 μήνες στη δεξαμενή ενός ναυπηγείου, καθώς και το διεθνές κανονιστικό πλαίσιο λειτουργίας του πλοίου. Έμφαση δίνεται στο ρόλο των νηολογίων (σημαίες) και των νηογνωμόνων (κλάσεις). Παρουσιάζεται όλη η διαδικασία πριν και κατά το δεξαμενισμό σε ότι αφορά στη διαπραγμάτευση και συμφωνία της βασικής τιμολόγησης.

Ο τακτικός δεξαμενισμός του πλοίου αποτελεί ένα σημαντικό κόστος λειτουργίας του πλοίου, η έρευνα αυτή το υπολογίζει σε 20% του ετήσιου

κόστους λειτουργίας. Για το λόγο αυτό γίνεται εκτενής αναφορά στην υπάρχουσα βιβλιογραφία που επικεντρώνεται όμως περισσότερο στα υπόλοιπα είδη λειτουργικού κόστους όπως η επάνδρωση του πλοίου, η συντήρηση κι η αγορά ανταλλακτικών, η αγορά λιπαντικών και προμηθειών, το κόστος ασφάλισης και τέλος η δαπάνη διαχείρισης. Είναι αξιοσημείωτο ότι απουσιάζει από την ακαδημαϊκή βιβλιογραφία η έρευνα σχετικά με το κόστος δεξαμενισμού. Η αιτία φαίνεται να είναι η δυσκολία στην πρόσβαση σε αξιόπιστα αριθμητικά στοιχεία, στοιχεία που δε δημοσιεύονται ούτε από τα ναυπηγεία ούτε από τις ναυτιλιακές εταιρείες – πελάτες, πλην εξαιρέσεων.

Προϋπόθεση της Ισλαμικής χρηματοδότης είναι η ύπαρξη πραγματικού προϊόντος ή υπηρεσίας. Ακόμη και στην περίπτωση μελλοντικής αγοράς – όπως στο κεφάλαιο κίνησης που διαπραγματεύεται η διατριβή – πρέπει να είναι συγκεκριμένη η περιγραφή και η τιμή της προσδοκώμενης υπηρεσίας.

Για το λόγο αυτό, δημιουργείται ένα οικονομετρικό μοντέλο (με τη Γενικευμένη Μέθοδο των Ροπών – που για πρώτη φορά χρησιμοποιείται σε ναυτιλιακή εφαρμογή) για τον υπολογισμό του κόστους δεξαμενισμού. Συνέλλεξα, προσωπικά, σχεδόν οκτακόσια λεπτομερή τιμολόγια από δεξαμενισμούς πλοίων της τετραετίας 2007-2010. Τα στοιχεία αποδελτιώνονται, ταξινομούνται και καταλήγουν στη δημιουργία μιας ομοιογενούς βάσης δεδομένων που περιλαμβάνει 414 αναλυτικά τιμολόγια από δεξαμενισμούς μόνο πετρελαιοφόρων πλοίων, όλων όμως των μεγεθών.

Πάνω σε αυτή τη βάση των δεδομένων χτίζεται το οικονομετρικό μοντέλο, που για πρώτη φορά στην ακαδημαϊκή βιβλιογραφία, προσπαθεί να τεκμηριώσει το συσχετισμό του ύψους της δαπάνης δεξαμενισμού με κάποια εγγενή στοιχεία του πλοίου (μέγεθος, τύπος, ηλικία), της ναυλαγοράς και της διαπραγματευτικής ικανότητας του πλοιοκτήτη.

Όλες οι αρχικές υποθέσεις επαληθεύονται από το οικονομετρικό μοντέλο με υψηλές τιμές αξιοπιστίας.

Η συμβολή της παρούσας διατριβής στην ακαδημαϊκή έρευνα είναι προφανής κι επιτυγχάνει δύο στόχους: πρώτον, αυτόν της εισαγωγής της Ισλαμικής χρηματοδότησης στην ναυτιλία και έπειτα της διερεύνησης κι

ανάλυσης της δαπάνης δεξαμενισμού μέσα από την ανάπτυξη ενός οικονομετρικού μοντέλου.

Ακόμη, δημιουργεί τις προϋποθέσεις για περαιτέρω έρευνα, όπως το θέμα της ανάπτυξης αυθύπαρκτων Ισλαμικών τραπεζικών προϊόντων (τα σημερινά στηρίζονται καθαρά σε εξισλαμισμό των δυτικών υαρχόντων τραπεζικών υπηρεσιών) με βάση τις ηθικές αρχές του Κορανίου κι όχι απαραίτητα με την ετικέτα του Ισλαμικού προϊόντος. Η ανάπτυξη ηθικών τραπεζικών υπηρεσιών μπορεί να αποτελεί και μια λύση στη σημερινή παγκόσμια χρηματοπιστωτική κρίση. Αφού, τελικά, τόσο το Ισλάμ όσο κι ο δυτικός πολιτισμός έλκουν τις ρίζες τους από τις ηθικές αξίες των κλασικών Ελλήνων φιλοσόφων.

Στο πεδίο της έρευνας τους κόστους δεξαμενισμού του πλοίου, πολλά μπορούν να γίνουν: πρώτα η τυποποίηση των εργασιών επισκευής και δεξαμενισμού στη βάση ενός διεθνούς αποδεκτά προτύπου. Αυτό θα διευκόλυνε την ταξινόμηση και σύγκριση των τιμών μεταξύ διαφορετικών ναυπηγείων και τύπων πλοίου.

Σημαντική συμβολή στην περαιτέρω έρευνα θα ήταν επίσης ο συσχετισμός των εγγενών χαρακτηριστικών του πλοίου (μέγεθος, ηλικία) με την κατανομή της δαπάνης δεξαμενισμού στις επιμέρους συνιστώσες κόστους (γενικές δαπάνες δεξαμενισμού, εργασίες αμμοβολής και βαφής, επισκευές ελασμάτων, σωληνώσεων, συντήρηση μηχανών και μηχανολογικού εξοπλισμού). Τέλος ένα τέτοιο μοντέλο να συγκρίνει και τη μεταβολή της δαπάνης δεξαμενισμού μεταξύ των πιο διαδεδομένων τύπων πλοίου (πετρελαιοφόρων, μεταφοράς ξηρού φορτίου χύδην και μεταφοράς εμπορευματοκιβωτίων).



The ambition of every author who aims to defend a thesis under the requirements for the degree of the Doctor of Philosophy is the identification and presentation of a unique – never explored so far - topic. Same goes for his supervisor who usually keeps driving him through *terra incognita* paths.

INTRODUCTION

The initial aim of the current thesis was to broadly explore an emerging mode of ship finance¹, that of Islamic finance. The thesis approach would not have been complete without the illustration of a pragmatic example. Ideas to analyse any of the existed - so far - projects were abandoned in favour of a peerless topic, that of ship dry-docking, a typical case of working capital in shipping. The lack of any preceding work - on dry-docking cost structure or estimation - propelled author to conduct a primary research and form a dry-docking cost model with the use of econometric tools.

I investigated and presented, for the first time in the shipping academic literature, the following topics:

1. Islamic finance for shipping projects.
2. Dry-docking cost modelling.

Besides the uniqueness of the above topics, it is their potential growing interdependence that lead me into making this choice.

Ship finance is a growing potential of Islamic finance. Further penetration of funds into the industry requires explicit knowledge of ship operating costs the most unexplored of which is dry docking cost. The modelling of dry docking cost using primary hand collected data establishes

¹ Ship finance or shipping finance is not only limited to the funding for the purchase of a single vessel, but embraces also the financing of any shipping related activities from working capital for ship operations to the development of ports, shipyards and any maritime infrastructure or idea in general

the necessary link in order to facilitate and strengthen the evolving interdependence between Islamic finance and the shipping industry.

To many ship-owners, Islamic finance is often perceived as complicated and challenging to tap into in practice. The reasons stem from the fact that any Islamic funding structures will have to be designed to accommodate the differences that Islamic banking has compared to conventional banking. Islamic banking does not recognise the time value of money and is very much based on productive (or real) investment. It also forbids interest but allows profits from business activities. Despite these challenges, some Islamic banks and institutions working efficiently are trying recently to offer more ship financing opportunities.

Letting access to a separate group of investors aside, Islamic finance in shipping has often been cited as uneconomical due to the costs and complications associated with the structuring of deals.

However, nowadays the trading environment for ship-managers has been extremely difficult, given that major economies stagger to get back on their feet and emerging economies try hard to adapt.

Traditional ship financing banks are being replaced gradually with Chinese and South Asian ones. Nevertheless, the latter feel also the lack of liquidity due to their obligation to maintain the recent Asian rapid growth and to buy significant part of the western world sovereign debt. The era of Initial Public Offerings (IPO) has been passed by² and private equities are looking for safer bets. Within this rapidly changing environment, Islamic finance is emerging as an alternative source of finance. As I analyse in the *Chapter Three*, a number of shipping projects have been financed until now and the most motivating is the recent surge of Islamic finance in the Middle East and the South Asia region.

² to the contrary, delisting of shipping companies from NYSE and NASDAQ are very frequent in the second half of 2011. Omega Navigation, General Maritime have already delisted within the above period whereas Top Tankers and FreeSeas, among others, have received warning for their stock trading below usd 1.0 (*Tradewinds*, 2011)

The good old days of 2003-08 are elapsed not only for the ship finance segment but for the freight (income) front as well. This is the reason that maritime scholars and shipping organizations believe that behind financing and freight issues, now there is a necessity to lean over the ship cost topics (Stopford, 2011)³.

Whereas there is a significant volume of literature for ship purchase costs – either as new-buildings or second hand – few can be found for ship operating costs. Among the operating costs, the second most significant is the dry-docking cost. Moreover, academic and professional assignments with dry-docking cost are in desert mode. It seems the most un-explored ship operating cost.

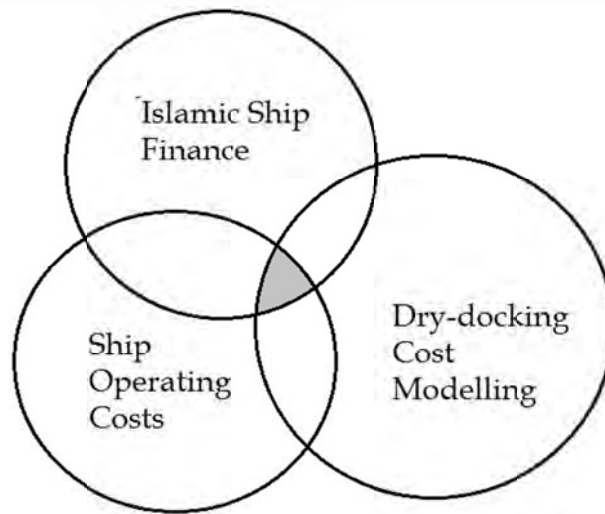
The present thesis was conducted through:

1. Personal professional experience and knowledge.
2. Contacts and discussions with Islamic scholars and maritime professionals.
3. Collecting manually actual dry-docking costs and ship repair bills during the period 2007-2010.
4. Investigation, reading and analysis of corresponding literature.
5. Conducting an econometric model for ship dry-docking cost, verifying results and reaching fertile conclusions.

and it can be schematically represented by the Figure 1

³ *Decade of cost management lies ahead, says Clarksons Research director Martin Stopford, Lloyd's List, October 20th, 2011*

Figure 1: Schematic presentation of the Thesis' topics



The structure of the current thesis comprises the following chapters: *Chapter Two*, where a literature review is presented covering all the references used in the existing thesis:

1. Islamic finance.
2. Islamic finance for shipping.
3. Ship operating costs.
4. Dry-docking & pertinent cost structure.
5. Econometric modelling.

Literature research includes books, papers in scientific journals, articles in professional magazines, preceding academic research and professional presentation in pertinent conferences and forums.

Nowadays, a number of books and references can be found regarding Islamic finance. It is also remarkable the number of papers, references and information that can be found in the web, either in special purpose websites⁴ or in conventional websites. Latter include major western banks and

⁴ www.globalislamicfinancemagazine.com is an Islamic finance magazine, whereas www.wdibf.com is an on-line database for Islamic banks and finance. These are only two examples among hundreds of similar websites.

organizations like *Ernst & Young*⁵. However, the current thesis shows that little is referenced to ship finance. Most findings come from the maritime special press where the pace of frequent news is significant.

Very few recent references were found for ship operating costs. Whilst the topic was popular in 1970s (Benford, 1968; Buxton, 1971; Goss, 1968) nowadays researchers focus more in the freight (income) and finance fronts. The lack of relevant references is culminated when search reaches dry-docking topics. Definitely, dry-docking and ship repairs stand closer to a practitioners' activity than a Forward Freight Agreement (FFA) for instance. However, the *holy grail* of shipping – the profitability – lives much closer to the cost management of ships (Stopford, 2011).

Further to the above statement – the lack of recent studies concerning operation costs or dry-docking ones - literature review found some econometric models for shipping applications (Vergotis, 1993; Cullinane, 1999; Evans, 1990) but very few for cost analysis (Glen & Reid, 2010).

Therefore, the shortness of pertinent literature regarding (a) Islamic solutions for ship finance and (b) dry-dock cost analysis strengthened author's position to conduct the current thesis.

In the *Chapter Three* a short broad introduction to Islamic finance is taking place. After reader having become familiar with the Islamic banking principals⁶ and products, a further investigation into ship-finance application is attempted. Finally, actual examples of recent shipping projects which supported by Islamic Funds are referred for the period 2002-2008, whilst more detailed ones are presented for the last two years 2009-2011. Examples are covering a wide geographical scope – from Middle East to South Asia – and a variety of projects from the acquisition of a container terminal network to the order of new-building ships. This Chapter shows the rapid development

⁵ They follow closely and invest in Islamic finance services, an example is their latest report on World Islamic Banking Competitiveness (Ernst & Young, 2011)

⁶ based on the Shari'ah law which derives from Prophet Mohammad's conception of social life

of Islamic finance and its penetration into the ship finance. The number of examples demonstrates that the above new ship finance mode is widely accepted and practiced by new as well as old and important shipping companies.

Dry-docking, not so frequent to literature, is extensively presented and analyzed in the *Fourth Chapter*. My field in this matter – as a competent naval architect and marine engineer - contributes largely to enlightening all possible shadow corners. Reader is firstly introduced into the legislative framework of ship construction and operation as well as to the international bodies which make such rules and regulations. The denoting role of flag states and classification societies that oblige a ship to dry-dock regularly is highlighted. In dry-docking there are two perspectives: that of ship managers and that of ship-yards. Both perspectives are analysed from operational and commercial point of view. The mechanism of inquiries, tenders and quotations is also exhibited.

Chapter Five is dealing with the principals of the ship operating costs. For each one of the following costs a short description is given together with a cost estimating approach:

1. Manning cost.
2. Repair and maintenance cost (R&M).
3. Stores and lubricants.
4. Insurance cost.
5. Administration cost.

Moreover, actual and updated figures are provided based on some industry annual reports for tankers. Reported figures for tanker dry-docking costs are presented and compared with their total operational costs. Latter comparison proves the significance of dry-docking cost among the rest of costs – that I estimated to 20% of the annual operation cost. Finally, special attention is given to the cost structure of the dry-docking process. Both shipyards' and ship-managers' positions are explored in a so called well-kept secret, such as the dry-docking calculations.

In *Chapter Six*, more than four hundred invoices of ship repair actual bills are collected over a period of four years – from 2007 to 2010 - and most potential determinants of ship repair and dry docking costs are explored. My finding that ship size, age, and number of stay days in the yard, constitute the main determinants of dry docking cost is consistent with the literature on operating costs as far as it concerns the ship size (Cullinane, 1999; Gilman, 1980; Ryder, 1979; Glen & Reid, 2010). Subsequently, I develop a simultaneous equation model where dry docking cost, measured by the amount on the invoices (LBILL) is treated as an endogenous variable and employ the Generalized Method of Moments (GMM) to estimate the interaction between dry docking cost and its determinants. I discover a statistically significant positive relationship between dry docking cost ship size, age and number of days staying in the yard. In addition, I find a strong and negative impact of the bargaining power of the ship company on dry docking cost, a fact always suspected but never actually empirically substantiated before.

Moreover, my results largely explain why shipping firms are keen on employing as insiders negotiators for dry docking purposes. They also have significant policy implications for vessel operators, as they suggest that lower dry docking cost is not a mere effect of sound financial performance, but also, and perhaps more importantly, a requirement for it.

Final conclusions on the investigated topics can be read in the *Chapter Seven*. The results of the econometric model and its usefulness to the shipyard and ship-manager are established. This thesis adds to the existing literature in two ways. First, it is the first thesis to investigate the relationship between dry docking cost and its determinants using hand collected ship yard information. Second, it develops the dry docking cost-profitability relationship of a ship yard treating dry docking as an endogenous variable: I

argue that the lower the dry docking bill, the ship yard experiences enhanced profitability⁷.

Finally, it becomes evident that Islamic finance will continue growing and penetrating more the ship finance industry, especially if similar studies enlighten and bring Islamic finance closer to maritime circles. The inherent ethical elements which are met in Islamic finance, most probably will lead to the establishment of new *ethic* banking products not necessary carrying any more the title *Islamic* but the title *fair*. This can be the subject of another study – as it is became apparent, that the lack of moral regulations and ethos gave birth to the crisis of 2008 with the well-known subprime mortgages and the collapse of Lemman Brothers.

A reference to the publications that I conducted during the thesis is given in the *Appendix A*. Both papers were published in reputable journals with high impact factor. The number of publications was a pre-requisite for the completion of my doctoral degree.

Shipping, ship repair and Islamic financial terms that are used more often in the current thesis have been collected and explained briefly under a Glossary section in *Appendix B*. It provides a quick and easy reference of the thesis to the reader. For more convenience the Glossary is divided in a glossary of shipping terms and another one for Islamic terms.

In *Appendix C*, an anthology of pictures has been collected and presented enlightening the non familiar reader with the dry-docking operations. Such photographic material was collected from author's past and present dry-docking experiences.



⁷ In December 2011, during a discussion with Murat Kiran, a major Turkish shipyard owner, he disclosed that the most profitable dry-docking projects are those with minimum stay days and limited scope of work

CHAPTER TWO: LITERATURE REVIEW

My first contact with Islamic finance was during the years I spent in Dubai. At that time I was hired to work as a naval architect for an important local maritime organisation. In my daily life I became familiar with the Islamic banking products offered to both Muslims and non-Muslims. Discussions with bankers and local Muslim scholars enlightened my knowledge over this *new* banking environment.

Soon enough it became apparent to me that Islamic finance was a newcomer player to ship-finance. I realized that when I attended the Marine Money 2007 Gulf Conference in *Dubai Grand Hyatt* and my frequent interactions with *Tufton Oceanic* – a very active Islamic finance entity - directors.

Islamic ship finance is a unique area identified by the following distinct characteristics:

1. Lending money to cover only fundamental needs of the borrower.
2. Pre-defined loan amount⁸.

Locating what I believe was an exemplar of Islamic finance in shipping adhering to the above pre-conditions, we decided with my supervisor to focus and explore the topic of *Islamic finance for ship repairs*. It is worthy to mention that ship operations, maintenance and pertinent costs constitute my professional daily work.

Research has not been limited to books, but it is extended to conference presentations, articles and papers in professional magazines and journals as well as building on my accumulated experience and knowledge of the topic. Paying due respect to the original authors' rights, sole reference to website is avoided; instead the original document was searched and identified, together with the reference and date of publication.

⁸ No 'cash in hand' in case of working capital

Citations and references are following as close as possible the principles of the American Psychology Association (APA) publication standards (APA, 2009).

The literature review covered the following directions which are embedded together by the present thesis:

1. Islamic finance.
2. Islamic finance for shipping.
3. Ship operating costs.
4. Dry-docking & respective costs
5. Econometric modelling.

2.1 ISLAMIC FINANCE

Islamic financial products are aimed at investors who want to comply with the Islamic laws (*Shar'iah*) that govern a Muslim's daily life. These laws forbid giving or receiving interest (because earning profit from an exchange of money for money is considered immoral); mandate that all financial transactions be based on real economic activity; and prohibit investment in sectors such as tobacco, alcohol, gambling and armaments. Islamic financial institutions are providing an increasingly broad range of many financial services, such as fund mobilization, asset allocation, payment and exchange settlement services as well as risk transformation and mitigation. But these specialized financial intermediaries perform transactions using financial instruments compliant with *Shar'iah* principles.

El Qorchi (2005), the Deputy Division Chief in the Monetary and Financial Systems Department of the International Monetary Fund (IMF), shows that Islamic finance is developing at a remarkable pace. Since its inception three decades ago, the number of Islamic financial institutions worldwide has risen from one in 1975 to over 300 today in more than 75 countries. They are concentrated in the Middle East and Southeast Asia (with Bahrain and Malaysia the biggest hubs), but are also appearing in Europe and the United States. Total assets worldwide are estimated to exceed usd 250 billion, and are growing at an estimated 15 percent a year (although cross-border data remain scarce).

Nevertheless, El Qorchi highlights some drawbacks in the way Islamic finance has developed: Islamic finance is practicing in many countries⁹ under different national laws. There is no common guidelines or world supervising authority for the Islamic institutions whose operations fall again within their national regulatory frames. The pace of rise and spread of Islamic banking is so fast that data become outmoded very shortly.

Maris Strategies (2011) illustrate the development of the Islamic institutions (Figure 3). She projects how the Islamic financial institutions will look like in 2023 arguing that developing countries with growing Muslim population¹⁰ will dominate the Islamic finance in volumes. Muslim population projections were based on the Pew Research Centre (2011) report.

Literature in Islamic finance follows the above pace and if someone made a on line search in Google Scholar (scholar.google.com) in December 2011 he could find about 121,000 books, articles and papers. In August 2012 the same website can provide the reader with 136,000 items (Google Scholar WWW user survey; n.d)

I found books about Islamic finance in all public & academic libraries in Dubai. Even, corner bookshops were full of significant and revised editions of books and pertinent magazines.

Ayub (2007) explains *all* about Islamic finance in a very comprehensive presentation from the religious principles to the numbering of banking and insurance Islamic products. He takes the opportunity to raise a strong criticism against the myths of Islamic finance concerning basic issues, that is the costless money and so forth. He devotes an extensive part of his analysis to the contracting issues of the financial transactions as it is made clear that such financing is not so clearly regulated leaving a broad room for lawyers and bank Shar'ia boards to draw their swords. Ayub (2007) offers a

⁹ From Sudan, Bahrain, Saudi Arabia, Malaysia to United States, Canada and UK, Turkey. Countries spread in almost all continents and governed either by Common Law or legislation based on Roman Codes

¹⁰ like Indonesia, Pakistan, India & Bangladesh

proficient reading for both non Muslims and non financial professionals, a perfect entrance into the world of Islamic finance.

El Gamal (2006) – who is a professor of economics and finance at Rice University - criticises the islamisation of the contemporary financial practise instead of a genuine development of financial services complying with the Quran morality. He provides also a qualitative overview of the practise of Islamic finance and its historical roots that have defined its modes of operation. This forward-looking book is constructive in helping to visualise the future development of the existing Islamic finance and banking processes.

Even, shipping finance editor Stephenson (2009) in the last edition of his reputed book does not omit to add a last chapter under the title *An introduction to Islamic finance* (pp 537-546).

Finally, Cihak and Hesse (2008) conducted a rational cross-country empirical analysis of Islamic banks' impact on financial stability. They reached the conclusion that (i) small Islamic banks tend to be financially stronger than small commercial banks; (ii) large commercial banks tend to be financially stronger than large Islamic banks; and (iii) small Islamic banks tend to be financially stronger than large Islamic banks. This IMF working paper adds to the argument that Islamic institutions may suffer less than their western counterparts from the 2008 – financial turmoil.

2.2 ISLAMIC FINANCE FOR SHIPPING

According to *Tradewinds* (2008) shipping projects of almost 8 billion usd value had been financed by Islamic banks and institutions until 2008. The most significant are those of P&O global container terminals' acquisition by DP World against 3.5 billion usd in 2006; the order of new-building tankers by the National Shipping Company of Saudi Arabia (1.7 billion usd) in 2007 and the financing of new-building container-ships by the Malaysia Investment Shipping Company (circa 1.0 billion usd) during the same year.

