10-28-2023

Pricing ocean freight services: a bargaining perspective

Pankaj Kumar

Juan Manuel Cerpa

WORLD MARITIME UNIVERSITY

PRICING OCEAN FREIGHT SERVICES: A BARGAINING PERSPECTIVE

PANKAJ KUMAR

JUAN MANUEL