Pondikoglou (2004) presents and analyses similar cases of Islamic finance in shipping. She extensively analyses the Al Rubban Navigation Finance Corporation (NFC) Fund which was jointly established in 2004 by

Kuwait Finance House (KFH) and an American shipping equity investment company, so called Northern Navigation International (NNI) and initially raised a capitalization of 80 million usd. Once being leveraged, the Fund was expected to reach a capitalization of 250 to 300 million usd. She illustrates also a simpler Islamic finance case, that of a Brunei natural gas carrier (LNG) new-building ship of 138,000 cbm capacity. Latter financing was reached 125 million usd.

I found reliable and useful reference material on the fast growing activities in the area of Islamic ship finance in shipping finance conferences as well as in shipping magazines and newspapers.

Marine Money is a regular shipping finance conference which takes place in many world shipping centres: New York, Hamburg, Athens, Dubai, London, Hong-Kong and so forth. The forum is repeated with an annual frequency. One of these conference the so called *Gulf Marine Money* takes place in Dubai every March. Always a favourite topic is covered with recent developments of Islamic Finance in shipping.

Alexiou (2007) in his presentation makes a discerning analysis of the most common Islamic financial techniques, particularly those addressed to shipping borrowers. As a lawyer, he keeps a sceptical and legal angle of view. He focused on the contract part of the loans and the contractual obligations of both parties, i.e. the lender's and the borrower's.

Machin (2007) and Hill (2008), both directors of the Dubai based *Tufton Oceanic LLC*¹¹ delivered their updated presentation on inside developments of Islamic shipping finance. Their contribution is noteworthy as they – themselves - are key players in Islamic finance. Moreover, they can better explain how Islamic Special Purpose Vehicle (SPV) techniques can work in practice.

¹¹more information can be retrieved from their corporate website: www.tuftonoceanic.com

Tradewinds (2008) makes extensive use of the above references of Alexiou (2007) and Hill (2008). The most recent projects are presented and Islamic finance glossary is provided.

The same weekly shipping newspaper keeps a close eye on such finance projects with detailed articles: only the last twelve months, someone can read *New Tufton fund targets wet growth* (Tradewinds, 2011b) a reference to the inauguration of an Islamic finance-compliant fund by *Tufton Oceanic* (Dubai) under the name *Wet Bulk Sector Fund*. Aim of the fund is to attract financing for tankers.

The newspaper (2011c) refers also to a recent Islamic financing facility of MYR 125m towards the Malaysian ship-manager Nam Cheong.

Finally, Tradewinds (2011a) highlights the financing deal of National Chemical Carriers Ltd. Co. (NCC) of Saudi Arabia with Banque Saudi Fransi and Samba Financial Group for the financing of two more chemical tankers.

When I was completing the current thesis, *Norton Rose* (2012) took over from *Tufton Oceanic* the regular Islamic finance topic in *Marine Money Gulf Conference*. A sign that in Shari'ah compliant finance, a qualified and knowledgeable legal advisor could be invaluable.

The number of shipping finance reports which make reference to the Islamic finance is growing steadily. An example is the Standard Chartered Bank (2012) report where the structure of the Islamic products is briefly presented. The report makes reference to the Standard & Poor's estimation that the total size of the Islamic finance market in May 2010 was 1.0 trillion usd adding that with a worldwide Muslim population in excess of 1.4 billion, there is still tremendous room for growth.

Islamic ship-finance is regularly covered by the daily shipping paper *Lloyd's List* as well. They give more emphasis to the legal counterparties of the Islamic finance. They often host interviews from law firms' professionals.

Lloyd's List (2011c) makes reference to the possible shortage of ship finance fund from the Italian banks. Paper hosts the opinion of a partner in

the Milan office of the law firm Norton Rose who says that there is a plan B for the Italian banks mostly counting on private equity and Islamic finance.

Lloyd's List (2011b) hosts an extensive interview with Davide Barzilai, a Norton Rose partner in Hong Kong who emphasises the potentiality of Islamic finance for the Asia Pacific region. He makes reference to finance projects since 2005 and he is very optimistic that even China will attempt to taste the vast finance opportunities offered by Islamic funds.

The same newspaper (2011a) hosts another interview with a legal person Martin Brown - a consultant with *Ince & Co* in Singapore. Latter led the *Ince & Co* team that helped structure a *Shar'iah* law-based forward sale and lease arrangement for Malaysian Islamic shipping fund *Safeena's* first deal in 2009. He seconds the growing number of Islamic finance deals in Singapore and consequently the need for specialised legal advisors. Such advisors in addition to contract law experience they need to prove qualifications in Islamic finance techniques and particularities.

Finally, *Marine Money* is not only an event organiser but the only ship-finance magazine available worldwide. The magazine is monthly and constitutes the information bible for ship financiers. When it covers Islamic finance deals, then the volume of information is immense, assisting the reader with a comprehensive approach.

The Saudi British Bank (SABB) and National Commercial Bank for Saudi Riyals signed a SAR 822.6 million (USD 219 million) *Murabaha* financing agreement with National Shipping Company of Saudi Arabia (NSCSA) according to the *Marine Money* (2011). The 12 year loan will be used to pay 80% of the construction cost of two 26,000 dwt general cargo ships and give the company the financial strength to exercise an option for two similar units at Hyundai MIPO Shipyard.

Marine Money (2010) is referring to Silk Holdings of Malaysia which secured two Shari'ah compliant Bai' Istisna facilities of usd 69.3 million to partly finance the construction of two Anchor Handling Tug Supply (AHTS) vessels. The Bai' Istisna structure is essentially a deferred delivery sale

contract similar to conventional work-in-progress financing, in which the financier pays to fund varying construction stages.

Marine Money (2009a) covers the announcement of an Islamic ship-financing, where Standard Chartered achieves a MYR 162 million bilateral ten year Islamic Finance Lease Facility for Tanjung Kapal Services Sdn Bhd. Latter will use such funds for the construction and commissioning of four new AHTS vessels.

Marine Money (2009b) makes reference to the first Malaysian Islamic shipping fund, so-called *Safeena*, which literally means *my ship* in Arabic. It was launched initially with a capital of usd 50 million whereas the sponsors aim to leverage the fund up to 300 million usd through a combination of equity and debt. Their purpose to acquire a portfolio of quality yielding vessels that can provide a stable income stream to fund investors.

2.3 SHIP OPERATING COSTS

Ship operating costs have been adequately and completely defined from an economic point of view by Stopford (2009). He provides updated figures regarding the running costs of the most common ship types and sizes. He uses data derived from *Clarksons Plc* database.

No academic paper or study has been found to be devoted particularly to the dry-docking cost, the reason seems to be the scarcity of such commercial information. However, dry-docking cost constitutes a major element of the ship operating cost. Therefore, I had no other choice than to focus on past studies and papers which deal with ship operating costs.

The ship operating costs are investigated and approached with different mathematical models by a number of authors.

Glen and Reid (2010) are presenting a model for tanker cost elasticities. They are revisiting the elasticity model of tanker costs – capital, operating and voyage costs - and finding that such model principals are still valid. They are comparing tanker data drawn¹² during the period 2007-2008

¹² from Gibsons shipbrokers, Moore-Stephens, and Clarksons

with a past study of Glen (1990) who collected and analysed data of 1970s. Glen and Reid are following similar approach with other studies such as those by Cullinane and Khanna (1999), Gilman (1980) and finally Ryder and Chappell (1979). Latter are focused on containership operating costs solely.

Brown (1996) makes a comparison of operating costs between single hull and double hull tankers. Figures are based on the US National Research Council, however they are of limited value as at that time double hull tankers were very rare and thus their operating costs did not provide representative samples.

Cullinane and Khanna (1999) examined two ways to calculate containership operating cost. The first was related to the elasticity of cost with respect to the size of the ship (*elasticity=0.43, $r^2=0.41$*). This result was derived from a empirical analysis of ZIM¹³ containerships' operating costs, conducted by Jansson (1987). Similar approaches were adopted by other researchers as well like Heaver (1968) and Goss and Mann (1974). Finally, Cullinane (1999) proposed a calculation of the operating cost as a function of ship's capital cost and particularly assumed

$$\textit{operating cost} = 3.5\% \textit{ of the initial capital cost}$$

To correlate the operating cost to the capital cost was a method that was followed also by Ryder and Chappel (1979), Gilman (1980) and Pearson (1988). However, the above methods have the disadvantage that they are applicable only close to the date of publication of the study. The reason is that, operating cost is subject to inflation - and thus a steady annual increase of approximately 3% can be noticed – whereas the initial capital cost has a commodity behavior, fluctuating strongly between good times and bad times.

¹³ www.zim.com – Zim is presently ranked in the 17th position of container carriers, with 325,000 teu capacity according to Alphaliner – Top 100 report (December 2011).

Apostolidis (1995) in his MSc thesis on the tanker design techno-economical model estimates the annual operating cost for tankers as a function of deadweight (size)

$$\text{operating cost} = 0.0059 \times \text{deadweight} + 3839.16$$

Above formula derives from a regression analysis that is based on actual tanker operating costs as they were published by Drewry Consultants (1994).

All above studies and models seem to give a fair approach to the estimation of ship operating costs at the time of their publication. However, the volatile environment of tanker shipping, that is the inflation in different countries, the fluctuation of currency rate of exchange, the rise and fall of steel or oil prices waive any advantage in long term estimation.

In the future, it will be worthy to correlate ship operating costs with historical values of parameters such as gross domestic product (GDP) of seafarers' nations – for the crew cost component - or steel and oil prices in order to achieve a diachronic estimating model.

Operating costs and corresponding book keeping still stay a well kept secret. Around one-third of shipping companies still keep their financial information under wraps – although, on the whole, transparency has improved over the past three years, according to a new survey from chartered accountants KPMG (Lloyd's List, 2011). This is the reason that there are two major chartered accountants and publishers – in the same time - who sell their respective annual reports at very high prices. Demand is big, since all ship-owners want to know whether they do well or not. Thus, latter need benchmarking, and such facility is provided on an annual and reliable basis.

The first one, it is published in September 2011 by the chartered account firm Moore Stephens under the name *OpCost 2011* for the year 2010. In fact, this report is published every September with operating costs of the preceding year (Moore Stephens, 2008, 2010, 2011). They collect such information on a volunteering scheme where shipping companies can provide

their own operating costs. As a reward, a free of charge subscription¹⁴ is offered to the company. The system seems fair and efficient. During the last years they achieved to collect more than 2,000 data for each annual report. They cover a broad range of ship types and sizes. This is the most popular and *wanted* report among the maritime economists and ship managers.

However, the oldest provider of ship operating cost data is Drewry Shipping Consultants Ltd¹⁵ who every summer publish the well expecting report¹⁶ *Ship Operating Costs Annual Review and Forecast 20xx-20xx* (Drewry Consultants, 2011). It is a remarkably reliable report as well and more detailed than that of Moore Stephens. It is based on long collecting data and gives also forecasting for the development of the various operating costs.

Moreover, Drewry (2003) drops some information of the above annual report into another report they publish annually, the so called *Finance for Ships*. In this report they devote a short paragraph giving the elementary annual operating costs for most ship types and sizes. They do not provide forecasting; however they give the figures for the last six to seven years. They do so, as operating cost knowledge is vital for the calculation of the estimated return on the shipping investment.

Smaller research firms attempt to publish reports on ship costs such as the Ocean Shipping Consulting (2002), however such attempts seem mostly spontaneous without continuation.

Concluding, I can see that there are two main groups of references for ship operating costs. The first group includes the annual reports which are based on collected actual commercial data. The purpose of these reports is mostly to contribute to benchmarking and help shipping professionals in their daily work. Publishers do some forecasting using simple Microsoft Excel graph projection.

¹⁴ The cost of one report is usd 950 (2011), in the past was higher

¹⁵ www.drewry.co.uk is their webiste, where reader can purchase such reports

¹⁶ It is also high priced report at 1,200 GBP

The second group of references includes articles in academic and professional journals and books which try to analyse and model the behaviour of the operating costs. All of them are based on collected data – the first group. It is worthy to mention that in spite that there are many data available now, the development of papers is not proportional. In the future, more scholars should lean on the operating cost and develop holistic models.

Glen and Marlow (2009) review all recent papers written on shipping statistics and recognise that cost statistics are variable whereas the most problematic are the statistics on the operating costs. Additionally, they are of the opinion that survey bases of the above mentioned industry based reports are less than ideal.

2.4 DRY-DOCKING & RESPECTIVE COSTS

Dry-docking is a quite particular job within the ship operation or maintenance activities. For frequent operations such as cargo loading and discharging, bunkering, for machinery or steel maintenance there is reasonable number of books and publications. However, for dry-docking (a well kept secret between shipyards and owners) very few has been written.

A unique book for dry-docking by Butler published first in 2000, it was reached recently its second edition (Butler, 2012). The author has a long experience in ship repair business and obviously had been involved in estimation projects in the past. His book is used as a bible for guidance in estimation by many shipyards. Very wisely, Butler presents most of the expected repair jobs in a dry-dock in terms of man-hours. This is in full agreement with actual practices, because a yard estimates a job's cost as:

$$\textit{estimation} = \textit{labour cost} + \textit{material}$$

Butler's figures are realistic and therefore, are used by – at least – three major ship repair yards¹⁷ as far as I know. Additionally, many ship management companies use this book as a rule of thumb to calculate the time

¹⁷ Lisnave (Portugal), Dubai and Asry (Bahrein)

that crew need to maintain a machinery maintenance onboard¹⁸. Someone could argue that not all people can perform the same way; Butler has a reply and presents a table he compiled with coefficients regarding labour productivity in different countries.

The second book – regarding dry-docking – that you can find in the shelves of a maritime bookshop is by the former Lloyd's Register – Fairplay¹⁹ organisation (2000). In fact it is a collection of a number of forms which can be used either by a ship-manager or a yard. The material is in bulk without any consistency and comments. Thus the usefulness of this attempt is questionable. Another negative topic was the overprice²⁰ of the book.

Both books (the latter in particular) can contribute little to the purpose of the current thesis, however, they were reviewed for completion principle.

Gratsos and Zachariadis (2005) contribute to dry-docking cost research as well, by analysing mostly the cost and time for steel plate replacement in bulk carriers of Handymax and Panamax size. Figures are considered valuable as both professionals have a sound technical expertise.

Moore Stephens fortunately, in the previously mentioned annual publication *OpCost20xx* they include one last page for the dry-docking cost. Similar, with the other operating costs, data are collected from actual accounts which are contributed voluntarily by ship managers. I make reference to Moore Stephens (2008, 2010) and elaborate the pertinent data for tankers which cover the examined dry-docking period.

¹⁸ Such as the overhauling of main engine cylinders, diesel generators or pumps. Overhauling means to open the machinery (e.g. a pump), dismantle, clean the various parts, take and record measurements, replace the wear or damaged parts, assemble and carry out an operational test.

¹⁹ Now Fairplay magazine and publications were bought by the American group of IHS (www.ihs.com) and now is called IHS Fairplay. It is unknown whether the new owner will continue the handbook publication or not.

²⁰ The price was in the range of 500 euros according to the on-line bookshop www.amazon.com (October 2010)

These annual reports constitute the only reliable reference available in the shipping industry regarding dry-docking costs. In addition ship stay days in the yard are given as average. Data seem realistic, however their usefulness is limited as they are presented as an average only for each type and size of vessel without mentioning the location of the yard and the age of the ship.

All in all very little if anything has been written on dry docking since it is large considered as a confidential practice procedure. Similarly it was very limited thought to establish benchmarks – for comparison – or financing purposes. On the other hand, Islamic ship finance considers such determination important - according to its principles - in order to extent its support to the shipping industry.

2.5 ECONOMETRIC MODELLING

Econometric modelling is not new in shipping²¹. However, I can find econometric applications mostly on the revenue side of shipping. The reasons are, on the one hand, that cost data are not widely available or reliable (Glen & Marlow, 2009) and on the other hand that revenue forecasting is more attractive for an investor or an outside reader.

The most well-known modelling is ship freight forecast is that of Vergotis and Beenstock (1993). Unfortunately, the book is out of stock for many years now, hence, I had to retrieved from *The British Library*.

Tsolakis (2005) conducted a insightful doctoral thesis for the Erasmus University of Rotterdam. He uses econometric models such as that of Error Correction Model in order to analyse the four shipping markers of (i) freight rates, (ii) second-hand ship prices, (iii) new-building ship prices and (iv) ship scraping values. He compares also his results with different econometric methods, like the atheoretical family of Auto Regressive Moving Average (ARMA) models.

²¹ for the purpose of the thesis, literature review is limited to econometric modelling in shipping. Nevertheless, econometric models and techniques are widely applicable in the rest of economic and financial activities

There are some papers on econometric modelling in shipping. Those which are related to costs have been analysed in the preceding paragraphs of the operating cost papers (Cullinane, 1999; Ryder, 1979; Jansson, 1987 among others).

Econometric modelling was always a tool for market forecasting despite the remarks of Stopford (2009) that forecasting in shipping is not so straightforward as in the other industries. In the 1970s, Hawdon (1978) creates his Tankship Building Model, estimating a tanker new-building price equation by including both cost related (steel price) and asset pricing (freight levels) variables in his approach. For Hawdon (1978) the price per dwt of new tankers is assumed to be linearly related to rates, rates lagged, the size of the fleet, the average size of tankers and the price of steel sections. He estimates a linear relationship employing both the Ordinary Least Squares (OLS) and the 2 Stage-Least Squares (2SLS) method.

By taking an asset pricing model approach, Beenstock (1985) observes that second-hand prices are flexible whereas new-building prices are comparatively rigid.

Finally, Beenstock and Vergotis (1993) distinguish between the market for new-built ships and second-hand ships and take an asset pricing model approach. Their model is a case of an asset pricing model. They assume that new-building and second-hand ships are practically perfect substitutes.

Later on Jin (1993) and Volk (1994) present their own econometric models attempting to analyze second-hand and new-building ship prices. According to Jin (1993) shipbuilding cost should be a decisive factor in a supply function, but in the short run, cost may be less influential than capacity. They both contribute to the theory that shipping and new-building order-book follows a cyclicity²².

²² Such theory is first introduced by Stopford in 1980s and it still broadly accepted and seconded. However, many shipping scholars believe that such theory is overvalued as shipping is just following the cyclicity rule that when everything goes well shipping goes

The volatility of freight rates in relation to the market structure in shipping has also attracted the interest of researchers. As noted by Stokes (1997), bulk shipping markets in general and the tanker market in particular tend to be highly cyclical. Freight rates are determined by the interaction of demand and supply and can be quite volatile. OSG Industry Profile (www.osg.com) reports that, during periods of high volatility, day-rates can move by 50 percent or more within a few days. While revenues can fluctuate significantly, most shipping companies have a high proportion of fixed costs. In these circumstances, tanker companies try different strategies, including entering shipping company pools and forming alliances, which help them manage the volatility in day-rates by creating greater asset utilization and cost efficiencies.

Hawdon (1978) pioneered research in the evolution of tanker freight rates both in the short- and the long-run. He considered the process of spot freight rate determination as a series of interactions between the market for tanker services and the market for tankers. His five-equation model comprised two equations explaining demand for orders and price of new tanker capacity, two additional equations explaining deliveries and scrapping of tankers, and a fifth equation depicting current fleet size determination. While in the short-run both demand for and supply of services were found to be price inelastic, in the long-run the supply of tanker services appears to be affected by current and expected values of freight rates.

Freight rate volatility in the dry bulk market was thoroughly investigated by Kavussanos (1996a), who studied differences between monthly spot rates and charter rates, as well as differences among spot rates and vessel size for the period 1973 to 1992. Using a standard generalized autoregressive conditional heteroskedasticity (GARCH) model that incorporated macroeconomic factors, such as industrial production, bunker prices, and fleet size, he concluded that there is no evidence for constant

well too. Attempts by researchers to derive the magic number of cycle years have never been fulfilled. In the past it was believed that shipping was following seven or nine year cycles.

volatility in any of the time series investigated. He found that time charter rates tend to be more volatile than spot rates. Drobetz, Gounopoulos, Merikas and Merika (2012) provide a possible explanation for this has been recently put forward by researchers that expectations are better reflected in time charter rates and, therefore, are more liable to changing perceptions over the future of the market. The authors also stress that the volatility of spot rates is positively related with vessel size, justifying their finding on the grounds that larger vessels are subject to more regulatory restrictions regarding their operations, thus being more sensitive to changes in market conditions.

To further explore the positive relationship between vessel size and freight rate volatility, Kavussanos (1996b) examined monthly changes in the prices of second-hand tanker vessels across different vessel sizes over 1980-1993. In this study, the GARCH model employed was extended to include amongst the macroeconomic variables the price of oil, which is significant in explaining time-varying volatility. The results were similar to those obtained for the bulk shipping sector: the larger the vessel, the higher the volatility. The positive relationship between vessel size and volatility was confirmed by Kavussanos (1997) when he extended the analysis to the dynamics of conditional volatilities for the prices of second-hand dry bulk vessels. Once again, he concluded that price volatility increases with vessel size.

Jing, Marlow and Hui (2008) investigated the volatility in dry bulk freight rates using daily returns of the freight rates indices Baltic Exchange Capesize Index (BCI), Baltic Exchange Panamax Index (BPI) and J.E Hyde Shipping Index (JEHSI), for three different vessel sizes, Capesize, Panamax and Handysize respectively. The period under investigation was March 1999 to December 2005 and the GARCH models employed indicated that shocks tend to enhance volatility for all the series considered. Moreover, changes in the bulk shipping market appear to have diverse effects on freight rate volatility in different vessel types due to their distinct flexibility. In order to assert the asymmetric characteristics of volatility in daily returns in the three bulk sectors and the different market conditions, the authors divided the sample into two sub-periods (1999-2002 and 2003-2005), for which the exponential general autoregressive conditional heteroskedastic (EGARCH)

model applied revealed that the asymmetric characteristics were distinct for different vessel size segments and different market conditions, possibly owing to distinct flexibility, commodity transported, and route.

In the same line of reasoning, Drobetz, Gounopoulos, Merikas and Merika (2012) investigated the volatility structure of freight rates utilizing daily and monthly data of the dry bulk freight market, by examining whether unconditional freight rate volatility is influenced by the size of the vessel. The methodology employed GARCH models that incorporate macroeconomic factors, as first introduced by Kavussanos (1996b). The results of the analysis reinforce the hypothesis that volatility increases with vessel size. The size variable is significant in both time charter and spot market. The analysis indicated that macroeconomic factors, such as the inflation rate, the TED spread²³, and US industrial production were highly significant in the conditional variance equation. Variables such as steel production, wheat prices, and U.S industrial production had a statistically significant impact on conditional volatility in the spot market. It was also asserted that negative innovations tend to have a higher impact on the conditional variance than positive innovations. The latter contradicts the demand and supply model of Stopford (2009), but could be explained considering that, in contrast with positive announcements, negative announcements reinforce the uncertainty of market participants.



²³ The TED spread is the difference between the interest rates on interbank loans and on short-term U.S. government debt ("T-bills"). TED is an acronym formed from T-Bill and ED, the ticker symbol for the Eurodollar futures contract.

CHAPTER THREE: ISLAMIC FINANCE

3.1 PREFACE

Institutions offering Islamic financial services started emerging in the 1960s in isolation but the movement of Islamic banking and finance gained real momentum with the establishment of Dubai Islamic Bank and the Jeddah based Islamic Bank in 1975.

Figure 2: Dubai Islamic Bank inaugurated by late Sheikh Rashid in 1975



While the increasing involvement of the Shari'ah scholars, creative work by research institutions like the Islamic Research and Training Institute (IRTI) - which is the research and training arm of the Islamic Development Bank (IDB) in Jeddah – and the issuance of Shari'ah standards by the Accounting and Auditing Organization For Islamic Financial Institutions (AAOIFI) in Bahrain provided a critically needed base to the emerging financial discipline, the participation of the world's top banking institutions like HSBC, BNP Paribas and Citigroup in the 1990s provided a driving force to transform it from a niche discipline to a global industry.

Nowadays, Islamic banking and finance is being practised in over 75 countries around the world, with about 550 Islamic financial institutions in the field (Ayub, 2007).

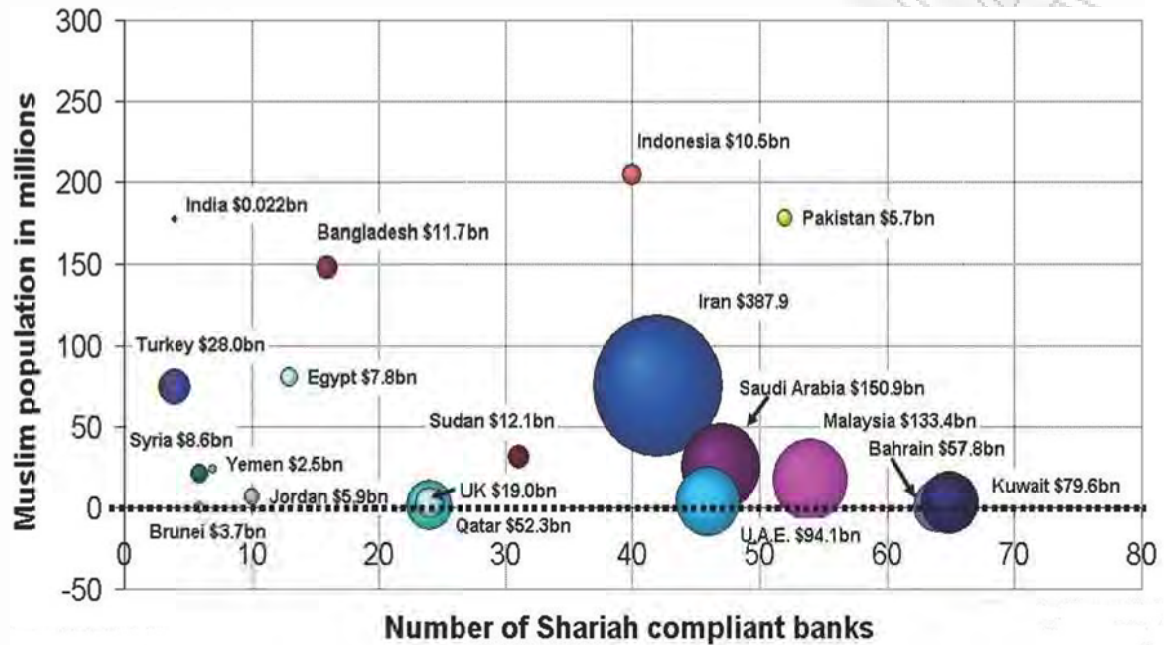
Table 1: Selected Gulf Islamic Bank foundation

1975	Dubai Islamic Bank	Institutions established primarily as local retail banks
1977	Kuwait Finance House Islamic Investment Co	
1978	Al Rajhi Bank	
1979	Bahrain Islamic Bank	
1983	Qatar Islamic Bank Al Barakah Islamic Bank	
1990	Arab-Islamic Bank	Establishment of international bank Islamic subsidiaries
1996	Citi Islamic Bank	
1997	Arcapita Investment Bank	
1998	HSBC Amanah	
2001	Noriba - UBS	Local institutions converted from existing conventional banks
2002	Sharjah Islamic Bank	
2004	Emirates Islamic Bank	
2006	Amlak Finance	
2007	Dubai Bank	

Source: Hill (2007)

Maris Strategies (2011) illustrate the current position and volume of the Islamic financial institutions worldwide:

Figure 3: Shari'ah compliant banks & Muslim population (2011)



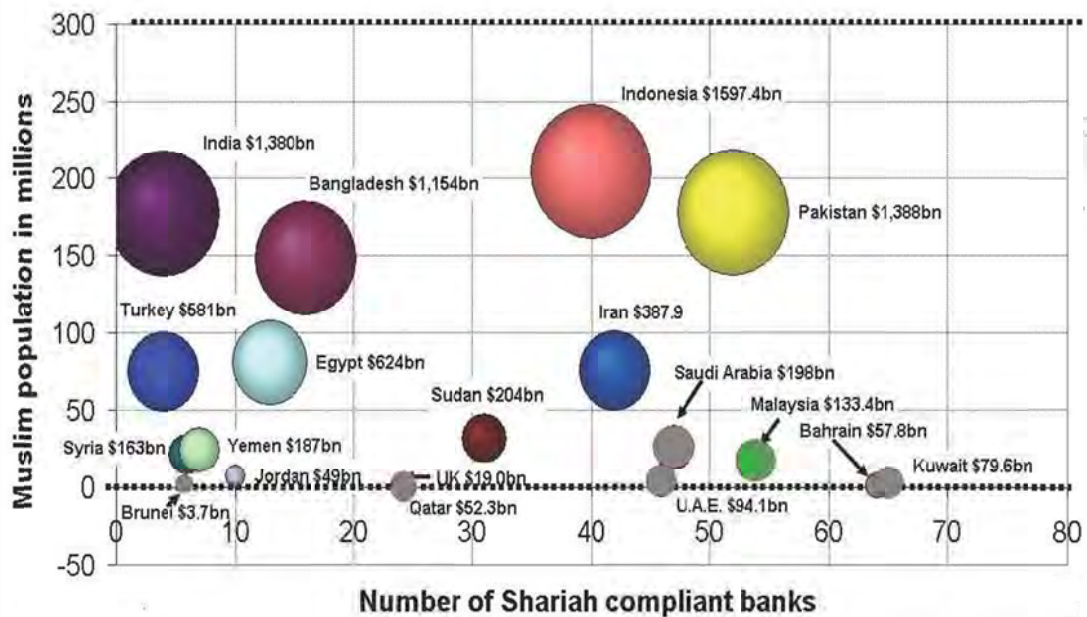
Source: Maris Strategies Ltd (2011)

Maris Strategies argue that even if the first Islamic institutions were built on the oil and gas natural resources' wealth, in Persian Gulf mostly, the future belongs to the countries with a growing Muslim population. She uses as a basis the country of Malaysia to define a ratio today:

$$\text{projection ratio} = \frac{\text{Shari'ah compliant assets}}{\text{Muslim population}}$$

then they project the corresponding *Shari'ah* compliant assets in 2023 (Figure 4).

Figure 4: Shari'ah compliant banks & Muslim population (projection 2023)



Source: Maris Strategies Ltd (2011)

3.2 THE SHARI'AH

The *Shari'ah* law are the rules which a Muslim has to comply with. Such rules are concluded by the Shari'ah scholars who suggest solutions and issue edicts regarding various human activities on the basis of the below primary sources of Shari'ah:

1. The holy book of Qur'an, and
2. The Sunnah, which consists of the sayings of the Prophet Muhammad as well as actions done or approved by him

Shari'ah rules can be divided into Dos (order to undertake any act) and Don'ts (prohibition from some acts)

3.3 THE BASIC PROHIBITIONS

Three are the major prohibitions of the Shari'ah law regarding the financial transactions:

PROHIBITION OF RIBA

In various verses of the Holy Qur'an the practice of *Riba*²⁴ is categorically forbidden²⁵. Furthermore, after the conquest of Makkah, Prophet Muhammad declared as void all amounts of *Riba* that were due at that time.

However, it is worthy to mention that such Shari'ah objective is not leading to a costless borrowing of money as I will analyse later on.

PROHIBITION OF GHARAR

The second major prohibition is that of *Gharar*, which refers to the uncertainty of hazard caused by lack of clarity regarding the subject matter or the price in a contract or exchange. A sale of any business contract which entails an element of *Gharar* is prohibited. In other words, selling contracts shall be clear - without embedding any hazard for either party – and the product or service to be available at the moment of the agreement.

PROHIBITION OF MAISIR OR QIMAR

The words *Maisir* and *Qimar* are used in the Arabic language identically. *Maisir* refers to easily available wealth or acquisition of wealth by chance, whether or not it deprives the other's right. *Qimar* means the game of chance – one gains at the cost of others; a person puts his money or a part of his wealth at stake wherein the amount of money at risk might bring huge sums

²⁴ the word *riba* means prohibited gain and generally can be addressed to interest. Thus, avoiding of interest is a fundamental corner stone of the Islamic theory of finance and economics.

²⁵ Surah (Qur'an chapter) al-Rum; verse 39, Surah al Nisa; verse 161 and Surah Al-e-Imran; verse 130

of money or might be lost or damaged. Again, there are clear references²⁶ in the Holy Qur'an that *Maisir* is flatly prohibited.

In my thesis, investigating the finance of the shipping activities the pre-dominant prohibition is that of *Riba* (interest) and *Gharar* (gambling) whereas the other two are of secondary importance.

3.4 PROFIT WITH LIABILITY

This principal states that a person is entitled to profit when he bears the risk of loss in business. It operates in a number of contracts such as the contract of sale, hire or partnership. Any excess over and above the principal sum paid to the creditor by the debtor is prohibited because the creditor does not bear any business risk with regard to the amount lent. In sale and lease agreements, parties have to bear risk as per the requirements of the respective contracts.

3.5 THE STRUCTURE OF ISLAMIC BANKING

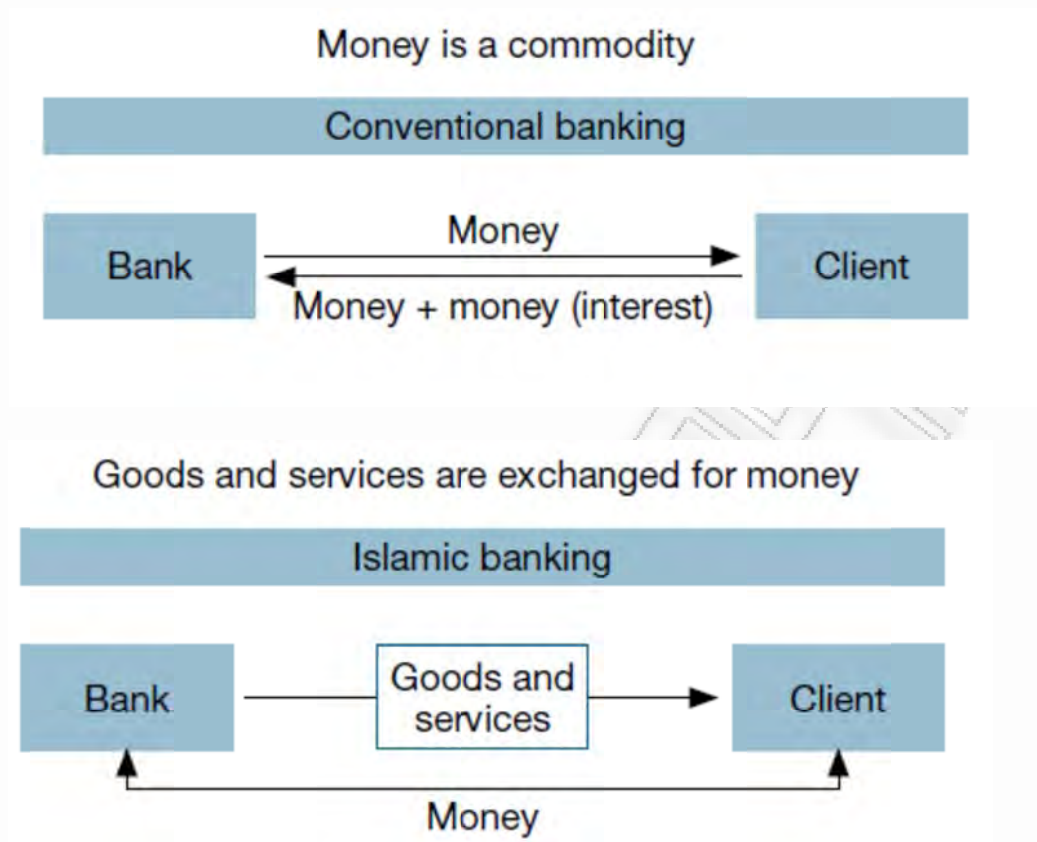
Islamic financial institutions serve as intermediaries between the saving surplus and the deficit units or households. However, the instrument of 'interest' is replaced by a number of instruments. While conventional banks mainly pay and charge interest in their operations, Islamic financial institutions have to avoid interest and use more than one key instrument as their basis of their intermediary activities. The striking difference is that risks in Islamic banking remain with the ownership, consequently, Islamic banks share profit or loss arising on investment and earn return on their trading and leasing activities by dint of the risk and liability taken and adding value in real business activities.

Shari'ah compliant institutions mobilise deposits on the basis of profit/loss sharing and to some extent on the basis of *Wakalah*²⁷ against pre-agreed service or agency fees.

²⁶ 5:90, 5:91 and 4:219 (i.e. Surah 4, verse 219)

²⁷ *Wakalah*: Contract of agency

Figure 5: Schematic difference between Conventional and Islamic Banking



Source: Chartered Standard (2012)

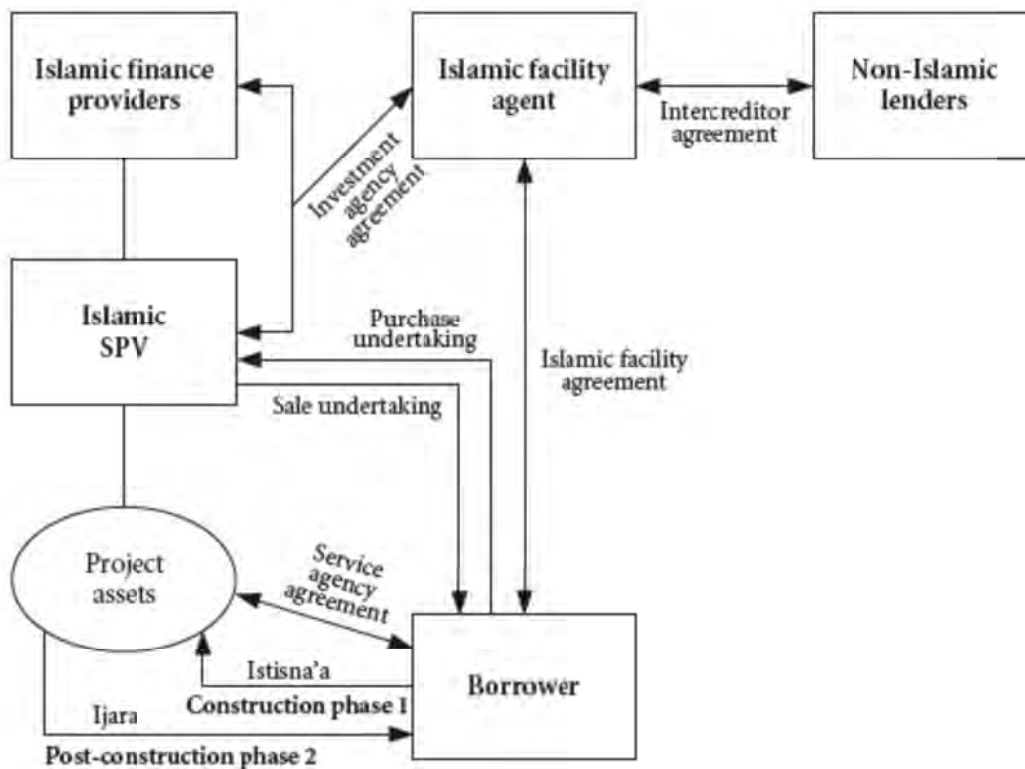
On the assets side, they take the liability of loss, if any, in case of *Musharakah*²⁸ or *Mudarabah*²⁹ – based financing and bear risk in trading activities so long as the assets remain in their ownership. In leasing activities,

²⁸ Musharakah: Partnership between two parties, who both provide capital towards the financing of a project. Both parties share profits on a pre-agreed ratio, but losses are shared on the basis of equity participation. Management of the project is carried out by both parties. However, the partners also have a right to forego the right of management / work in favor of any specific partner or person. There are two main forms of Musharakah: Permanent or Diminishing Musharakah.

²⁹ Mudarabah: A form of partnership where one party provides the funds while the other provides expertise and management. The latter is referred to as the Mudarib. Any profits accrued are shared between the two parties on a pre-agreed basis, while any loss is borne by the provider of the capital.

they purchase the assets, give them on rental and bear ownership-related risks and expenses. This implies that Islamic banks will remain as intermediaries, as they collect savings from a large number of savers or investors for financing the needs of business, agriculture and industry, but their modus operandi will change. Their subject matter will be goods and real business activities.

Figure 6: Islamic documentation in project financing (illustration)



Source: Freshfields Bruckhaus Deringer (2006)

Construction phase 1 – borrower develops, constructs and sells project assets to the Islamic SPV. As consideration, Islamic SPV makes phased payments to borrower (equivalent to loan advances).

Post-construction phase 2 – Islamic SPV leases projects assets to borrower. Borrower makes lease payments (equivalent to debt services)

3.6 THE ROLE OF SHARI'AH BOARDS

Shari'ah boards constitute an integral part of any Islamic Bank. They monitor the transactions of the Islamic Bank and give the go-ahead in transactions and have the final word on whether any given transaction is *Shari'ah* compliant or not.

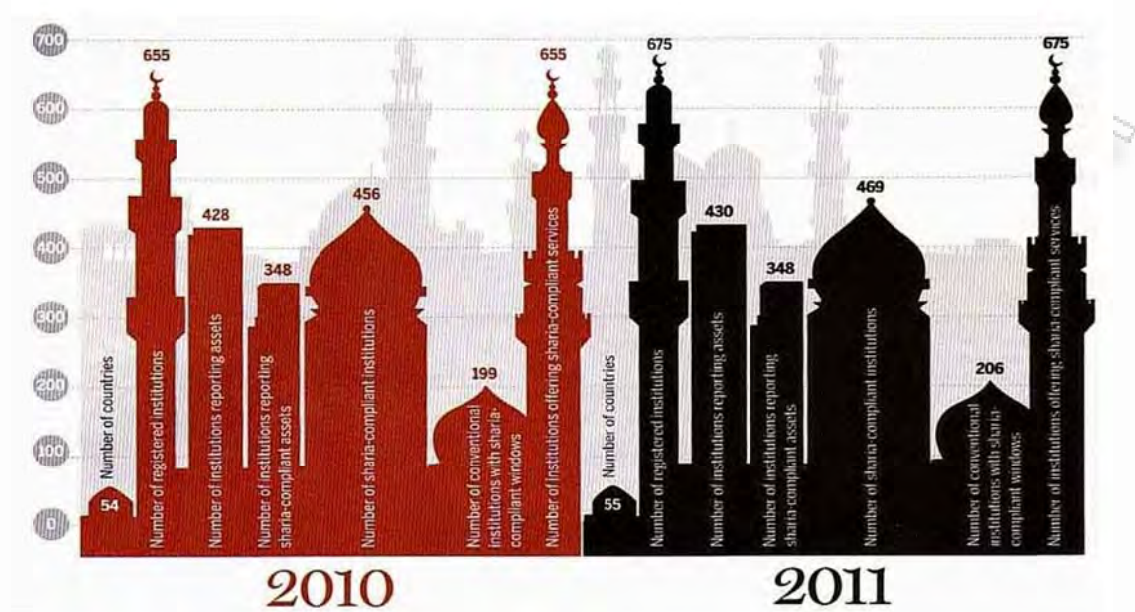
Nowadays, the *Shari'ah* boards are comprised by highly educated and esteemed scholars. Their opinions are expressed in the form of *fatawa*³⁰. *Shari'ah* lacks a unified and codified system of law. In fact it is quite similar to Common Law.

Methodology used in interpreting *Shari'ah* is on legal inference based on case studies and legal precedents and reasoning by analogy. Interpretation is based on *ijtihad*: the process of injecting new ideas and rulings into the heritage of Islamic jurisprudence.

Given the wide platform *Shari'ah* boards work on in interpreting *Shari'ah*, there are divergent views as to whether a transaction is *Shari'ah* compliant or not. Therefore, *fatwah* lack a standard and coherent interpretation especially in cases of debt and equity financing.

³⁰ Fatwah: a religious decree or edict, plural Fatawa

Figure 7: Number of Shari'ah compliant Institutions (2010-11)



Source: Maris Strategies Ltd (2011)

3.7 ISLAMIC FINANCIAL PRODUCTS FOR SHIPPING

The Islamic financial products have gone at great lengths to mimic its conventional counterparts. Finance in general connotes the allocation of risk and financial credit between financier and borrower. Islamic scholars have noted that Islamic finance has a long way in meeting this objective. Moreover, Islamic scholars have argued that given the current state of Islamic finance efficiency and fair pricing is not of essence. Emphasis is placed on mimicking conventional financial products and *Islamizing* them in order to achieve *Shari'ah* compliance.

Conventional shipping finance is not hindered by these factors. Traditionally Western shipping finance is recapitulated on three main choices:

1. Use retained earnings.
2. Borrow through debt, or
3. Issue new shares.

In the Western banking the most common form of financing vessels is the combination of equity and debt borrowing.

MURABAHA: COST PLUS FINANCING

Murabaha used extensively to facilitate trade finance activities. Financier takes title to the goods from a third party (either directly or through a SPV³¹). Financier then sells the goods to the customer at cost plus reasonable profit. This technique is not tainted by *Riba* as the financier is assuming risk by acquiring title to the goods entitling him to a reasonable reward. Profit is ascertained by customer's credit rating benchmarked to conventional interest rates such as conventional mortgage based loans.

Finally, the difference between conventional loans and *Murabaha* contracts is not so obvious. The bottom line of differentiation rests on contract naming.

Islamic sale contracts require an offer, an acceptance and a meeting of the minds of the parties. Objects of sale must be owned by the seller - to be within his possession - at the time of the contract. The financier is entitled to mark up the associated risk he assumes and thus, build up his profit.

The risk, that assumed by the financier is the fact that he is taking title to the goods and the risk of the customer rejecting them should they be found defective. Insurance is born by the financier yet bundled in the mark up the customer has to pay. This form is costly as it involves the setting up of SPVs, legal fees and other associated operating expenses.

³¹ Special Purpose Vehicles, Regulators world-wide require banks and other lenders to hold sufficient capital to cover any expected losses. Mortgage business is low margin business. So although in bulk it can be profitable, it can tie up a bank's capital which could otherwise be used for more profitable business. Over the years, banks have found ways to shift this business off their balance sheets by moving the mortgages and their funding into a Special Purpose Vehicle (SPV). These SPVs often get their funding by issuing bonds which are purchased by other banks. The SPV is, in effect, designed to insulate the issuer of the bonds from the sponsor, or originator, of the assets (mortgages). This process of moving the mortgages into a SPV and financing the loans with a bond is known as securitisation and the bonds are known as Asset Backed Securities (ABS)

Alexiou (2007) believes that it is doubtful whether this financial product can be used to finance vessels as conventional banks are normally prohibited from trading goods that they own. Fear of rejection of the vessel by the customer is a major risk given the current state of the shipping asset market. Nevertheless, two shipping companies, that is NSCSA and MISC agreed to finance the purchase of their new-building ships on Murabaha terms (Table 2).

From a legal point of view, the promise of the financier has to be unilateral and not stipulated as condition to the contract. However, Islamic banks tend to make the customer promise to purchase the goods yet the binding effect of such promise is questionable given that it is based on a minority view of Islamic scholars.

MUDARABAH AND MUSHARAKAH

The application of Mudarabah contracts in shipping is also questionable. In this case the bank provides the funds whilst the other party is responsible for the management, creating thus an agency relationship. The financier is subject to full responsibility of capital losses as well as claims from third parties in the case where the project is unsuccessful provided that the borrower is not guilty of wilful negligence.

Musharakah contracts, in other words, a joint venture between the bank and the client also cannot be reconciled under modern conventional finance arrangements. Primarily, banks as noted aforesaid, are prohibited from trading goods they own so one can hardly envision the application of this arrangement under current ship financing techniques. However, Musharakah was the favourite Islamic financial scheme of Tufton Oceanic Ltd every time they set up an Alislami shipping product (Table 2). In the same table it is shown that DP World in the most significant ever Islamic transaction used a Sukuk (bond) al Musharakah as well.

SHIPBUILDING AND ISTISNA

It was mentioned before that in order for a sale contract to be valid under the Shari'ah law; the seller must own the goods at contract inception. Departure

for this rule given normal commercial dictates was attained through Salam contracts. Juristic approval of Salam contracts was attained because Salam contracts were used initially by farmers needing capital to purchase materials in order to cultivate their land. Salam contracts apply only to raw materials and metals. In construction, the Salam contract counterpart is called Istisna or commission to manufacture.

Payments are made by instalments as per usual shipbuilding contracts. Earlier Jurists considered not to be binding between the parties, yet later based on a minority view they were considered binding and codified in the AAOIFI standard. The one commissioned to manufacture is only expected to use reasonable efforts to manufacture. Subcontracting is allowed under parallel Salam contracts.

The discouraging fact is that there is no direct liability of the final worker towards the initial commissioned to manufacture.

IJARA AND SUKUK

Banks buy the property and then lease it to the customer with monthly instalments consisting of a rent component and a purchase component, most often reproducing an amortization table that would also be used in Murabaha financing.

Leasing of the property with a future starting date and prior to obtaining has been found not to be controversial. Thus the bank proceeds to acquire the property after having in fact a valid lease starting after the property has been purchased. Usually contain a purchase option at the end of the lease.

The promise to sell the property at lease end must be unilateral and not made as a condition to the lease.

Price of leasing does not have to be predetermined as in murabaha contracts giving parties more flexibility.

Sukuk or bonds are usually used in conjunction with *Ijara* leases.

A trust so called Special Purpose Vehicle (SPV) is used for issuing lease backed securities that need to obtain short term funding either by

1. Obtaining a bank loan or some substitute thereof until the proceeds are collected from the *Sukuk* buyers, or
2. Selling the *Sukuk* prior to purchasing the property at lease end.

The lease payments are passed to the *Sukuk* investors. The bonds must represent ownership of an undivided part of the asset with all its rights and obligations. Truly (Table 2) shows that most of the Islamic shipping transactions during the period (2002-2007) were concluded on Ijara (lease) terms.

Table 2: Structured Islamic Shipping Transactions (2002-2007)

Year / Deal	USD Million	Tenor	Structure
2002			
Brunei Gas Carriers	129.0	5 yrs	Ijara lease
2004			
Alislami Oceanic	76.0	5 yrs	Ijara lease
Alislami Oceanic	141.0	7 yrs	Musharakah
Al Safeena	26.0	5 yrs	Sukuk al Ijara
Al Rubban	100.0	>10 yrs	Ijara lease
2006			
Alislami Oceanic	114.0	> 9 yrs	Musharakah
NSCSA VLCC financing	168.0		Murabaha
DP World	3,500.0	2 yrs	Sukuk al Musharakah
Qatar Gas II	500.0	15 yrs	

2007			
NSCSA VLCC financing	1,320.0		
Alislami Oceanic	200.0	8 yrs	Musharakah
Topaz Energy Marine	50.0		Ijara lease
MISC Malaysia	741.0	15 yrs	Murabaha
Alam Maritime Resources	148.4	10 yrs	Ijara lease

3.8 LATEST CASES OF ISLAMIC FINANCING IN SHIPPING

CASE 1: SILK HOLDINGS OF MALAYSIA (2010)

The rapidly growing offshore oil and gas industry in South Asian region continues to attract strong investor interest and new players are entering the market to take advantage of the attractive charter rates commanded by offshore vessels and equipment. Malaysia's Silk Holdings is one such example.

Deal	USD	Tenor	Structure
Silk Holdings (Malaysia)	69.3 M	n/a	Istisna
Silk Holdings (Malaysia)	30.0 M	n/a	Musharakah

Listed on the main board of Malaysian stock exchange so called Bursa Malaysia, Silk Holdings' main business is to own and operate a 37 km highway in Malaysia. In 2009, the financially distressed company went through a comprehensive restructuring scheme and identified the oil and gas sector as a potential new business driver. It subsequently went on to acquire AQL Aman, the holding company that owns 70% of offshore marine support services company Jasa Merin, with the remaining 30% stake held by the Terengganu State Government. Today, the company operates a fleet of 12

offshore support vessels, providing offshore support services to leading oil majors such as Petronas and Exxon Mobil and plans to take delivery of another four vessels by the end of this year.

In 2010 Silk Holdings secured two *Shari'ah* compliant *Bai' Istisna* facilities of a total MYR 220 million (USD 69.3 million) to partly finance the construction of two anchor handling tug supply (AHTS) vessels (Marine Money, 2010). Both subsidiaries are 51% owned by Jasa Merin while the remaining stakes are held by Global Maritime Venture, the venture capital arm of Bank Pembangunan Group. The twelve year facilities are secured by corporate guarantees from the shareholders. The *Bai' Istisna* structure is essentially a deferred delivery sale contract similar to conventional work-in-progress financing, in which the financier pays to fund varying construction stages.

This is not Silk Holding's first successful attempt at Islamic loans. In May 2011, the group secured an eight year MYR 85.52 million (USD 30.0 million) *Musharakah* facility from Maybank Islamic Berhad. The facility was used to part finance the construction of two more AHTS vessels.

CASE 2: NATIONAL SHIPPING COMPANY OF SAUDI ARABIA (2011)

The Saudi British Bank (SABB) and National Commercial Bank for Saudi Riyals signed a SAR 822.6 million (USD 219 million) *Murabaha* financing agreement with National Shipping Company of Saudi Arabia (NSCSA) according to Marine Money (2011). The 12 year loan will be used to pay 80% of the cost of construction of two 26,000 dwt general cargo ships and give the company the financial strength to exercise its option for two similar units at Hyundai MIPO Shipyard. In March 2011, the company signed shipbuilding contracts worth USD 400 million for four general cargo ships including the option to build two additional units with the Korean shipbuilder.

Deal	USD	Tenor	Structure
NSCSA	219.0 M	12 yrs	Murabaha
NCC	173.0 M	10 yrs	Murabaha

The loan is to be repaid in equal quarterly instalments and there is a balloon payment of about 30% at the end of the tenure. The ships will be mortgaged to the financing banks as security for the *Murabaha* financing.

The remaining two options of the four general cargo ships were financed by another *Murabaha* agreement for the amount of USD 120 million (Lloyd's List, 2012).

In March 2011 NSCSA's 80% owned subsidiary National Chemical Carriers (NCC) announced that it had signed two *Murabaha* agreements worth SAR 650 million (USD 173 million) in total with Banque Saudi Fransi and Samba Financial Group. The ten year loans will be used to finance four new chemical tankers ordered at SLS Shipbuilding and Daewoo Shipbuilding & Marine Engineering the year before.

Murabaha structure is often used by Islamic banks to purchase an asset on behalf of a client and then sell it back with a mark-up/margin on a deferred payment basis. This complies with Islamic laws that prohibit interest but allow profit.

CASE 3: SAFEENA SHIPPING FUND (2009)

Safeena is the first Malaysian Islamic shipping fund. *Safeena* which literally means *my ship* in Arabic, was launched on 28 April 2008, with a committed equity participation from its two sponsors, the Asian Finance Bank (AFB) and the Amanah Raya Investment Bank (ARIB) amounting to USD 50 million. The sponsors aim to expand the fund further to USD 300 million through a combination of equity and debt (leverage) to acquire a portfolio of quality yielding vessels that can provide a stable income stream to its investors (Marine Money, 2009a).

Deal	USD	Tenor	Structure
Safeena (Malaysia)	50.0 M	10 years	Istisna / Ijara

As a recap, the objective for *Safeena* is to provide long term stable returns through a new asset class of *Shari'ah* compliant investment products for the shipping industry. The fund suppose to buy ships that have long term employment contracts with credit worthy charterers such as oil majors and global commodity traders. The shipping fund has no restrictions when it comes to investing in local or overseas projects involving new-buildings or second hand vessels. The *Shari'ah* compliant fund has an added ability to source equity from sophisticated investors especially in Malaysia and the Middle East. And for the investors, they can look forward to consistent high cash dividend yield (about 90–100% target dividend payout with target average dividend yield of 8-10% per annum) and at the same time gain exposure to the oil and gas sector.

In *Safeena's* first transaction arranged by *RS Platou Finance Singapore*, it has acquired a 19,900 dwt stainless steel chemical tanker, through a structure that comprises *Istisna* (construction contract) and *Ijara* (forward lease) from *Jimbaran AS*, a Norwegian entity that owns and manages chemical tankers. Mohd Zamri Shariff, Head of Asset Management Division, Asian Finance Bank explains (Marine Money, 2009a) that this structure allows *Safeena* to participate in the cash-flow of the underlying asset, this the vessel, without having to place the asset onto its balance sheet (like any other typical sale and lease back structure). This structure works for both parties because *Safeena* provides immediate cash-flow to *Jimbaran SA* through the *Istisna* deposit payment while *Safeena* enjoys future cash-flow from *Jimbaran SA* through lease payments of the forward lease, so called *Ijara Mawsufah fi dzimmah*, throughout the contract period of 10 years.

As an added security layer for the forward lease, *Jimbaran SA* allows *Safeena* to place its second charge on its existing vessel, MT Puspawati, which currently on long term lease with PT Berlian Laju Tankers (BLT). *Safeena* takes comfort from the fact that it directly and indirectly benefits from the cash-flow of *Jimbaran's* existing asset (the long term lease to BLT, being one of the largest chemical players in the world) and is shielded against any fluctuation of the value of the underlying asset (off-balance sheet).

A put and call option is also embedded into the structure to allow both *Safeena and Jimbaran* to exit. Should any or both parties decides to end the *Istisna -Ijara* transaction, the strike price for the put/call option will be sufficient to return at the very minimum the principal sum to Safeena within the first five years. “This Islamic and innovative structure is the first of its kind being implemented in the marine industry and helps Safeena Islamic Fund to mitigate the risks involved in vessel financing,” said *Safeena’s* Chairman Dato Abdul Latif Abdullah (Marine Money, 2009b).

Safeena’s latest acquisition is expected to achieve a net return which meets the minimum return required by Safeena. This level of return would be attractive for investors looking at *Shari’ah* compliant investments as *Sukuks* generally yield is about 7% in Malaysia. Additionally, a 10% cost of equity is attractive to ship-owners in 2010 market conditions.

According to Lloyd’s List (2011a) *Ince & Co* advised *Safeena* in structuring the investment, ensuring the transaction was *Shari’ah* compliant and that it complied with the fund’s obligations to investors. *Ince & Co* also advised on the drafting of the purchase and lease documentation, its security in the sister vessel and conformity with the conventional financing arrangements in place in respect of the sister vessel. Another reputable law firm, *Norton Rose* represented the senior debt on this deal.

CASE 4: STANDARD CHARTERED FINANCING TANJUNG KAPAL (2009)

Standard Chartered is well established in the Middle East and South Asia Muslim countries, thus they have been actively closed a relatively large number of modestly sized deals.

Year	Deal	USD	Tenor	Structure
2009	Tanjung Kapal	51.0 M	10 years	Ijara

As an example in 2009 they achieved a MYR 162 million bilateral 10-year Islamic Finance Lease Facility for Tanjung Kapal Services Sdn Bhd, a subsidiary of Tanjung Offshore, for the construction and commissioning of

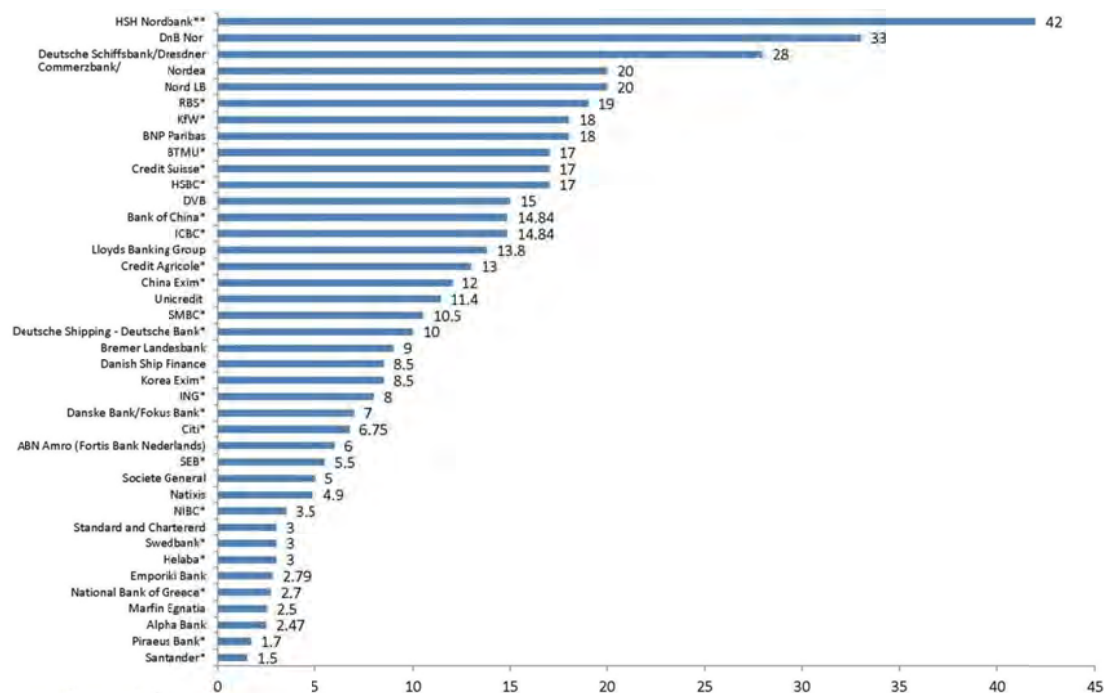
four new AHTS vessels (Marine Money, 2009). These will complement Tanjung's existing fleet of 11 offshore support vessels. The facility is based on the *Shari'ah*-compliant concept of *Ijara* and shall be disbursed in two tranches within an expected timeframe of two years.

3.9 TURMOIL IN GLOBAL SHIPPING FINANCE

In January 2012, the top 40 shipping lending banks reached a 459.69 billion usd portfolio according to the updated shipping finance report of Petrofin Research³² (Petropoulos, 2012). The pole position in the list (Figure 8) belong to European institutions. Chinese participation is counted only for 9.07% (Figure 9)

³² updated reports regarding ship financing statistics, specially for the Greek borrowers can be retrieved – free to download – from their website www.petrofin.gr

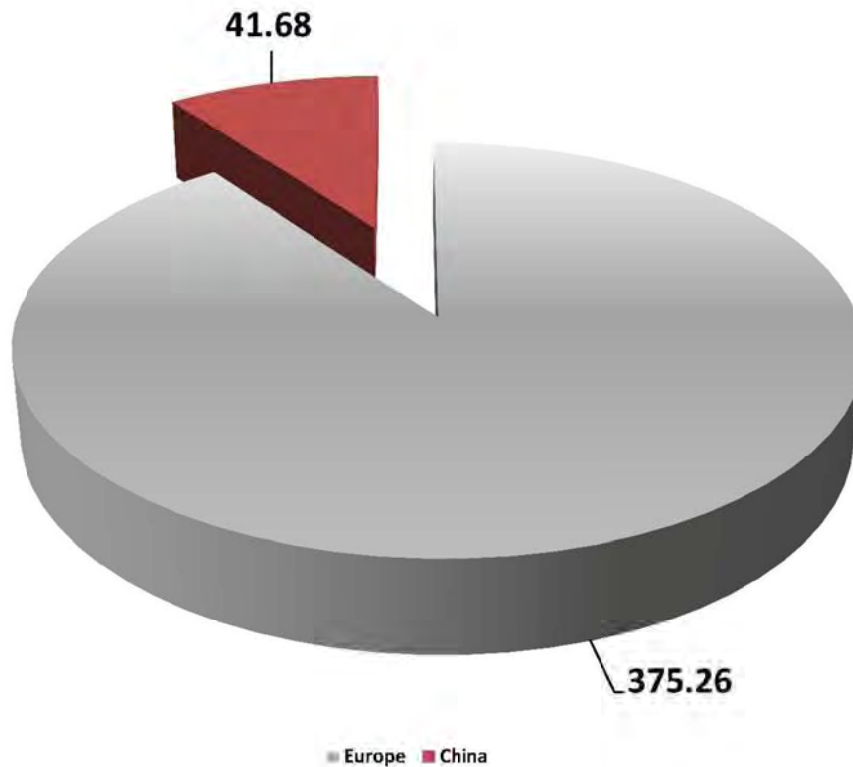
Figure 8: Top 40 global shipping banks in billion USD (Jan, 2012)



Source: Petropoulos (2012)

The debt crisis in the Eurozone is forcing some major European institutions to pull out from the risky shipping finance by reducing or selling out their portfolio. For instance *BNP Paribas*, *Societe Generale* and *Credit Agricole* have downsized their shipping departments and in the same time are looking for potential buyers of their shipping portfolio (Lloyd's List, 2012c). During finalizing of the current thesis *Commerzbank* with a portfolio of 26.0 usd billion was added to the financial institutions that pulled out from ship financing (Lloyd's List, 2012b)

Figure 9: European versus Chinese banks – billion USD (2012, January)



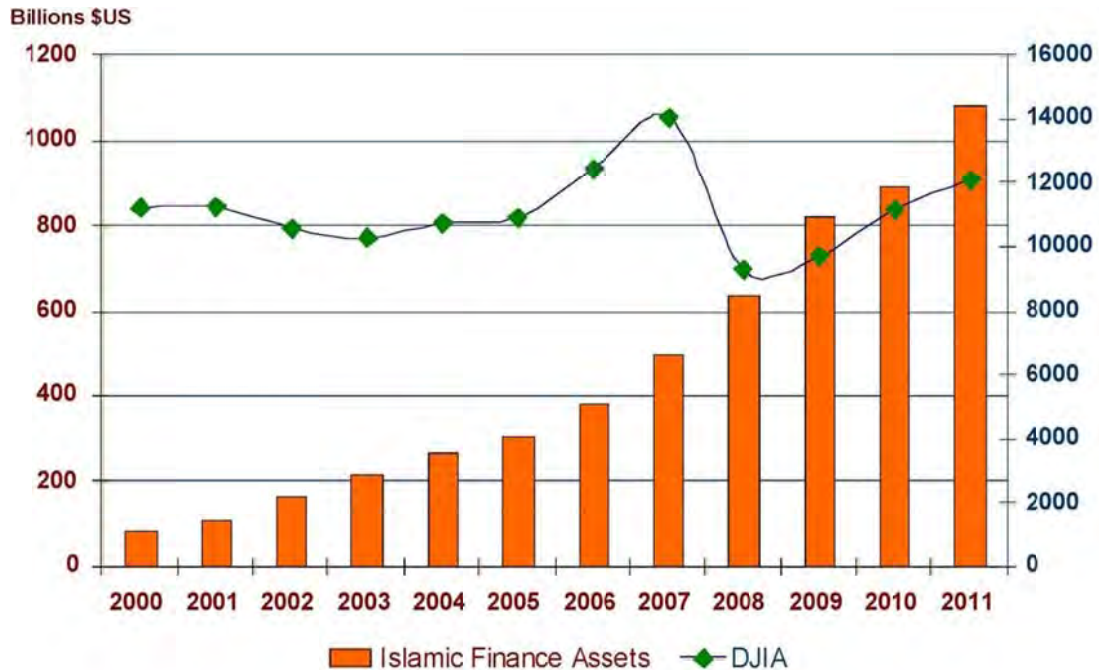
Source: Petropoulos (2012)

Ship finance is a vital component of the maritime industry. It remains a crucial question who will fill the gap of the pulled out European institutions. It is clearly shown (Figure 9) that Chinese and Asian banks still too far to undertake a portfolio of approximately 450 billion USD. This question is extensively explored by Koenig (2012) adding that presently European funds are available only for solving re-structuring problems and serve existing borrowers. According to him some 99 billion USD are needed for new-building finance during the period 2012-2014 and he does not expect such gap to be filled by the Asian or Chinese banks.

It seems that Islamic Finance could be proved a *white knight* for the ship finance industry. The very low asset prices of ships today, could offer a significant return on asset to a prudent and patient investor.

The above argument can be seconded by the impressive robustness of the Shari'ah compliant institution versus the 2008 financial turmoil.

Figure 10: Steady growth for Islamic Banking despite 2008 turmoil



Source: Maris Strategies Ltd (2011)

where DJIA is the Dow Jones Industrial Average Index (New York)

Most resources (Maris Strategies, 2011; Ayub, 2007; El Gamal, 2006) underline the fact that Islamic banking keeps a steady growing pace over that last ten and more years. Islamic banks do not have signs of turmoil during the market downturn in 2008-2009 (Figure 10).

3.10 FINANCING SHIP REPAIRS & DRY-DOCKING

It is clear from the above investigation that the safest way of Islamic finance is when a purchase of property or goods is involved. Through different Islamic finance products such as *Murabaha* or *Ijara*, a lease back agreement is conducted between the borrower and the Islamic finance provider.

But what is applicable when just a working capital is needed? In conventional financial institutions such will be called 'credit line'.

Similarly, Islamic banks provide credit cards to individuals under different Islamic products such as *Tawaruq* (in Gulf countries) or *Ujra* (in UAE). However, both techniques are questionable by a number of Islamic Scholars (Khan, 2009) as no pre-defined property or good are involved. 'Cash in hand' is not so popular among Shari'ah boards and therefore Islamic banks are scrutinising thoroughly the underlying need for which the finance is being requested by the customer. Both sides try to the furthest possible degree to find a solution involving the purchase of a tangible good.

Fortunately, in the case of ship repair and dry-docking the shipyard can form a selling product which comprises material, labour and its profit.

However, two more preconditions must be fulfilled:

1. Contribution to borrower's productive capacity.
2. Pre-defined price.

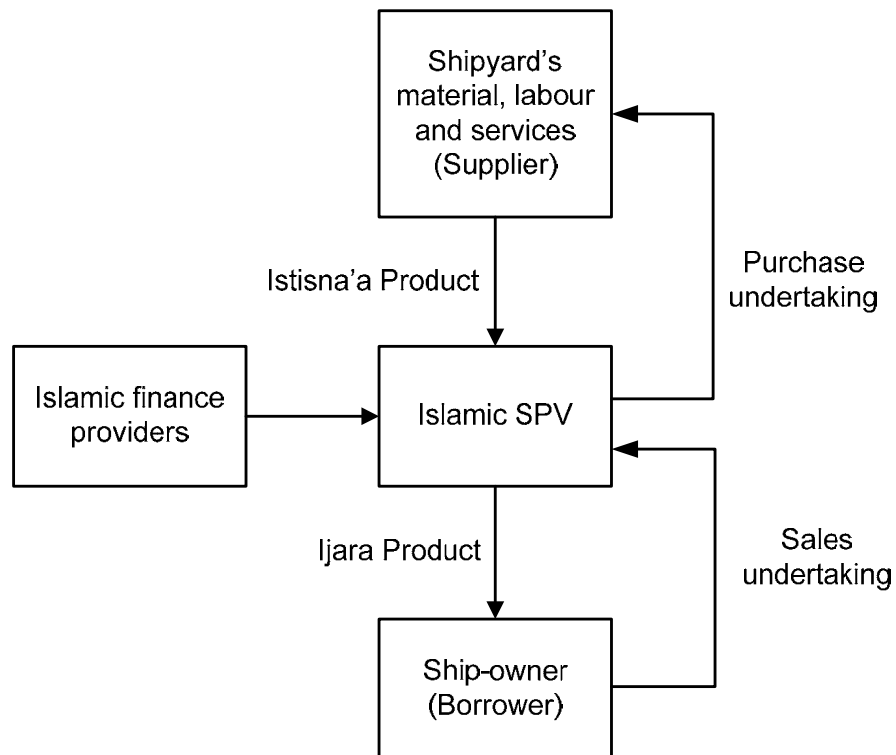
The first is discussed in the Chapter Four under the title *Dry-docking* where it is clearly presented the international maritime regulatory frame which forces every ship to visit a dry-docking shipyard at least every 30 to 36 months. In few words, without dry-docking, no certificates can be issued by the ship's flag authority and the respective classification society. Without certificates, no insurance cover can be provided to the ship and consequently no cargo can be insured onboard. Finally, ship's trading possibility is really limited.

The second prerequisite was the trigger of the establishment of a dry-docking cost model which is extensively presented in the Chapters Six later on. Data for more eight hundred ship repair bills were collected and analysed,

aiming to link the estimated dry-docking cost with well defined variables such as the size, the type and the age of the ship, the expected stay days in the yard and the market conditions. Such parameters known before entrance of the ship to the shipyard could facilitate the estimation of the final ship repair (the product) price.

Initially an *Istisna* and later an *Ijara* (lease) financing products could be established accordingly:

Figure 11: Financing the dry-docking bill



1. Initially, the shipyard can develop and sell the dry-docking asset to the Islamic SPV through an *Istisna* transaction.
2. The Islamic SPV in return, agrees to pay the shipyard under a Service agency agreement.

3. On completion of the ship repair & dry-docking project, the Islamic SPV leases the above asset to the ship-owner – the borrower at a cost plus profit price.
4. The ship-owner undertakes to proceed with lease payments until to pay off the above agreed price (ijara).
5. On completion of the last instalment, the established SPV becomes inactive and terminated.

3.11 CONCLUSION

In this chapter, I have presented the emerging phenomenon of Islamic banking and financing. Well spread in the Muslim world, it covers from households' daily needs up to corporate and government financing. Islamic finance is based on the Shari'ah law – a law that is not written but it is based on verses from the holy book of Qur'an as well on Prophet Muhammad's acts and position on a number of social topics. Shari'ah boards are established on each Islamic bank or finance institutions and decide whether a bank product is according the Shari'ah or not. Such system looks very similar to the Anglo-Saxon Common Law. Major Islamic financial centres are Dubai, in Middle East and Malaysia in the South Asia.

The 2008 starting economic crisis and the resulted upturn in the western banking liquidity highlight the potential role that Islamic finance can play in the Shipping finance. Already, from the beginning of 2000s, shipping projects have been financed through Islamic channels. Financial products which can serve the shipping industry are more or less close to the existing techniques - once developed for households and businesses.

The core idea of the current thesis is discussed clearly – to investigate the possibility and the condition that Islamic institutions to finance with working capital ship-owners. Such working capital would be used for cover their dry-docking expenses. The most suitable Islamic technique is choose and the interrelation between the borrower (Ship-owner), the lender (Islamic Bank), the service supplier (Shipyard) and the facilitating Islamic SPV is presented (Figure 11). However, it becomes clear that such financing is not a ‘key-turn’ product, since the setup of a SPV involves legal fees, operational expenses and a legal framework ruled by a Shari’ah board.



CHAPTER FOUR: DRY DOCKING

4.1 PREFACE

As it was presented in the preceding chapters, the current thesis investigates the funding of ship working capital under the terms of Islamic finance. More specifically, the financing of ship managers for the purpose of a regular dry-docking. Therefore, it becomes indispensable to analyse thoroughly the principles of dry-docking.

Charterers are employing ships to carry their cargoes. Charterers are usually cargo traders – either sellers or buyers – who need an insurance policy for their cargoes. Undoubtedly, cargo underwriters consider as a prerequisite that a ship should be under an insurance policy as well. Therefore, ships need an insurance policy and underwriters provide such, subject to proper certificates of both flag administration³³ and classification society. Such certificates have a validity of five years.

Both flag administration and classification society – in order to renew a ship's certificates – require that a ship has conducted two dry-docking surveys within the five year period³⁴.

4.2 SHIP SURVEYS AND CERTIFICATION

As I mentioned the above ship's operations are ruled by two major bodies which are her Flag Administration and Classification Society respectively. Often the role and the scope of surveys of these two bodies are confused.

³³ Flag administration is - in other words - the Flag State, whose the flag a ship is flying. Flag States as members of IMO, have primary goal to ratify all international conventions (such as SOLAS, STCW, MARPOL etc), to monitor and ensure their implementation on flag's ships and in ports.

³⁴ Regulations order that such two dry-docking surveys have to minimum gap of 30 months and a maximum of 36 months.

THE CLASSIFICATION SOCIETIES

There are approximately 60 companies that deal with ship classification world-wide. Of these, however, only thirteen are member of the International Association of Classification Societies (IACS). Membership in IACS is a de facto prerequisite to the world wide acceptance of a classification society by flag States, insurers, underwriters and other relevant industry organizations.

Classification societies have many fields of responsibility:

1. Classifying ships on the basis of classification rules at the request of a ship-owner, or a shipyard on behalf of the ship-owner;
2. Conducting surveys in accordance with international Conventions on behalf of the flag State;
3. Issuing the appropriate certificates - Class Certificates and Statutory Certificates - following a successful survey.

Table 3: Class Societies member of the IACS

Name	Abbreviation
American Bureau of Shipping	ABS
Bureau Veritas	BV
China Classification Society	CCS
Croatian Register of Shipping	CRS
Det Norske Veritas	DNV
Germanischer Lloyd	GL
Indian Register of Shipping	IRS
Korean Register of Shipping	KR
Lloyds Register of Shipping	LR

Nippon Kaiji Kyokai	NK
Polish Register of Shipping	PRS
Registro Italiano Navale	RINA
Russian Maritime Register of Shipping	RS
Source: http://www.iacs.org.uk/Explained/members.aspx	

THE FLAG STATES

Flag Administration is in charge of statutory matters which arisen from the IMO international conventions that such Flag has ratified:

1. International Conventions such as SOLAS, MARPOL, STCW, COLREG and so forth.
2. IMO Codes and Resolutions.
3. Regional legislation, that is any EU legislation regarding the European flags.
4. National laws.

Flag States are responsible for complying with internationally agreed standards on their ships and for monitoring them. Their function is to issue statutory (government) certificates at internationally-prescribed survey intervals. This may be carried out by the flag State itself after the ship has been surveyed, but it is generally performed by representatives of the flag State.

Most flag States delegate parts of their duties related to survey and certification of ships to Recognized Organizations, mostly classification societies. Owing to a world-wide network of surveyors, it is possible to carry out surveys of vessels during a voyage on the scheduled date and in all the major ports in the world.

Table 4: Top 10 Flag States in million Gross Tons

	Country	GRT³⁵ (Mio)	Ships
1	Panama	206.27	8,769
2	Liberia	107.82	2,804
3	Marshall Islands	63.45	1,766
4	Hong Kong	55.85	1,757
5	Bahamas	52.71	1,510
6	Singapore	45.56	2,808
7	Greece	40.86	1,616
8	Malta	38.40	1,783
9	China	37.93	4,629
10	Cyprus	20.97	1,088
Source: IHS Fairplay, published in the <i>Fairplay</i> magazine, 20 January 2011			

In order to simplify the above mentioned procedures IMO further to an International Conference on the Harmonised System of Survey and Certification (HSSC) adopted the Protocol of 1988 which is related to the SOLAS convention.

³⁵ Gross Registered Tonnage (GRT) in physical terms is the total volume of all closed spaces of a ship. The word tonnage is confusing – resembling to weight units, but in fact it is a volume: one gross ton is equivalent to 100 cubic feet.

Further to the HSSC, now the Flag *follows* the Class. Flag Administrations have authorized a number of Classification Societies to survey ships and issue certificates on their behalf – always regarding statutory topics. Furthermore, surveys and certification expire dates have been harmonized in order to eliminate the duplication of surveys and certificates.

SURVEYS AND CERTIFICATES

In the current thesis I refer to cargo ships³⁶ as they address similar class and statutory requirements. During the five year validity of their certificates³⁷, someone can distinguish the following milestones:

1. Initial survey (only once in life time) & issue of certificate.
2. Special survey (in the end of the 5 year period) & issue of certificate.
3. Two annual surveys.
4. One intermediate survey.
5. Two periodical bottom surveys in Dry Dock.

Latter can have a maximum gap of 36 months. Moreover, the one of them is a precondition for renewal of certificates and thus coincidences with the special survey.

4.3 SHIPYARDS FOR DRY-DOCKING

Dry dock as a concept is as old as almost 2000 year old. First reference is in Egypt (200 BC) where experienced Phoenician shipbuilders invented a

³⁶ Cargo ships: Tankers, Bulk Carriers, General Cargo ships, Containerships, Reefer vessels and so forth but definitely not Passengers ships or navy ships. Passenger ships, for example, are subject to annual renewal of certificates and consequently to annual dry-docking. Navy ships – few have Class – according to respective Class rules are subject to 7 year dry-docking inspection.

³⁷ It would be wrong to generalise that all ship certificates are valid for five years, as there are some – few – which have shorter validity. However, for the purpose of my thesis we can consider that all major class and statutory certificates have a 5 year validity.

graving basin to build and launch their ships³⁸. It seems that Greeks and Romans used such facilities. The Roman shipyard of Narni³⁹ is an example, where Romans excavate an artificial channel connected to the River Nera, in the region of Umbria, not far from Rome. Similar evidences can be found in China around 1080 AD (Levathes, 1994).

In the modern history, first dry-docking basins can be found in England, Scandinavia and Germany.

Nowadays, there are a number of shipyards all over the world – most of them in the developing world. All shipyards do not have necessarily dry dock facilities; they can carry out only *afloat* repairs when ships are berthed along side. Normally, such yards are small but not always outmoded. In the Netherlands, for example, there are shipyards which are specialized only in outfitting: steel hulls are towed there, whereas all machinery items (main engine and so forth) and deck outfitting and accommodation are installed in the shipyard with the vessel in afloat condition.

Purpose-wise shipyards may be classified into:

1. Shipyards for new buildings.
2. Ship repair yards.

It is worthy to mention, that above ship yards cannot easily interchange roles. In other words, a ship repair yard to start building ships⁴⁰ or a new-building yard to get into the ship repair business⁴¹.

³⁸ Athenaeus of Naucratis (Yonge, C.D., Editor) *The deipnosophists, or, Banquet of the learned of Athenæus*, volume I, London: Henry G. Bohn, p.325

³⁹ Alvaro Caponi [2006], *I segreti del porto etrusco e il cantiere navale di Narnia: ritrovamenti unici al mondo: Villa Pompeia Celerina, Ricerca obiettiva*

⁴⁰ It happened with Mangalia shipyard in Romania, when yard was bought by the Korean shipbuilding giant Daewoo. All ship repair activities were terminated and the yard was totally re-structured into a new-building shipyard.

⁴¹ Recently in Tuzla (Turkey) a number of small shipyards which were in ship building business try to get into ship repairs, however, their labour and facilities are not qualified or suitable for ship repair activities. Similarly, in China, hundreds of green field shipyards which

There are two type of dry-dock facilities, both are universally popular:

1. Graving docks, and
2. Floating docks.

GRAVING DOCKS

The classic form of dry-dock, properly known as graving dock, is a narrow basin, usually made of earthen beams and concrete, closed by gates or by a caisson, into which a vessel may be floated and the water pumped out, leaving the vessel supported on blocks. The keel blocks as well as the bilge block are placed on the floor of the dock in accordance with the "docking plan" of the ship.

Some fine-tuning of the ship's position can be done by divers while there is still some water left to manoeuvre it about. It is extremely important that supporting blocks conform to the structural members so that the ship is not damaged when its weight is supported by the blocks.

Once the remainder of the water is pumped out, the ship can be freely inspected or serviced. When work on the ship is finished, water is allowed to re-enter the dry dock and the ship is carefully re-floated.

FLOATING DOCKS

A floating dry-dock is a type of pontoon for dry docking ships, possessing floodable buoyancy chambers and a "U" shaped cross-section. The walls are used to give the dry-dock stability when the floor or deck is below the surface of the water. When valves are opened, the chambers fill with water, causing the dry-dock to float lower in the water. The deck becomes submerged and this allows a ship to be moved into position inside. When the water is pumped out of the chambers, the dry-dock rises and the ship is lifted out of the water on the rising deck, allowing work to proceed on the ship's hull.

were scheduled to built new ships, now they are attempting to transform themselves into ship repair yards. It is not impossible but definitely it is far from a turn-key process.

A typical floating dry-dock involves multiple rectangular sections. These sections can be combined to handle ships of various lengths, and the sections themselves can come in different dimensions. Each section contains its own equipment for emptying the ballast and to provide the required services, and the addition of a bow section can facilitate the towing of the dry-dock once assembled.

4.4 DRY-DOCKING JOBS

When a ship manager schedule a vessel to dry-dock, the corresponding superintendents prepare a plan of jobs to be carried out during dry-docking. These jobs are classified according to the location on the ship, the qualification of the required workshop (for example, painters, welders or mechanics) and whether such jobs can be carried out afloat or only in the dock. Normally, a dry-docking job planning looks like following:

Table 5: Classification of Dry-docking jobs

Code⁴²	Category	Description
100	General Services	Tugs & pilots, shore power, fresh water, sewage, security, gas free, garbage & cleaning services
200	Dry-docking Jobs	Tail-shaft, propeller, rudder & overboard valves
300	Blasting & Painting	Hull cleaning, blasting & re-painting
400	Deck Outfitting	Mooring winches, cranes, lifeboats

⁴² There is no international standard for the ship repair / dry-docking jobs' codification. Above numbering belongs to the author. Similar but not identical codes are used by some major companies like Maersk and Norden (Denmark) or OSG and Excel (Greece). Same goes for some ship maintenance and repair software such AMOS or DANAOS.

500	Mechanical	Main engine, diesel generators, boilers, engine or pump room machinery
600	Steel Works	Steel renewal in the hull, tanks, cargo holds, decks and any other location
700	Piping Works	Renewal of pipes on deck, in tanks or in engine room
800	Electrical & Automation	Inspection and cleaning of electrical switchboards, alternators and motors. Inspection and calibration of automation.
900	Various	Non routine jobs, new equipment, modifications

On the other hand, a ship repair yard is organized in corresponding departments with qualified labor and suitable equipment and facilities; an example is given:

Table 6: Shipyard Organization

Code	Category	Description
100	General Services	Services Dpt
200	Dry-docking Jobs	Mechanical Dpt
300	Blasting & Painting	Hull Treatment Dpt
400	Deck Outfitting	Mechanical Dpt
500	Mechanical	Mechanical Dpt

600	Steel Works	Steel Dpt
700	Piping Works	Pipe Dpt
800	Electrical & Automation	Electrical Dpt

Not all ship yards are organized as above. I met such organization only in big and well-established repair shipyards like the *Dry-docks World Dubai* in UAE or *COSCO Zhoushan* in China. Smaller or newer shipyards are many times organized in departments named upon the ship location that they are taking care: Dock Dpt, Deck Dpt or Engine Dpt.

As we have seen in the beginning of this chapter, the dry-docking process is well defined in time. Regulations give a tolerance of plus / minus six months for young ships and three months for older ones. Consequently, ship-managers inspect the ship in case and prepare a list of the planning jobs: such list is called 'dry-docking specification' or 'specs'.

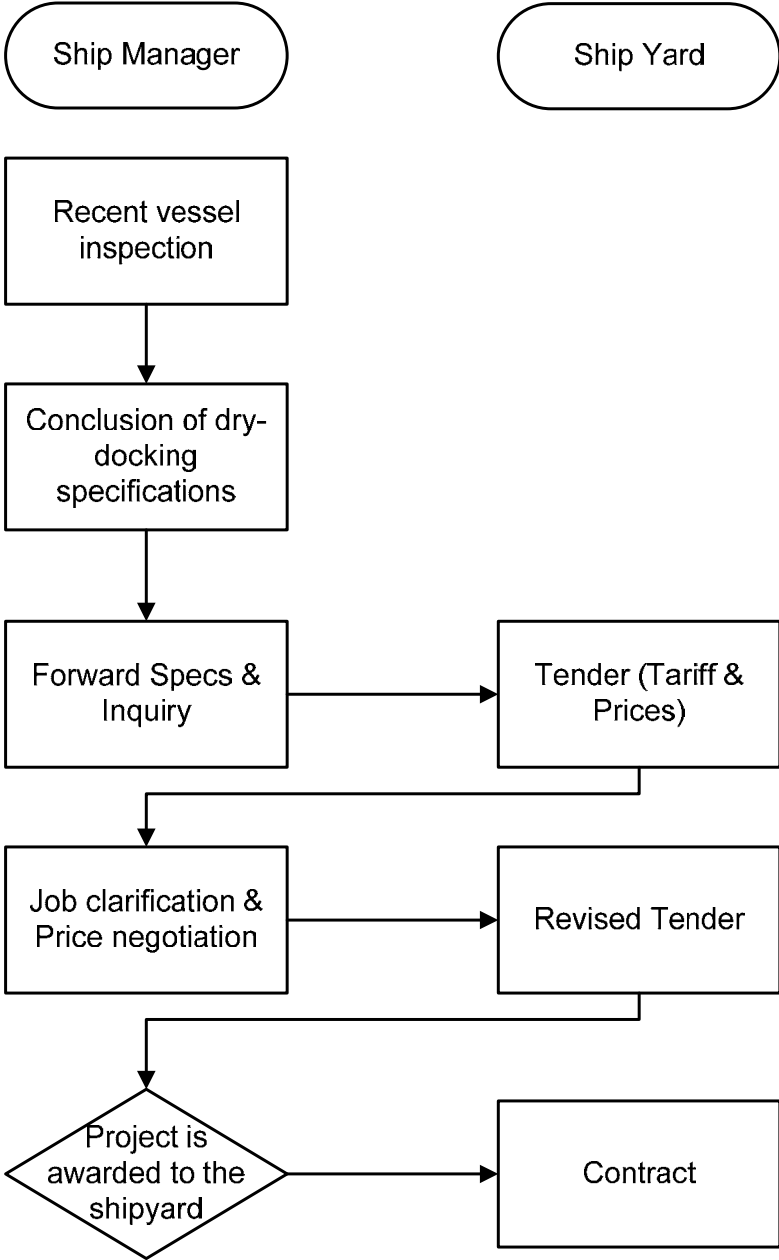
Specifications are sent to any prospect ship yard in the form of a dry-docking inquiry. Yards respond with tenders. A tender comprises yard's tariff and prices for every job requested.

The ship-manager compares yards' estimated dry-docking costs, facilities and proximity to the trading route of his vessel and finally awards the dry-docking project to one yard. Such selection process can be figured out in the following flow chart of Figure 12.

Ship-manager's criteria for the selection of the most suitable ship yard are among others:

1. Estimated final cost.
2. Estimated repair period.
3. Proximity to the trading route of the ship.
4. Yard facilities and experience (in case of demanding repairs).
5. Yard quality and safety standards.
6. Proximity and availability of engineer specialist workshops.
7. Logistics.

Figure 12: Shipyard Selection Process



4.5 CONCLUSION

The aim of this thesis to investigate the funding of dry-docking cost under the Islamic finance terms, makes imperative the presentation of the principles of dry-docking.

In the current chapter the international regulatory framework is shown. Such framework is mainly determined by the classification societies' rules and the flag states' regulations. Major international bodies – classes or flag states – are provided in updated tables.

Dry-docking facilities of shipyards are introduced and a brief reference is made to the historical evolution of dry-docks from the Roman to the modern times.

During a regular dry-docking a number of jobs – hull cleaning and inspection, steel and pipe repairs among others - are carried out. The kind and description of such jobs are given with a suggested codification. Reader can be additionally assisted by the corresponding pictures in Appendix B.

Finally, owners' criteria for the selection of the most suitable shipyard are shown together with a flow chart description of this selection process. Cost matters are not referred to the current chapter as they will be broadly introduced into the successive chapter five.



CHAPTER FIVE: OPERATING & DRY-DOCKING COSTS

5.1 PREFACE

A pre-requisite term of the Islamic finance requirements is that the borrowed money to be used for an inherent need of the borrower's property. In other words 'cash in hand' cannot be easily financed. In the current thesis, it was proved until now, that dry-docking is a indispensable require for the maintenance, certification, insurance and finally operation of a ship.

The structure of the various ship costs are briefly presented whereas analysis is larger for the operating costs. Latter include the dry-docking cost, the less explored vessel cost according to the literature review of chapter two.

Vessel economic outcome can be categorised as follows:

1. Vessel purchase cost.
2. Voyage costs.
3. Operating costs.

For the purpose of the current thesis I will analyse the third group of operating costs because Dry-docking falls within those costs. Moreover, I will emphasise why Dry-docking cost is significant among the regular operating costs.

VESSEL PURCHASE COSTS

Under this group, we can find all costs⁴³ which are related to the purchase of the vessel. Vessel can be bought either by owner's cash or with the assistance of a loan. Normally, a loan covers a part of the value whilst the remaining is provided as owners' equity. In additional, bank charges and legal expenses have to be included. Ships can be found in two markets: new-building and second-hand. In the former case, payment – towards the shipyard – is in usually four equal instalments. In the latter case, payment towards the seller

⁴³ Often such costs are so called Capital costs, as the ship is the only capital / asset for her Owner

is one off. Recapitulating, it is worthy to mention that capital costs burden solely the owner of the ship.

VOYAGE COSTS

At the broadest level the term *voyage cost* can be taken to include three principal cost areas - the cost of fuel, the expenses incurred while using the facilities of a port, and the costs faced when completing a passage through one of the world's major seaways. In addition there can be a whole host of other minor or miscellaneous outgoings such as cleaning, brokers' commission, taxes, and so forth.

Voyage costs are of great importance in the spot market as they can, in a depressed market, determine a minimum rate at which a vessel will be taken on. The costs of fuel, port charges and canal tolls at least must be covered by the charter revenue.

The distribution of these costs between the ship-owner and charterer will depend upon the type of employment, key considerations concerning the terms of carriage of the cargo, liner terms and other conditions of the charter party. Port costs will differ from port to port, and even from facility to facility, and also with the employment of the ship and its size/cargo. Some of the costs falling into this category are (Drewry, 1994):

- Agency fees
- Berthing costs
- Berth dues
- Tonnage dues
- Pilotage fees
- Tugs and towage
- Launch hire
- Fresh water supply
- Rubbish disposal
- Cargo survey costs
- Cargo preparation and handling costs

5.2 OPERATING COSTS

Operating costs are the ongoing expenses connected with the day-to-day running of the vessel (excluding fuel, which is included in above voyage costs) together with an allowance for occasional costs such as dry-docking, tugging, classification, and so forth. In gross terms operating cost consists of:

1. Manning cost.
2. Repair and maintenance cost (R&M).
3. Stores and lubricants.
4. Insurance cost.
5. Administration cost.

MANNING COST

Crew (or personnel) cost may account for up to half of operating cost. The ship-owner can vary manning cost by reducing crew levels by automation and by operating under a flag that allows the use of low-wage crews. Furthermore, exchange rates will be an important factor here if wages are paid in currency other than the one in which revenue is earned.

Apostolidis (1995) carried out a regression analysis using Drewry (1994) data for different sizes of oil tankers flagging a North European or an Open Register flag. As a result crew cost can be calculated as following:

$$\text{North European Flag: } f(Dwt) = 0.0033 \times Dwt + 1673.9$$

$$\text{Open Register: } f(Dwt) = 0.0015 \times Dwt + 840.83$$

STORES AND LUBRICANTS

Stores and lubes form one of the smallest cost components of the total operating cost. Although generally increasing with the size-band of the tanker, there are wide variations from owner to owner. The variation arises from differences in storing policy and accounting procedure. For instance, machinery spare parts might, on occasion, fall under this heading instead of under the R&M maintenance component or the dry-docking component. Storing costs might, on the other hand, be moderate for a ship on a regular run but be inflated for a vessel calling consistently at out-of-the-way ports.

The price of lube oil is subject to fluctuation with the oil market, and might be more cheaply acquired in bulk at a major port as compared with other sources. The amount of lube oil necessary is also dependent upon the type and age of a vessel's machinery and the policy followed in its re-use.

Similar to the preceding operating cost component, store and lubricant costs can be estimated upon a regression analysis, Apostolidis (1995)

$$\text{Annual Store and Lube Cost: } f(Dwt) = 0.0004 \times Dwt + 237.87$$

REPAIRS AND MAINTENANCE

Repairs and maintenance, as the second largest cost centre in operating costs, is composed of two main parts - running repair and maintenance costs, and dry-docking costs.

Generally speaking, much of a ship's machinery is surveyed on a continuous basis, and machinery maintenance also tends to follow that pattern, although there is a grouping of machinery repairs and maintenance at dry-dock times where accessibility, opportunity or technical assistance is demanded. Hull surveys are largely conducted on a periodic basis, and hull repairs and maintenance, are therefore, concentrated largely in dry-docking times.

Classification rules normally call for two dry-dockings (with no more than a thirty six month interval) in the five-year survey cycle, and it has become common practice for ships to follow such a timetable for all major repairs and maintenance.

An early cost estimation formula for repairs and maintenance was published in 1960s (Benford, 1968):

$$\text{Repairs and Maintenance} = 10^4 \times \left(\frac{L \times B \times D}{10^5} \right)^{\frac{2}{3}} + 4800 \times \left(\frac{\text{SHP}}{1000} \right)^{\frac{2}{3}}$$

where:

- L ship length in m
- B ship breadth in m

D ship draught in m

SHP ship propulsion power in HP (horsepower)

Apostolidis (1995) upon a regression analysis, proposes the following formula:

$$\text{Annual R\&M Cost: } f(Dwt) = 0.0029 \times Dwt + 374.09$$

INSURANCE

The ship-owner's insurance needs are largely catered for by two means - Hull and Machinery (H&M) insurance, and Protection and Indemnity (P&I) cover. The scope of these two categories is approximately as follows (Drewry, 1994):

Hull and Machinery

Cover of tangible assets, such as the ship's hull and machinery, in which the ship-owner has a direct insurable interest. These risks are placed with underwriters in the insurance market.

Protection and Indemnity

Cover of all assets belonging to others, such as cargo, and protection against risks of a less tangible nature, such as a loss of earnings, oil pollution claims or injury to employees, which cannot be covered by the insurance market, or may be more conveniently covered by mutual insurance between ship-owners.

The dividing line between the two types of cover is not a clear one. It varies according to the ship-owner's overall choice in insurance matters and the underwriter's willingness to accept risks of a particular nature.

Benford (1968) estimates the annual insurance cost as a function of crew number and ship's value, using the following formula⁴⁴:

$$\text{Annual Insurance Cost} = 965 \times (\text{Crew Number}) + (\text{Ship's Value}) \times 0.008 + 10,000$$

Correspondingly, Perras (1980) proposed the equation (in usd):

⁴⁴ It refers to USD and 1967 prices.

$$\text{Annual Insurance Cost} = 1000 \times (\text{Crew Number}) + (\text{Ship's Value}) \times 0.02$$

Apostolidis (1995) links the tanker insurance cost with her dwt capacity using again regression analysis based on Drewry (1994) data as follows:

$$\text{Annual Insurance Cost: } f(Dwt) = 0.0005 \times Dwt + 208.17$$

However, none of the above authors took the age of the ship as a parameter in their calculation, which relies on a further research.

ADMINISTRATION

Costs arising from administration and management vary significantly from company to company. Substantial economies of scale can be achieved by companies operating large fleets, and because of the disproportionate cost falling upon owners managing one or two vessels only, they often find it more economic to contract out the operational management to a management company. The scope of this cost component is also subject to differences in interpretation by different companies - for instance, as regards shore technical support. The Drewry (1994) survey of operating costs showed that administration and management costs ranged from usd 420,000 per annum for smaller tankers of 15-25,000 Dwt, to usd 550,000 p.a. for ULCCs⁴⁵.

Benford (1968) estimates the overhead⁴⁶ cost as a function of crew number, using the following formula:

$$\text{Overhead cost} = 80 \times \left(\frac{\text{Crew} \cdot \text{Number}}{10} \right)^4 \quad (\text{in USD})$$

However, Perras (1980) uses the cubic number of the ship as a basis to calculate administration costs:

⁴⁵ ULCC: Ultra Large Crude (Oil) Carrier it refers to tankers above 350,000 dwt. It is a rare size, with a number of operation and insurance restrictions. Nowadays, most of them are used as storage facilities by oil traders.

⁴⁶ The term overhead is used sometimes for administration cost

$$\text{Administration Cost} = 65,000 + 70 \times \left(\frac{L \times B \times D}{100} \right) \text{ (in USD)}$$

Apostolidis (1995) proposes:

$$\text{Annual Administration Cost: } f(Dwt) = 0.0006 \times Dwt + 408.2$$

According to Moore Stephens (2008) annual⁴⁷ publication for the year 2007 benchmark operating costs for tankers were recorded as follows:

Table 7: Annual Operating Cost (0,000 USD per year)

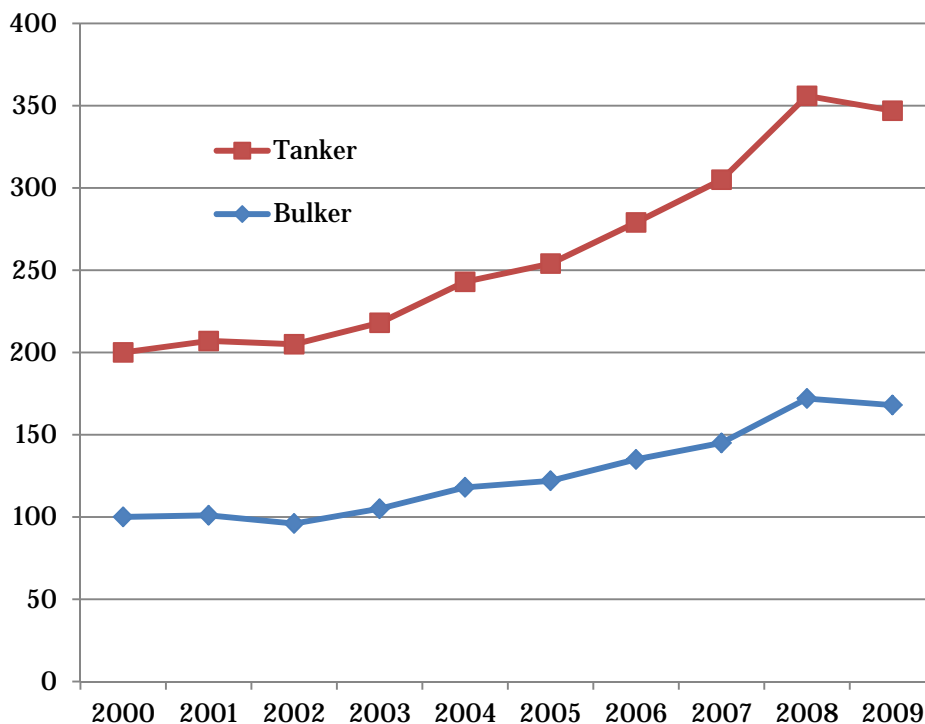
Tanker Size	Crew	Stores & Lubs	Spares, R&M	Insurance	Admin	Total
Chemical	1,119	264	392	202	279	2,256
Product	1,184	314	436	194	369	2,498
Panamax	1,388	360	504	267	358	2,877
Aframax	1,193	331	395	279	412	2,610
Suezmax	1,308	411	422	323	461	2,925
VLCC	1,432	503	639	476	443	3,493
Average	46%	13%	17%	10%	14%	

The Table 7 confirms the preceding literature that crew cost is accounting for the half of the operating cost, where definitely *spares & maintenance* is the second most significant component.

⁴⁷ Moore Stephens Consultants publish, once per year, a well established review on ship operating costs. Such annual report is released preciously every September since the year 2000. It comprises data from almost 2,000 ships. A number of ship-managers contribute voluntary their actual ship operating figures against their right to purchase one free copy of the report.

Moreover, it is noteworthy to include the development of operating cost during the last decade 2000-2009 (Moore Stephens, 2010). Figures are given separately for tankers and bulk carriers. Index basis is set for the year 2000.

Figure 13: Operating cost index (2000 – 2009)



5.3 DRY-DOCKING COST

Moore Stephens (2008, 2010, 2011) contribute great assistance to my thesis as they do not include dry-docking costs in the above mentioned spare and maintenance cost. Instead, they collect separately dry-docking bills and present them independently in the following table:

Table 8: Dry-docking costs for Tankers

	2007		2009	
Size	Cost	Days⁴⁸	Cost	Days
Chemical	1,244,277	38	1,050,881	19
Product	1,319,309	26	1,208,904	26
Panamax	1,286,054	40	1,167,641	22
Aframax	1,369,398	23	1,245,547	16
Suezmax	1,460,362	33	1,335,642	27
VLCC	1,601,492	19	2,176,715	19

Data of Table 8 do not take into account the location of the shipyard nor the age of the vessel, both of which influence the cost of a dry-dock. The average dry-docking costs and dry-docking days are based on data submitted to Moore Stevens by industry participants.

Since, regular operating costs are collected independently of the dry-docking cost, I draw the opportunity to put together and compare them. My purpose is to quantify the weight of the dry-docking cost versa the operating costs. Data for the same time period that is that ending on 31.12.2007 can be seen in the Table 9:

⁴⁸ Ship stay days in the ship-yard due to dry-docking

Table 9: Dry-docking vs Operating Cost (0,000 USD per year)

Tanker Size	Dry-docking Cost	Annual Operating Cost	Dry-docking x 2 times	Five year Operating Cost	Dry-docking vs Operating
Chemical	1,244	2,256	2,489	11,280	22%
Product	1,319	2,498	2,639	12,491	21%
Panamax	1,286	2,877	2,572	14,386	18%
Aframax	1,359	2,610	2,719	13,048	21%
Suezmax	1,460	2,925	2,921	14,625	20%
VLCC	1,601	3,493	3,203	17,464	18%

The Table 9 shows that dry-docking is adding a 20% on the operating cost, equal to one yearly cost every five years.

Concluding, the significance of the dry-docking cost among the other operating costs, is the main reason that motivated the author to explore the nature and determinants of the dry-docking cost.

DRY-DOCKING COST GEOGRAPHY

Mostly, ships dry-dock on routes upon they trade. Only for conversions or for extensive repair & maintenance scope – steel renewal for example – ships can deviate⁴⁹.

⁴⁹ Deviation, means among others, lack of income (ship is off-hire), bunker, crew and lubricants' unnecessary costs.

Thorpe (2001) tabulates his knowledge and experience in ship repairs in an interesting comparison of expected dry-docking costs through the following table. Singapore is selected as the base cost (=100) and all regional shipyards are classified accordingly. The reference is well before the crazy days of 2007-8 and the crisis of 2008; however author can ensure that the table below reflects with reliability the difference between regional shipyards even in December 2011:

Table 10: Regional shipyard cost of repairs

Region	Low	High
Singapore (base)	100	100
S. Korea	105	110
China	50	65
Indonesia	60	75
Japan	250	250
Middle East	100	105
South Africa	110	115
Mediterranean	125	130
Black Sea & Turkey	110	115
North Europe	140	150
Scandinavia	150	160
Baltic & Russia	110	115
USA	170	180

The main factors which can lead to the above differences can be summarized as follows:

1. **Labor cost:** ship repair activity is a labor intensive one. More than half of the shipyard's cost is for labor.
2. **Steel prices:** Shipyards which are close to the steel-mills have a pole position on steel pricing.
3. **Currency:** Shipping is working on a US dollar frame. Moreover, the vast majority of freights are paid in US dollars. The exchange rate of the local currency can make a large difference between shipyards of different countries.
4. **Oil prices:** Ship repairs are also energy consuming activities, thus the oil prices can influence the cost of tugs, trucks and electricity. Shipyards, which are located in the Persian Gulf, have the privilege to enjoy low energy cost.
5. **Productivity:** Fast yards are more expensive. Either, because they pay for more qualified personnel, more modern equipment and processes or, because they demand their achievement (no matter how) from the happy⁵⁰ ship-owners.
6. **Taxes:** In competitive countries ship repairs have either low or no taxes. One reason is that shipyards feed thousand of families and support the economy of the local communities. Another, that income is in strong currency, functioning in fact as an export of goods. However, in some countries taxes and VAT are applicable.
7. **Environmental restrictions:** Needles to mention that ship repair is hardly friendly to the environment. Air and noise pollution, disposal of waste water, oil and solids can easily burden the air, soil and water. The use of more sophisticated repair methods and the extensive treatment of the disposals lead to higher costs.
8. **Supply / occupancy of ship-yards:** In some countries, there are no so many shipyards, mainly because of the above reasons (labor cost, taxes, and environmental policy). In other countries – like in Japan and Korea – dry-docks are occupied with new-building projects thus ship repairs are of low priority.

⁵⁰ in a pretty good market level, a vessel can profit 10 - 60,000 usd daily – depends on her type and size. Consequently, days spent additionally in a lazy shipyard can lead easily to a significant loss of income

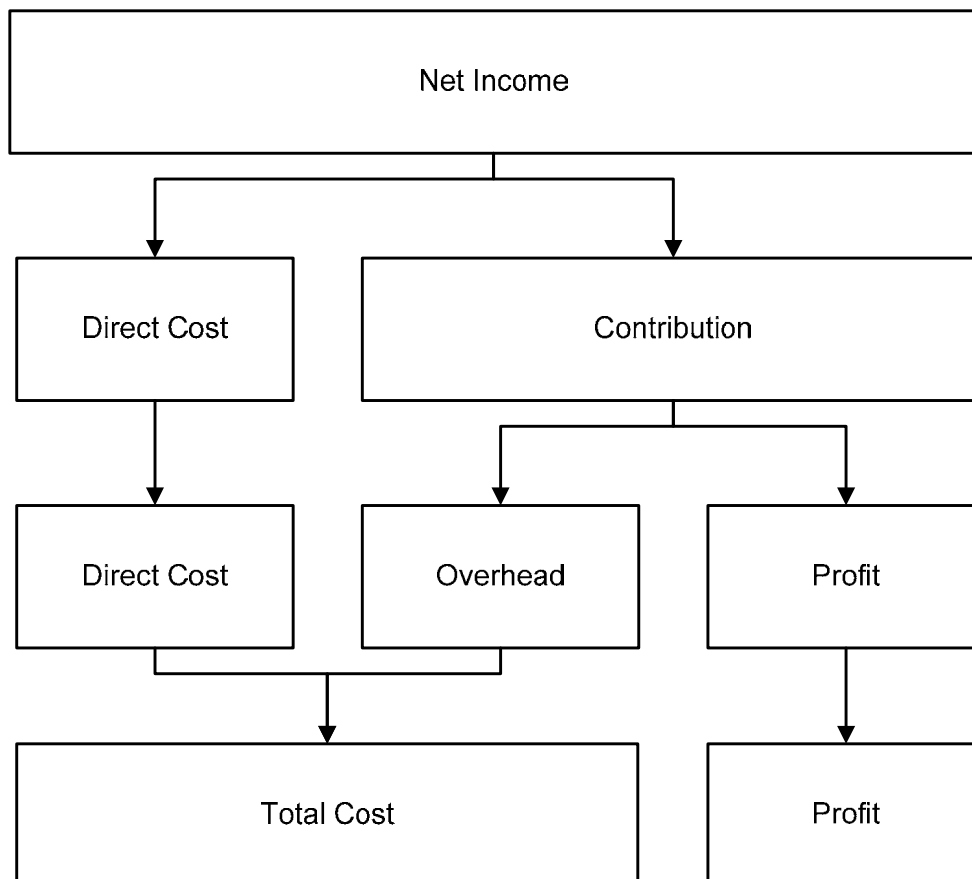
The two most significant factors – by far – are the labor cost and the steel prices, whereas local currency and taxes contribute strongly as well.

This above high fluctuation from the lowest Chinese cost of 50 to the highest Japanese cost of 250, forces the author to build his dry-docking cost model based on data from the same geographical region - if not from the same yard.

SHIPYARD SHIP REPAIR COST

In the current thesis I analyze and explain the dry-docking cost from ship's point of view. However, in order to obtain a better understanding of the shipyards' behavior it is necessary to watch inside the shipyard's own cost structure.

Figure 14: Shipyard cost structure



Direct Cost is the group of costs which are directly related to the production of the shipyard – it can be considered as the opposite of the overhead. No production, no direct cost. It comprises the following costs:

1. Labor: workforce directly involved with the production.
2. Raw material: steel plates, pipes and so forth.
3. Consumables: welding electrodes & gases, industrial wear for man protection, tools.
4. Hire of equipment.
5. Subcontractors: external workshops undertaking jobs not offered by the yard, or used when yard manpower is overloaded.
6. Utilities: a significant portion of the water and electricity consumed in a yard is directly related to the production.
7. Various: for example, waste disposal fees.

Overhead on the other hand, cover the fixed costs of the yard, no matter if there is even one ship repair in the yard or not. It is consist of the following elements:

1. Labor cost of administration staff and manpower not directly involved in production: commercial, security, quality and safety inspectors, marketing, transportation, medical staff and so forth.
2. Land rental and fees.
3. Building & equipment maintenance.
4. Utilities: a small portion of water and electricity consumption enough. for the maintenance and run of the shipyard.

Contribution is the decision making element of the ship-yard. Shipyard calculates the contribution of each project and decides the respective price policy and finally whether to undertake a project or not.

The success of the shipyard is based on the ability to forecast the market conditions and adjust their direct and overhead cost accordingly.

Finally in the *Net Income* it must be added an amount which represents the recycling⁵¹ activity of the shipyard. The shipyard normally recycles and cashes in the following materials among others:

1. Steel plates and pipes: are sold to cash buyers or directly to steel mills
2. Copper: copper pipes, electrical cables and motor windings
3. Aluminum: either in removed pieces or pipes
4. Not ferrous alloys: nickel, and so forth
5. Oil: oil collected from oily water onboard is segregated and sold in the oil market. Alternatively, it can be burnt in boilers for steam or electricity production.
6. Grid: used grid from grit-blasting hull (or tanks / holds) treatment is collected and can be either re-used⁵² or sold to cement factories.

OWNER DRY-DOCKING TOTAL COST

Until now, I have introduced the shipyard's dry-docking bill as the corresponding cost that burdens the ship-owner. However, in order to obtain a complete picture of owner's dry-docking cost, I have to rehearse some additional expenses that occur:

1. Paints: a considerable amount which starts from few hundred thousand and end up to more than one million us dollars.
2. Superintendents, surveyors, specialists: remuneration, traveling and accommodation expenses.
3. Procurement of spares – which are replaced during the shipyard stay and their forwarding (air freight) expenses. The urgency and short time in the shipyard often increase largely this cost element. Specially, for unexpected repairs.

⁵¹ always in the terms and conditions of a dry-dock contract it is provided that all scrap and removed material constitutes shipyard's property

⁵² re-used grit is of less efficiency. It takes more volume and time to reach the same results and additional labour cost is key decision factor

Adding above mentioned expenses, it is not surprising if we reach an amount equal to the dry-docking bill. In particular, when there is no extensive steel or pipe work – means, a moderate dry-docking bill – then both amount are at the same level.

This additional cost is not investigated in my cost model and it can be a topic of a further research.

DRY-DOCKING ACCOUNTING

I have reached the conclusion before that, dry-docking cost is alone the 20% of the annual operating cost. In addition, it occurs once every 2½ years. It is important – for its financing – to study the way that accounting estimates and records such expense.

Baylson (2008) in his article admits that, historically, shipping companies capitalized many of their expenses. However, now shipping companies which are listed in the NYSE or NASDAQ have to follow the recent accounting guidance of the Financial Accounting Standards Board, in other words, the US Generally Accepted Accounting Principles (US GAAP).

Consequently, as from 2008, some listed shipping companies, such as DryShips, Paragon, Star Bulk and Top Ships moved from a deferral to a direct expense method. The most usual account recording methods will be presented in the following tables:

Table 11: Dry-docking accounting methods (1)

	Accrue in advance
How it Works	Estimated cost that will be incurred in the future
Numerical example	In 1Q06, owner estimates cost for 3Q08 dry-docking at \$750,000. Expense spread at \$75,000 over each of next 10 quarters
Income statement impact	Expense the estimate, over 30 months, as the reserve is created
Cash flow impact	Cash outflow at time of dry-docking of \$1M – \$250,000 above the original \$750,000 estimate
Balance sheet impact	Creates a liability that is built up over dry-dock cycle
Source: Baylson (2008)	

The three accounting methods for planned major maintenance are shown using a 30 month dry-docking cycle and used 1 million dry-docking expense. The above accrue in advance method has been unacceptable under US GAAP since 2006. The following examples show how the 'accrue in advance' method commonly underestimated actual costs.

Where owners are capitalizing dry-dock costs, they follow the deferral method, amortizing costs of a just-completed docking over time, until the next dry-docking:

Table 12: Dry-docking accounting methods (2)

	Deferral
How it Works	Actual cost of dry-docking, after the fact
Numerical example	Vessel dry-docked in 3Q08 at a cost of \$1M. Expense spread at \$100,000 over each of next 10 quarters
Income statement impact	Expense item over 30 months from the time of dry-docking
Cash flow impact	Cash outflow at time of dry-docking of \$1M
Balance sheet impact	Creates an asset that is amortised down over dry-dock cycle

The recent shift has been away from deferral in favour of direct expense. Such method for all expenditures incurred at the time of dry-docking simplifies matters because it removed the sometimes tricky judgmental element from decisions on the proper treatment of costs:

Table 13: Dry-docking accounting methods (3)

	Direct expense
How it Works	Actual cost of dry-docking, after the fact
Numerical example	Vessel dry-docked in 3Q08 at a accounted for in 3Q08
Income statement impact	Expense item aligns with cash. Expense in the quarter of the actual dry-docking

Cash flow impact	Cash outflow at time of dry-docking of \$1M
Balance sheet impact	No asset or liability related to dry-docking

5.4 CONCLUSION

In the previous chapter, it was made clear that dry-docking is an inherent require for the proper maintenance, certification, insurance and finally operation of a ship. Hence, the pre-requisite of the Islamic finance not to fund 'cash in hand' but only property's indispensable needs is fulfilled.

In the current chapter, an analysis of the ship's costs was made, starting with a general approach to the three basic costs - purchase, voyage and operating – and reaching in details that of the dry-docking cost.

The position of dry-docking cost among the group of the operating costs is presented. The various operating costs are explained in terms of correlated variables such as the ship size for instance. This approach shows that researchers always attempt to link the given operating cost values with some variables which can represent uniquely the ship. The same method is followed in the next chapter where dry-docking cost is correlated to dry-docking variables.



CHAPTER SIX: DATA, METHODOLOGY & MODEL APPLICATION

6.1 INTRODUCTION TO COLLECTED DATA

For the purpose of developing the cost function and testing my hypotheses, I have manually collected eight hundred actual dry-docking invoices. They spanned over a four year period (2007-2010) from one of the biggest ship repair yards which is strategically located in the Persian Gulf. Data were collected for all types of ships; those visited the above shipyard during the given period.

It chose to collect and analyze data from one only major shipyard in order to eliminate any geographical effects such as different labor cost (which varies between Europe, Middle East or Far East), exchange rate fluctuations (which was highly volatile during 2007-10) and different transportation and purchase cost of materials and spares (when yards do not have the same access to factories and manufacturers).

The first filter concerned the regular dry-dockings from the extraordinary ship repairs. Latter are ship-repairs which do not fall within the class survey timeframe, such as repairs in case of accidents⁵³, modifications and major conversions⁵⁴.

Invoices were classified and sorted according to the type of each ship, her age, the repair duration and the dry-docking reason (regular or due to damage or accident). Inherent differences⁵⁵ between types of ships made me restrict my analysis to use only those of tankers out of the overall collected – the ship type with the highest data population. In addition, such restriction

⁵³ usually grounding, collision or fire

⁵⁴ for example, from VLCC to Floating Production & Storage Offloading (FPSO) facility

⁵⁵ A good example of such differences is that bulk carriers have cargo holds with opening/closing hatch covers and sometimes crane facilities. Containerships have increased number of small ballast tank, wide cargo hold openings, strengthened hatch covers and demanding electric power production due to the reefer containers they are carrying. Tankers have extensive piping network and often coated cargo tanks. LNG carriers have more sophisticated machinery which is culminating with the -162 °C cargo cooling facility.

increased the uniformity of the analysed data and the confidence of the extracted conclusions:

Table 14: Collected data by ship type

Type	Number
Tankers	414
LNG ⁵⁶	48
Bulk Carriers	38
Container ships	91
LPG ⁵⁷	11
Small / other types	199
Total	801

Therefore, analysis was carried out solely on data regarding tanker ship repair cost. Tankers are classified into six universally accepted types depending on their deadweight size (always expressed in tons' capacity) as follows:

⁵⁶ LNG: Liquefied Natural Gas carriers

⁵⁷ LPG: Liquefied Product Gas carriers

Table 15: Classification of tanker data by size (dwt)

Tanker Type	From	To	Samples
VLCC	200,000	Above	197
Suezmax	120,000	200,000	36
Aframax	90,000	120,000	51
Panamax	60,000	90,000	29
Product Carrier	35,000	60,000	54
Chemical Carriers	Below	35,000	47
Total			414

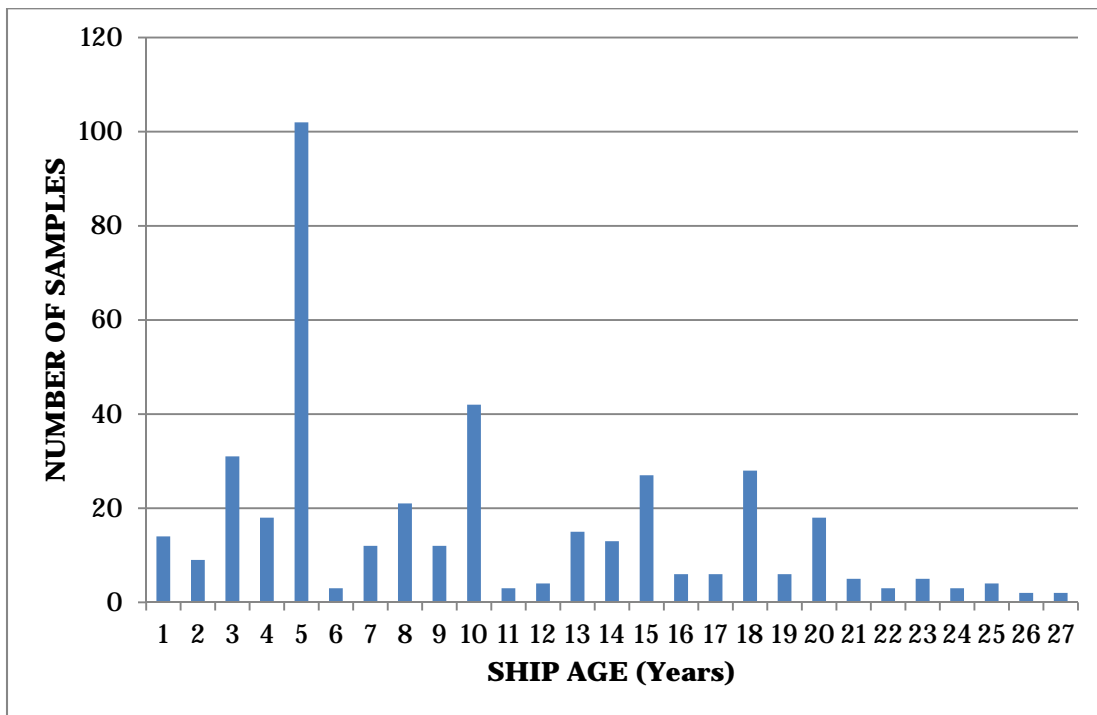
Some average values, of the data collected and elaborated are also presented in the Table 16.

Table 16: Data elaborated for the model and dry-docking parameters

Tanker Size	Records	Average age	Average days of stay	Average cost (usd)
VLCC	197	9	16	987,381
Suezmax	36	10	25	1,309,755
Aframax	51	10	16	922,827
Panamax	29	9	17	732,108
Product Carrier	54	11	16	583,368
Chemical Carrier	47	11	15	479,823
Total	414	10	17	879,261

As it can be seen from the above table, the size of the ship and the number of days that each ship stayed in the yard are directly influencing the dry-docking cost. However, data obtained for the age of each ship do not look very encouraging for my model, in particular, when a ship's age distribution (Figure 15) shows that most of the ships visited the shipyard were young. It must be mentioned that 100 out of the 414 ships are five years old – almost 25% – and only 10% are 10 years old. Such ages do clearly reflect the first and the second class renewal periods (read 4.2 Ship Surveys and Certification).

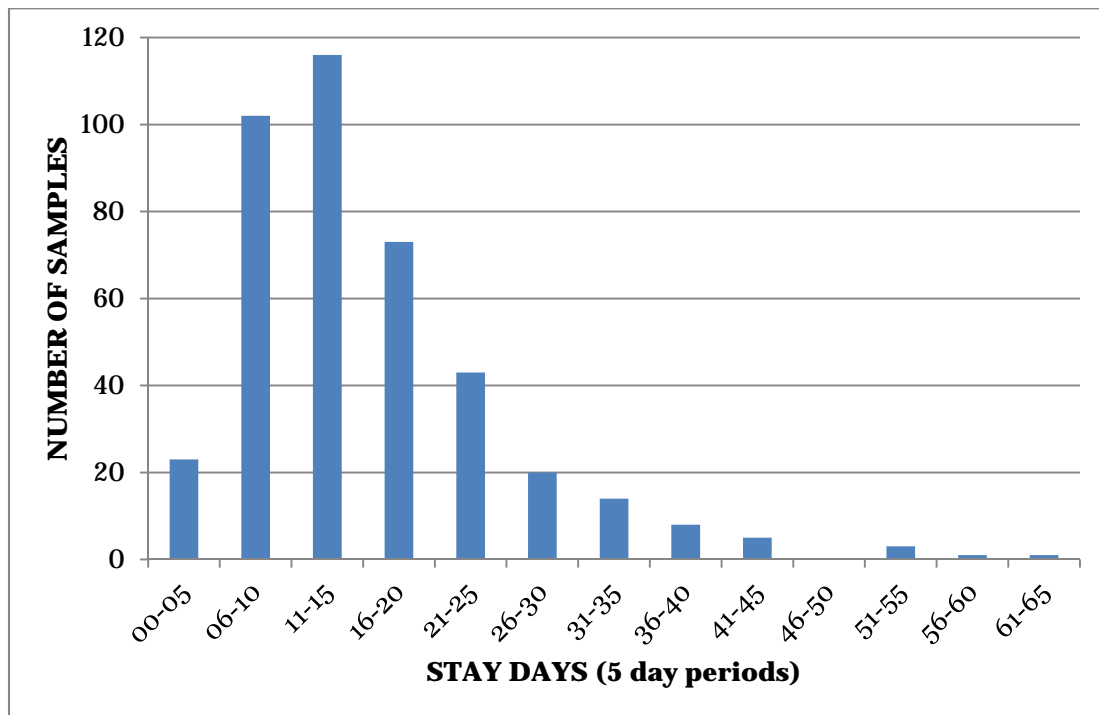
Figure 15: Distribution of ship age among 414 samples



An irregularity occurs (Table 16) for the Suezmax size which brings higher average cost of usd 1,309,755 million than VLCC (latter have the doubled size) of 987,381 usd. Such deviation is explained by the average longest stay of 25 days comparing with the average stay of 16 days for the VLCCs. Therefore, a further investigation in the future seems interesting to explain the reason of longer stay of Suezmaxes in that shipyard.

Interesting enough is also the distribution of stay days in the shipyard in a figure where stay days are illustrated as periods of five days. Coinciding with my previous references, most ships stay up to two weeks, that is fifteen days or three periods of five days.

Figure 16: Stay days (shown in 5 day periods)



6.2 DATA FORMS

Data collected were organized in the following tabular form:

Table 17: Data elaborated in a tabular form (sample)

Ship Repair Number	Size (dwt)	Age years	Arrival Date	Stay Days	Profitability Index	Owner's Capacity	Bill (in usd)
R10188	VLCC	15	2007	17	11.71	1	829,675
R10203	VLCC	6	2007	88	39.26	0	1,065,185
R10229	Suezmax	3	2007	24	13.41	1	2,046,514
R10236	VLCC	18	2007	40	22.00	0	3,589,000
R10257	VLCC	17	2007	13	18.50	0	745,000

R10266	VLCC	4	2006	11	18.94	0	564,498
R10267	VLCC	18	2007	7	14.27	1	264,452
R10278	Aframax	16	2007	8	16.27	0	205,024
R10283	Aframax	19	2006	19	16.62	0	514,900
as so forth							

where each column had the following meaning:

SHIP REPAIR NUMBER

Each ship repair project can be identified by a unique number in the form R10810 and so forth. Missing numbers correspond either to non regular dry-docking projects or to other – than tankers – ship type project.

SHIP SIZE

Criterion for the sorting by size was the deadweight – the carrying weight capacity - of each vessel. Good to refresh that:

$$\text{Deadweight} = \text{cargo} + \text{bunkers} + \text{stores} + \text{provisions} + \text{crew}$$

It is expressed in metric tons and accompanies the official records of each vessel. As I mentioned before, tankers are classified into six main sizes, depending of their dwt capacity.

BILL

The total net amount – after discounts – that ship manager paid to the yard in us dollars. Normally, payment is taken place upon completion or shortly after ship sailing from the shipyard. No long installments exist in this business. Not frequent (occasional) customers can be asked to pay before vessel sailing. Same goes for customers with limited credibility.

SHIP AGE

It is expressed in years from the date that shipyard delivered ship to her owners and the class and statutory certificates were issued.

STAY DAYS

The number of days that ship stayed within yard premises. Ship can carry out repairs before and after her stay in the yard as well. However, respective costs are not reflected into the yard invoice.

ARRIVAL YEAR

The year that a vessel arrived into the yard for repairs. It can play a significant role in repair cost analysis, as during the pro-crisis (mid 2008) period the yard pricing was aiming towards a higher profitability. To the contrary, after mid 2008, the yard pricing was targeting a high customer-retention ratio.

PROFITABILITY INDEX

It has not to confuse reader with profitability percentage. It is always positive even for projects in loss. It can give a comparative possibility to assess the profitability of different projects. Shipyard only can decode this index into profit amounts, but more figures – regarding cost structure – are needed. In the end this is the well kept secret of each ship repair yard.

OWNER'S BARGAINING CAPACITY

It is a binary variable which was added after having analyzed the terms and tariffs of each invoice. Some owners had better terms (that is discounts) and lower basic tariff. Aggressive and organized ship-managers; those who handle a big number of ships and specially constitute frequent customers enjoy more favorable terms. It is worthy to mention that very big companies sign 'service' or 'fleet' agreements where they can reach much lower prices. On the other hand they much contribute to the yard'

6.3 MODEL PARAMETERS & HYPOTHESES

I used the collected data under the following hypotheses which I finally verified in my cost model:

AGE

The age of a ship is counted from the delivery date, in other words, from the date the ship is delivered by the building shipyard to her owners. All insurance documents, flag and class certificates are issued for first time at that date. Drawing on these issues, I formulate my first hypothesis: Older ships – like older humans – experience higher wear. Additionally, flag and class have higher criteria for surveys of older ships. As a result, older ships demand more extensive repairs and maintenance than younger ships.

H1: *Ceteris paribus*, the age of the ship is positively associated with the extent of dry-docking cost.

SIZE

In the present thesis the size of tankers is taken from their deadweight capacity which can be openly translated into 'the carrying capacity'. It is provided in weight metric tons.

Bigger vessels have more areas for painting, longer pipelines, more steel plates, bigger machinery capacity and sizes

H2: *Ceteris paribus*, the size of the ship is positively associated with the extent of dry-docking cost.

STAY DAYS

Stay days are calculated from the ship's arrival date at the yard until the departure date. A part of these days are spending in the dry-dock (normally five to seven days) whereas in the remaining days the vessel is berthed alongside to complete her repair and maintenance jobs. There is a universal period for ship stay in a yard - up to 15 days. An extension of a longer stay marks the expectation for a higher repair cost. It will be worthy to correlate older ships and their stay.

The fixed or movable dry-dock facilities⁵⁸ and berths are limited in every shipyard and constitute yard's most valuable assets. In parallelism with the deadweight of ship, above facilities are the dead-capacity of a shipyard. Undoubtedly, the volume of repair work is proportional to the stay days. As repair work is very intensive and no time can be wasted, every additional stay day increases the final dry-docking expense. If, for any reason, a ship repair delays not because of the volume but of other reason, delay in delivery of some spares for example, the shipyard again feel rightful to charge the time of the underused facilities. Drawing on this argument, I formulate my hypothesis that longer stay days contribute to the increase of the dry-docking expense.

H3: *Ceteris paribus*, the number of stay days in the shipyard is positively associated with the extent of dry-docking cost.

MARKET CONDITIONS

This is a binary variable as well, an indication whether the sea freight market is upturn or not. When freight rates are increased, owners silently accept to pay a repair premium to shipyards. For instance, when in 2008Q1 a VLCC had a daily charter hire of 200,000 usd, owners were keen to pay overtime, express supply of spares (first class airfreight), attendance of specialists and other such processes in order their ship to stay as short as possible in the shipyard. Every day was counting. During the good times of 2008, shipyards also used to urge ship-owners to book their facilities well in advance, creating a king of dry-dock slot auctioning (Wingrove, 2008). In good market time, most suppliers are looking for higher profit. In bad markets, they are looking for customers. Thus, their pricing is softer.

This argument can be further strengthened by the comparison of the shipyard's profitability index of the period 2007-2010 (Figure 17) and the corresponding tanker spot freight rates (Figure 18) retrieved from Clarksons Research Services Ltd.

⁵⁸ There are two types of dry-dock facilities: graving docks and floating docks – details are presented in the Chapter Four (Dry-docking)

Figure 17: Profitability Index (2007-2010)

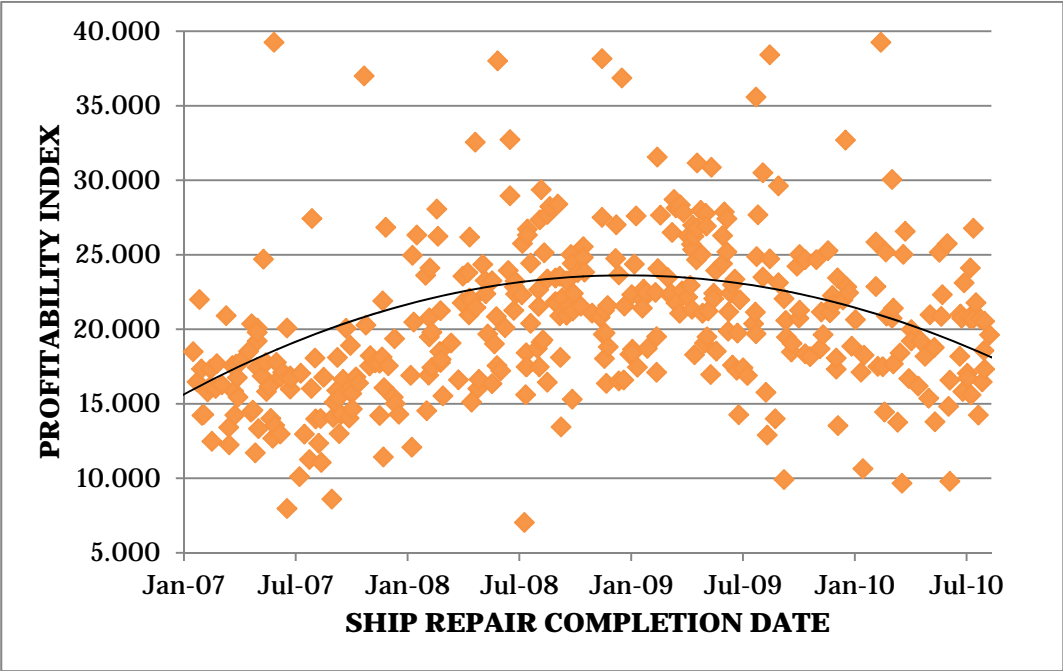
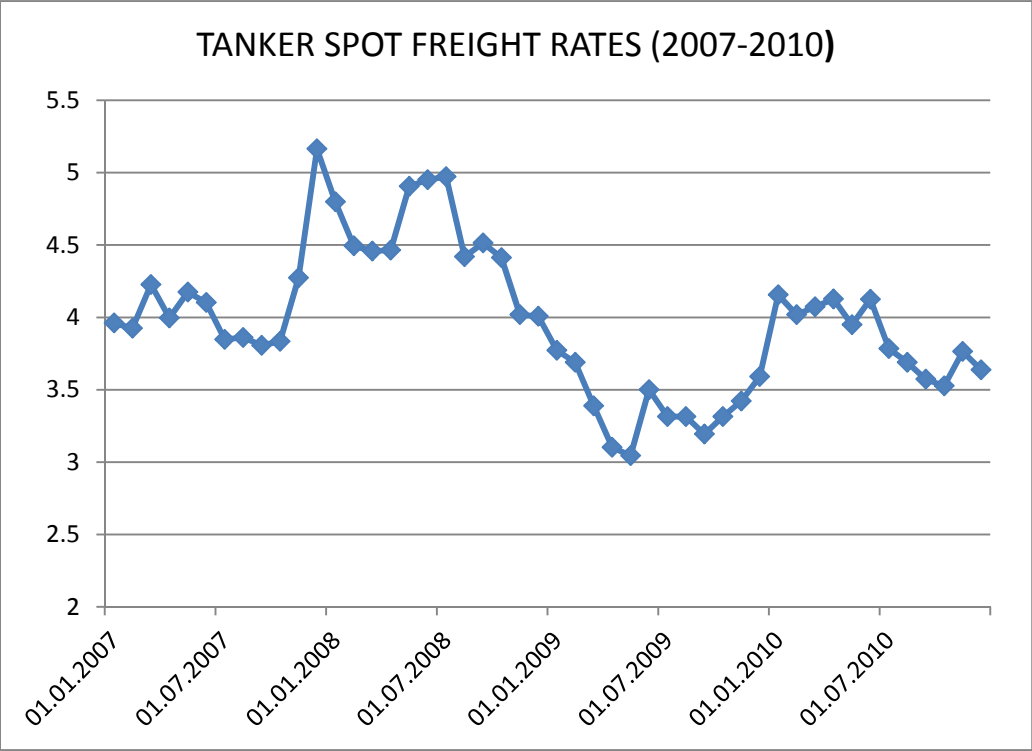


Figure 18: Tanker Spot Freight Rates (2007-2010)



Source: Clarksons Research Services Ltd

H4: *Ceteris paribus*, the market conditions is positively associated with profitability of the shipyard.

OWNERS' BARGAINING CAPACITY

This is another binary variable, which is the 'mirror' of the preceding *Market conditions* variable. Whereas, the previous variable is reflecting the shipyards' ability to take advantage of the 'good' shipping market, the new variable herewith is expressing the Owners' ability to achieve better terms and conditions, highlighting the fleet size, the financial credibility, the preference frequency in a specific yard or better preparedness regarding the dry-docking requirements. The latter is the reason that one of the InterManager operational performance KPIs is the 'Drydock management performance' (Matthews, 2011). Without doubt, for the same repair job a *big*, sound, frequent or organized ship-owner pays less than another ship-owner.

H5: *Ceteris paribus*, the bargaining power of the owner is negatively associated with the extent of dry-docking cost.

6.4 METHODOLOGY

The first stage was to collect the dry-docking bill data. Now a regression analysis must be carried out in order (a) to verify what is empirically known, (b) to introduce new parameters into the dry-docking cost level and finally (c) to weight the significance of each above parameter.

To regress my cross-sectional collected data, I use an innovative method to maritime statistics, that of Generalised Method of Moments (GMM). The method was introduced by Hansen (1982) and further developed by Arellano and Bond (1991), Blundell and Bond (1998), Wooldridge (2001), Stock and Watson (2003), Stock, Wright and Yogo (2002).

In order to map the causal interdependence between dry-docking cost and its determinants, a model of simultaneous equations was set up:

$$\text{PROFINDX} = g(\text{LBILL}, \text{AGE}, \text{DAYS}, \text{LSIZE}, \text{MARKETC})$$

$$\text{LBILL} = f(\text{AGE}, \text{LSIZE}, \text{DAYS}, \text{BARGAINP})$$

The left variables (PROFINDX, LBILL) are the dependent variables whereas the right side ones are the explanatory ones.

more specifically:

LBILL is the dry-docking expense in logarithmic terms. I use logarithms as a standard procedure to scale out differences in the magnitudes of data series (Cherkassy & Mulier, 2007). This is the net payable amount in usd that a ship-owner pays to the yard. Before transforming into logarithmic figures the initial values ranged between 22,800 and 5,160,123

AGE is the age of the ship as it was defined in the preceding paragraphs. It is given in physical numbers ($1 < \text{value} < 28$).

LSIZE is the size of the ship in logarithmic terms. In the present thesis the size of tankers is taken from their deadweight capacity which can be openly translated into 'the carrying capacity'. Before transforming into logarithmic figures the initial values ranged between 10,280 and 441,693

DAYS are the stay days which are calculated from the arrival date at the yard until the departure date. Values range between 1 and 88 days.

PROFINDX is the profitability index. Shipyard has an index to assess the profitability of each repair project. This index is always positive; however a certain value corresponds to the breakeven point of the shipyard's operation cost. Values range between 7 and 70. Such index is not numerically correlated to the profit margin.

MARKETC is an indicator (dummy) variable, assuming the value of 1 if on arrival the market is in upturn and 0 if the market is in recession, and

BARGAINP is another indicator (dummy) variable expressing the bargaining power of the ship-manager as 1 when it is strong and 0 when its bargaining power is weak.

For the first time in econometric modelling in shipping the Generalized Method of Moments (GMM) was chosen over other regression estimators (models) such as 2SLS or the Instrumental Variables (IV) estimator because in the presence of heteroskedasticity GMM is more efficient than the simple IV estimator but even in the absence of it is no worse asymptotically than the IV estimator (Wooldridge, 2001). Assume my set of instrumental variables (so called instruments) is

$$X = [AGE, DAYS, LSIZE, BARGAINP]$$

where none of them appears explicitly on the left hand side of my equations. To provide more orthogonality conditions I use not only X but also $X \cdot X$ that are squares and cross-products of the variables in X. In my case this would mean fifteen instruments ($k=15$) in total⁵⁹.

Given the linear system:

$$PROFINDX_i = g(LBILL_i, AGE_i, DAYS_i, LSIZE_i, MARKETC_i) + u_{i1}$$

$$LBILL_i = f(AGE_i, LSIZE_i, DAYS_i, BARGAINP_i) + u_{i2}$$

where i the number of observations ($i=1, n$ with $n=414$ the number of analysed samples / bills)

The error terms can be correlated and exhibit arbitrary patterns of heteroskedasticity⁶⁰, since I use cross-sectional data. The orthogonality conditions have as follows:

⁵⁹ For reader's better understanding the number of instruments $k=15$ are explicitly stated as: AGE, (AGE)², DAYS, (DAYS)², LSIZE, (LSIZE)², BARGAINP, (BARGAINP)², (AGE*DAYS), (AGE*LSIZE), (AGE*BARGAINP), (DAYS*LSIZE), (DAYS*BARGAINP), (LSIZE*BARGAINP) and C (the constant)

⁶⁰ Heteroskedasticity occurs when $\text{var}(u_i) \neq 0$, which makes hypothesis testing invalid. In my case I use the GMM as a more efficient estimator compared to 2SLS to deal with arbitrary heteroskedastic error terms (Wooldridge, 2001).

$$n^{-1} \sum_{i=1}^n (PROFINDX_i - g(LBILL_i, AGE_i, DAYS_i, LSIZE_i, MARKETC; \theta)) X_{ik} = 0$$

$$n^{-1} \sum_{i=1}^n (LBILL_i - f(AGE_i, LSIZE_i, DAYS_i, BARGAINP_i; \theta)) X_{ik} = 0$$

θ is the vector of parameters in the linear models g and f . This provides a total of 2k (thirty in my case) equations for the fifteen parameters (including constant terms) and provides the fundamental basis for GMM. Thus, I run GMM estimations for two models.

An important issue in GMM estimation is the issue of weak instruments. If instruments are weak, 2-Stage Least Squares method (2SLS) and GMM can lead to biases even in large samples and the distributions can be far from normality. This issue is dealt with in Stock, Wright and Yogo (2005). As I noted in Stock and Watson (2003, p.350) a simple guide is the calculated F-statistic in the first stage (reduced form) regression. If F is greater than 10, I need not worry, but this number of course depends on the number of instruments used. About the weak instrument problem Wooldridge (2001) demonstrates that in certain instances the problem of weak instruments can result in the (biased) Ordinary Least Squares (OLS) estimator being preferred.

Also benefits of GMM for a system of equations are explicitly shown in Arellano-Bond(1991) and Blundell-Bond(1998).

Table 18: The set of model instruments

	R^2	F
LBILL	0.70	16.08
PROFINDX	0.77	23.11

In my application LBILL and PROFINDX pass the test comfortably.

6.5 MODEL APPLICATION

The GMM estimation of my model is shown in the following table:

Table 19 : Modelling Results

Estimation Method: Generalized Method of Moments

	<i>Dep. Variable</i> <i>LBILL</i>	<i>Dep. Variable</i> <i>PROFINDX</i>
	<i>Coefficient</i>	<i>Coefficient</i>
<i>Const.</i>	<i>8.424051</i> <i>(21.06320)***</i>	<i>91.31821</i> <i>(13.19933)***</i>
<i>AGE</i>	<i>0.007680</i> <i>(1.581717)*</i>	<i>0.170000</i> <i>(1.920761)**</i>
<i>LSIZE</i>	<i>0.374144</i> <i>(11.54703)***</i>	<i>3.192184</i> <i>(7.849129)***</i>
<i>DAYS</i>	<i>0.027718</i> <i>(13.48093)***</i>	<i>0.272594</i> <i>(33.31700)***</i>
<i>MARKETC</i>	-	<i>5.644102</i> <i>(5.158217)***</i>
<i>LBILL</i>	-	<i>-8.825140</i> <i>(39.78476)***</i>
<i>BARGAINP</i>	<i>-0.53765</i> <i>(11.34257)***</i>	-
<i>J-statistic</i>	<i>0.113497</i>	

where:

- *** stands significant at the 1% level. It implies that we reject the null hypothesis that the population parameter is equal to zero with probability 1% to be wrong to say so. So, it is the strongest level of significance.
- ** stands significant at the 5% level, and
- * stands significant at the 10% level

J-statistic In the context of GMM, the over-identifying restrictions may be tested via the commonly employed J-statistic of Hansen (1982). This J-statistic is none other than the value of the GMM objective function, evaluated at the efficient GMM estimator. The J-statistic is distributed as χ^2 with degrees of freedom equal to the number of over-identifying restrictions

$$L - K = 15 - 4 = 11$$

in my case, rather than the total number of moment conditions L because, in effect, K degrees of freedom are used up in estimating the coefficients. J-statistic is the most common diagnostic utilized in GMM estimation to evaluate the suitability of the model. In the present case the value of J-statistic is much smaller than the critical value of χ^2 with 11 d.f at 0.05 level of significance, which is 19.675. So I cannot reject the null of model suitability.

Findings support the initial hypotheses and are consistent with the previous literature. In the model all variables have the expected signs and the impact of ship size, age and stay days in the yard have a positive and significant impact on dry-docking cost. Furthermore, it appears that lower dry docking bill, goes hand to hand with better profit performance, and as such it evolves as an important item in the investor's decision making process.

It is worthy to mention that results of the current thesis offer a comprehensive tool to both sides of the dry-docking bill: the shipyard operator-investor as well as the customer-ship manager.

Focusing on the current model, which passes comfortably the weak instruments test, it appears that lower dry-docking bill contributes significantly towards greater profitability; more specifically 1% reduction in the dry-docking cost will increase profitability by 8.8%. It also appears that the larger the ship is and the longer the number of days she stays, the higher the dry-docking cost will be, more specifically 1% increase in the no. of days the ship stays in the yard the bill rises by 0.03% and 1% increase in the ships size implies according to my results 0.37% rise in the bill. Also from the dry docking cost equation of the Table 19 we observe a significant and negative impact of the bargaining power of the shipping company on the formation of the dry docking cost, if the bargaining is effective the reduction in the final bill is 0.54%. This result which is reported for the first time in the literature renders support to the view that professional customers are treated in a preferential way.

Furthermore, it appears from my results that market conditions in shipping affects positively and strongly yard profitability, a finding which allies with the results reported for the shipping industry as a whole. Finally, the value of the J-statistic confirms the validity of my model.



CHAPTER SEVEN: CONCLUSION & FURTHER RESEARCH

The present thesis has investigated the implication of Islamic finance in shipping and for that purpose developed an econometric model of dry-docking cost for tankers. It contributes to the existing literature on ship operating costs by conducting an investigation of the relationship between dry docking cost and its major determinants. It extends previous research, which largely deals with other types of operating costs, by arguing that the dry docking cost is an essential item of a ship's operating cost and as such it needs to be carefully studied and taken into account together with its determinants by the investor, in his quest for enhanced profitability.

In *Charter Two* a literature review was conducted and analysed separately each of the main thesis dimensions: Islamic finance, operation costs, dry-docking and econometric modelling. The literature review is not limited to books and articles in academic journals but it extends to articles in professional magazines (*Lloyd's List*, *Tradewinds*, *Marine Money* and others) and conferences presentations as well.

Chapter Three set the scene by providing a historic study of the roots and principals of Islamic finance worldwide. Reference was made to the holy book of Qur'an and Prophet Mohammad's conception of the social life. In particular his thoughts and guidelines for the application of interest and profit, that interest is prohibited whereas risk reward is allowed.

The penetration, so far, of Islamic finance into shipping business is presented. The two more reliable sources of information were approached, those of *Tufton Oceanic* in Dubai and *Marine Money* magazine and conference organisers. Most shipping projects which attracted Islamic funds during the last ten years are mentioned and the most recent ones are presented with details. Appropriate Islamic techniques are provided and discussed with their *pros* and mostly legal *cons*.

Finally, my example for funding the working capital for ship dry-docking is presented and schematically explained. The most suitable among the Islamic techniques are chosen, that of *Istisna'a* towards the shipyard and

that of *Ijara* between the Islamic SPV and the borrower, that is the ship-owner.

Dry-docking as a concept and significant ship maintenance and repair activity is explored in *Chapter Four*. The fundamental reasons which impose frequent dry-dockings to ship-managers are described: the requirements of the IMO regulations and Class rules. Both are converged into the - 30 up to 36 months - bottom survey in the dry-dock. Historical data for ancient dry-docks from 200 BC and references to the most significant flags and classes, attempt a more complete approach.

At last, the preparation process for dry-docking tender and contracting is elucidated, highlighting the importance and cost benefit of a prudent ship-manager preparedness.

Ship operating costs are introduced in *Chapter Five*. Manning, repair & maintenance, lubricants and spares, insurance and administration constitute the regular operating costs, whilst dry-docking accounts for the 20% of the annual operating costs but it occurs once every 30 months. Data from frequent publications such as Drewry Consultants (2011) and Moore Stephens (2008, 2010, 2011) are included covering the period 2007-2010. Previous academic efforts to estimate operating costs through regression analysis by Benford (1968), Perras (1980) and Apostolidis (1995) are reviewed. However, all such formulae lack validity over time, because they derived from historical data of a certain period.

Emphasis is given also to the accounting handling of the dry-docking book keeping, particularly in light of the recent directive of US GAAP affecting the annual reports of listed shipping companies.

An econometric approach to dry-docking cost is reached in *Chapter Six*. Primary data were personally collected of approximately eight hundred actual dry-docking bills during the period spanned 2007-10. Elaboration of the invoices led to a slimmer database comprising only 414 data for tankers only. Tanker bills had the highest population among the collected data.

Data tables were built consisting of ship's size and age, dry-docking date, number of stay days in the yard, the invoiced net amount and the

profitability of each project. In addition, two indicator (dummy) variables were developed, the market condition – whether upwind or downwind – and the bargaining capacity of the respective ship-manager.

Based on above, a fundamental relationship was set and a Generalised Method of Moments (GMM) model employed to explore the potential determinants of dry docking cost.

My results provide justification for the apparent keenness of shipping firms in making more and more to put their operating cost under close monitoring for sound financial performance. Thus, the main policy implication of my thesis for ship management is that performance could be substantially propped up by being aware of the precise structure of the dry docking cost.

ISLAMIC FINANCE

Though the current thesis, it became evident that Islamic finance constitutes an emerging mode for banking and financing. Major reasons can be contributed to the accumulation of funds in hands of the rich oil driven economies in the region of the Persian Gulf, the high growth of Muslim dominant South Asian countries like Malaysia and Indonesia, the global lack of liquidity due to the 2008 crisis and in general the rising of banking services among the 1.6 billion of Muslims (Pew Research Center, 2011).

It is before 1970s that Islamic institutions came to light and even today (Ayub, 2007) the majority of the Islamic banking products are – in the end - Islamized conventional products. The author – grew up with deep Christian ethics – recognises that the corner stone of the Islamic approach, that is the stay away from making money over money, the avoid of gambling in economy and the request for clarity in financial transactions⁶¹ much resample the lost elements of the current capital markets. Every day, it becomes clearer that the

⁶¹ On the other hand, the recognition of profit when someone contributes to the value of a property or undertakes a risk, eliminates any misbelieve for costless money under the Shari'ah law.

present turmoil of the western banking system has its roots to the de-regulations and the lack of morality.

El Gamal (2006) bravely criticizes the above short steps of Islamic institutions proposing more ethical banking products even without the label of Islamic; mentioning that when Luther⁶² fabricated a good quality shoe and sold it at a fair price, he did not introduce the 'Christian shoe'.

Therefore, for someone who intends to study further the Islamic finance, the development of innovative ethical products should be included in his agenda. In the end, both Western and Islamic civilizations derive their ethical roots from the ancient Greek philosophers.

DRY-DOCKING

Twenty percent of the annual operating cost cannot be overlooked. Especially when it occurs twice every five years and unveils a bill starting from half million us dollars and above. However, there is a complete lack of academic research and limited appearance of professional publications. One of the reasons is the scarcity of data in a well-kept secret of the ship yards. Another reason could be the priority that given to ship new-building studies and models until now. The new-building boom in 2000s made a number of professionals and academic scholars to focus in the development of new-building cost modeling, such as Tvedt (2003), Dikos (2004) and Schinas (2005). The easier and more reliable access to steel prices and labor cost⁶³ surely made more attractive the exploration of the new-building prices. To the contrary, access to ship repair costs is very limited. Shipyards, on one hand, do not provide any data and ship-managers, on the other hand, keep such data for their own benefit. An exception is the annual report of Moore Stephens which devotes one page only to dry-docking average prices.

Ship-managers have much to benefit from supporting the collection and analysis of data between different shipyards and for different ship types

⁶² Martin Luther (1483-1546), the father of Protestantism in Germany

⁶³ Steel prices and labor cost determine much the new-building prices.

and sizes. Academia research has to contribute to this direction, as most of ship managers do not possess the sources and methods to conduct such analyses.

Future research on dry-docking cost could be the investigation of the determined parameters, i.e. ship, size, stay days, owner bargaining capacity on each of dry-docking individual elements. Latter are general services, dry-docking jobs, steel work, piping, mechanical work, electrical and automation works. Additionally, a study on dry-docking cost geography could be welcome, comparing similar dry-docking projects in different regions as well as a comparison of dry-docking elements – mentioned above – for same size/age but different type of ships, that is. tanker versus bulk carrier or containership.

Furthermore, it seems necessary the development of international standards for the classification and description of ship repair jobs. Such progress will enable the cross comparison of prices, for the same scope of work, between different ship yards.

Last, but not least, is the development of valid, over the time, operating cost models by correlating the ship costs with dynamic variables such as crewing countries' GDP and commodity prices of oil and steel.



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APPENDIX A: PUBLICATIONS

Apostolidis, A., Kokarakis, J. & Merikas, A. (2012). Modelling the Dry-Docking Cost: the case of Tankers. *Journal of Ship Production & Design*, 28 (3), 134-143.

Apostolidis, A., Merikas, A. & Merika, A. (2012). The Modelling of Maintenance Cost: The case of Container-ships in dry-dock. *Journal of Computational Optimization in Economics & Finance*, 5 (1)

APPENDIX B: GLOSSARY

SHIPPING TERMS

Aframax	An Aframax tanker is smaller than 120,000 metric tonnes and has a breadth above 32.31 m. Nothing to do with Africa, the term is based on the Average Freight Rate Assessment tanker rate system.
Barrel	A volumetric unit measure for crude oil and petroleum products equivalent to 42 U.S. gallons, or approximately 159 litres.
Dwt	Dead Weight Tons - International unit of measurement that indicates the loading capabilities in metric tonnes of the particular vessel, including the weight of crew, passengers, stores, bunkers and so forth
FPSO	Floating Production & Storage Offloading Unit - When an FSO ship has also oil (or gas) processing capabilities.
FSO	Floating Storage Offloading Unit. Ship used as substitute for a conventional oil platform at oil fields that are either too deep in the ground or too small to justify the use of a conventional oil platform.
IMO	In 1948 an international conference in Geneva adopted a convention formally establishing IMO (the original name was the Inter-Governmental Maritime Consultative Organization, or IMCO, but the name was changed in 1982 to IMO. IMO's first task was to adopt a new version of the International Convention for the Safety of Life at Sea (SOLAS), the most important of all treaties dealing with maritime safety (1960). Nowadays, IMO headquarters are located in London. Organisation's website is always a source of valuable references (www.imo.org)
Panamax	Ship with dimensions that allow her to pass through the Panama canal: maximum length 295 m, maximum beam overall 32.25 m, maximum draught 13.50 m.

- Suezmax Crude oil tanker with the maximum dimensions for passing through the Suez Canal (approximately 120,000–200,000 dwt.)
- VLCC Very Large Crude Carrier. Crude oil tanker of between approximately 200,000 and 320,000 dwt

ISLAMIC TERMS

- Gharar The Arabic word *gharar* means risk, uncertainty, and hazard. Unlike *riba*, *gharar* is not precisely defined. *Gharar* is also considered to be of lesser significance than *riba*. While the prohibition of *riba* is absolute, some degree of *gharar* or uncertainty is acceptable in the Islamic framework. Only conditions of excessive *gharar* need be avoided. There are strict rules in Islamic finance against transactions that are highly uncertain or may cause any injustice or deceit against any of the parties. In finance, *gharar* is observed within derivative transactions, such as forwards, futures and options, in short selling, and in speculation. In Islamic finance, most derivative contracts are forbidden and considered invalid because of the uncertainty involved in the future delivery of the underlying asset.
- Ishara Leasing: The *Ijara* is a contract where the bank buys and leases out equipment required by the client for a rental fee. The duration of the lease and rental fees are agreed in advance. Ownership of the equipment remains with the lessor bank, which will seek to recover the capital cost of the equipment plus a profit margin out of the rentals payable. There are two types of *Ijara*: operating leases and lease purchase. In a lease purchase, the obligation to purchase the equipment at the end of the lease and the price at which the assets will be bought is pre-agreed. Rental fees already paid constitute part of the final purchasing price. Where an asset is financed through floating rate funds, the owner will usually pass the risk of rate

fluctuations down to the lessee through the rentals payable by the lessee. This creates a problem under Islamic finance principles as lease rentals cannot be expressed by reference to interest rates. This difficulty is partly surmountable. In leasing transactions the lessor is providing an asset, not funds, so the return is in the form of rent, rather than principal and interest. In an *Ijara* lease, the amount and timing of the lease payments should be agreed in advance, though the amount of those payments may be subject to adjustment on a predetermined basis. Ways in which the problem has been overcome therefore include: referring to the rent payable under the lease at the date of signing but subject to adjustments by reference to provisions in other documents; or adjusting the rent by cross-reference to LIBOR or to a fluctuating rent payable under a non-Islamic lease signed at the same time. Such structures may be cleared by some *Shari'ah* boards but not by others.

Istisna'a Commissioned manufacture: The principle of *gharar* prevents one from selling something that one does not own. The technique of *Istisna'a* has been developed as an exception to this. As defined by the Islamic Development Bank, *Istisna'a* is a contract whereby a party undertakes to produce a specific thing that is possible to be made according to certain agreed specifications at a determined price and for a fixed date of delivery'. Accordingly, the technique is particularly useful in providing an Islamic element in the construction phase of a project, as it is akin to a fixed price turnkey contract. As the contract is one of procurement and sale of an asset, it also lends itself to non-recourse financing. In an *Istisna'a* transaction, a financier may undertake to manufacture an asset and sell it on receipt of monetary instalments. As banks do not normally carry out manufacturing, a parallel contract structure will typically be used. The ultimate buyer of the asset will commission it from the bank, which will institute a parallel

contract under which the bank commissions the asset from the manufacturer. The bank charges the buyer the price it pays the manufacturer plus a reasonable profit. The bank therefore takes the risk of manufacture of the asset

Mudaraba Profit sharing: The *Mudaraba* is a profit sharing contract, with one party providing 100 per cent of the capital and the other party (the *mudarib*) providing its expertise to invest the capital, manage the investment project and, if appropriate, provide labour. Profits generated are distributed according to a predetermined ratio, but like the capital itself, cannot be guaranteed. Losses accrued are therefore borne by the provider of capital, who has no control over the management of the project. *Mudaraba* structures are often used for investment funds, with investors providing money to the Islamic bank, which it invests as *mudarib*, taking a management fee.

Murabaha Cost-plus financing: The *Murabaha* is a method of asset acquisition finance. It involves a contract between the bank and its client for the sale of goods at a price that includes an agreed profit margin, either a percentage of the purchase price or a lump sum. The bank will purchase the goods as requested by its client and will sell them to the client with a markup. The profit mark-up is fixed before the deal closes and cannot be increased, even if the client does not take the goods within the time stipulated in the contract. Some Islamic banks use an agency arrangement, where the client takes delivery of goods from the seller as agent of the bank. Payment will usually be over time by instalments.

Musharaka Partnership financing: The *Musharaka* involves a partnership between two parties who both provide capital towards the financing of new or established projects. Both parties share the profits on a pre-agreed ratio, allowing managerial skills to be remunerated, with losses being shared on the basis of equity participation. One or both parties can undertake management

of the project. As both parties take on project risk, it is relatively rare for banks to participate in *Musharaka* transactions.

Ribaa The word *riba* means to increase, to grow, to multiply and to climb. However, in economic context, it is generally considered as a contractual increase on loaned money or interest. “And from the ribaa-based giving (investment), you think as if your wealth is increasing at the cost of others (borrowers), but in the sight of Allah (from overall perspective), it is not increasing. On the other hand, when you give something in charity to please Allah, then your wealth is increasing (in the sight of Allah)”. (al-Rum 30:39)

COST DEFINITIONS

Table 20: Crew Cost Elements

Crew Wages	Payroll, seniority pay, special working allowance
Provisions	Victualing
Crew other	Crew agency fee, crew change, crew costs, crew life assurance, establishment costs, hold cleaning, housekeeping, laundry, leave pay, manning, movement, representation, restaurant and bar, social contribution, training, union fees, watchman, working clothes

Table 21: Store Cost Elements

Lubricants	Lubricant for main and auxiliary engines. Hydraulic oil for machinery on board.
Stores others	Chemicals, consumables, engine stores, new equipment, purchasing, sea stock paints, ship stores, steward stores, supplies

Table 22: Repair & Maintenance Costs Elements

Spares	Charts and nautical, deck machinery, freight and forwarding, spares for main & auxiliary engines and machinery.
Repairs & Maintenance	Accommodation upgrading, equipment hire, improvements, modifications, radio & electronics' maintenance, renewal class certificates, safety audits, ship certificates, sludge disposal, technical expert assistance, workshops

Table 23: Insurance Cost Elements

P&I Insurance	Club calls, freight, demurrage and defence (FDD) calls Contractual liability, drug seizure, excess oil pollution, hull & machinery, insurance, loss of earnings, war risks
Marine Insurance	Insurance claims, insurance deductibles, insurance irrecoverable, off hire

Table 24: Administration Cost Elements

Registration Costs	Annual ship registration fees ad national authorities fees
Management Fees	Both in-house and third party ship management services
Sundry expenses	Administration, agency fees, bank charges, communications, general costs, legal and professional expense, miscellaneous non-voyage expenses, OPA 90 expenses, travelling costs.

Source: Moore Stephens (2011)



APPENDIX C: DRY-DOCKING IN PICTURES



Picture 1: Floating dock in Shanghai, China



Picture 2: Floating dock in US



Picture 3: Graving dock is drying



Picture 4: Graving dock is drying



Picture 5: Container ship resting on keel blocks



Picture 6: Two ships in the same dry-dock



Picture 7: Legend liner vessel in a dry-dock



Picture 8: Ship in graving dry-dock



Picture 9: Container ship resting on keel blocks



Picture 10: Container Ship resting on keel blocks



Picture 11: Propeller removal in a dry-dock



Picture 12: Rudder removal in a dry-dock



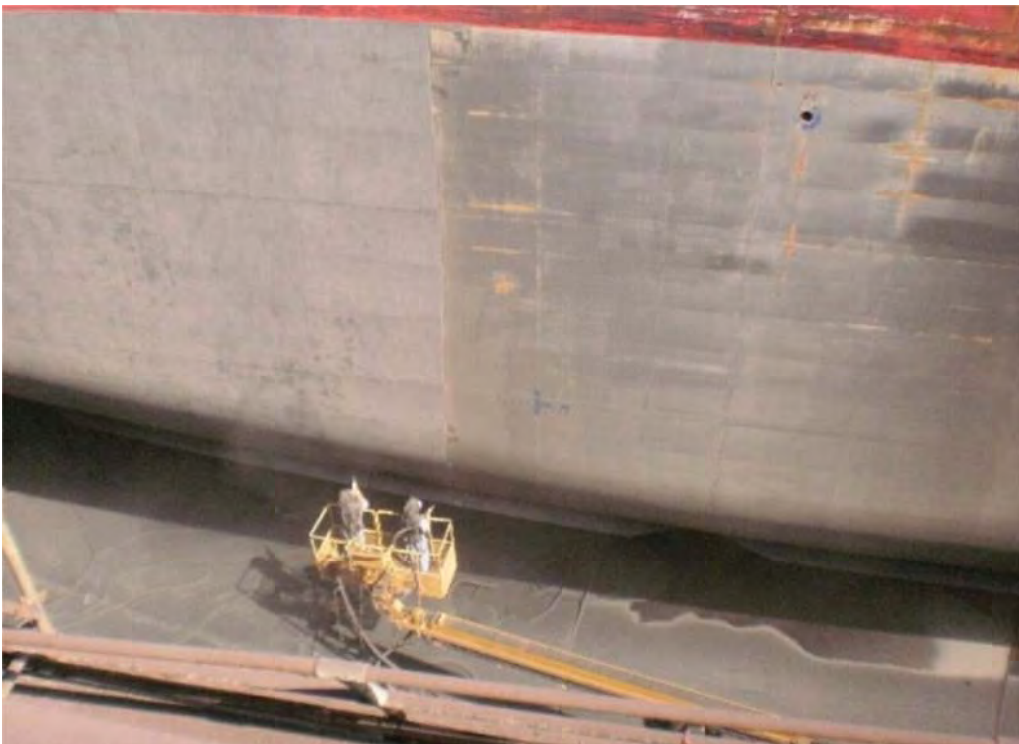
Picture 13: Polishing and dye-checking of propeller



Picture 14: Inspection of stabilising fins



Picture 15: Side shell high pressure washing



Picture 16: Side shell sand-blasting



Picture 17: Side shell painting



Picture 18: Superstructure painting



Picture 19: Protecting measures from silicon painting



Picture 20: Side shell steel repair



Picture 21: Side shell steel repair



Picture 22: Bottom shell steel repair



Picture 23: Main deck steel plate repair



Picture 24: Main deck steel plate repair



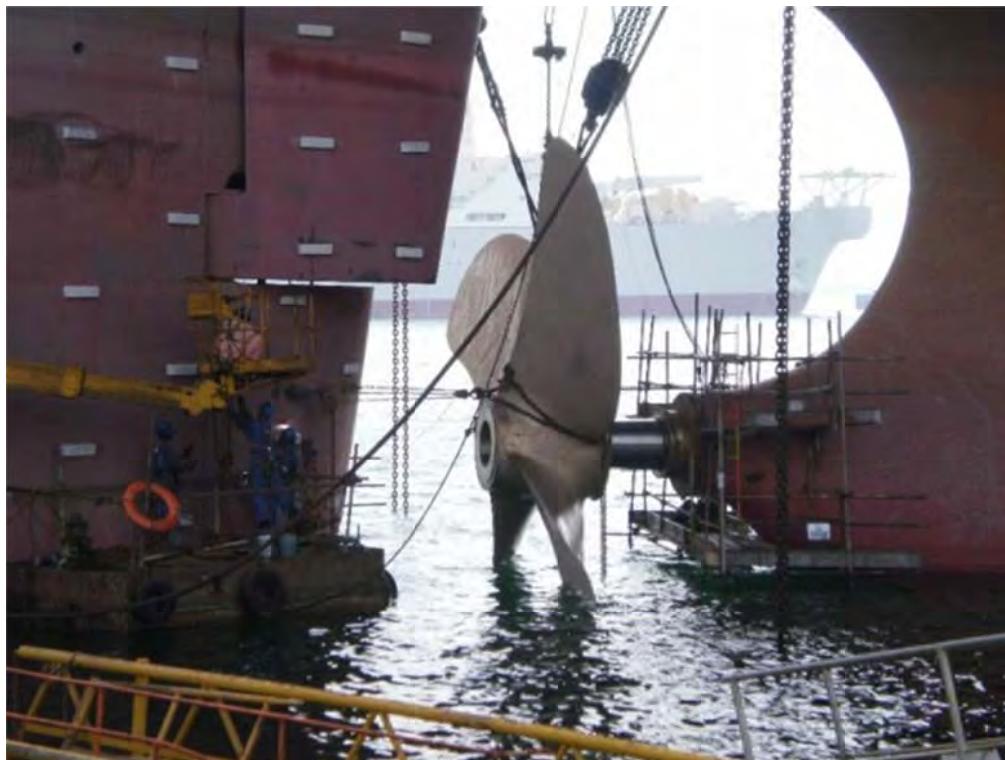
Picture 25: Steel repair in a VLCC ballast tank



Picture 26: Erecting hanging staging



Picture 27: Afloat steel repair after collision



Picture 28: Afloat re-fitting of propeller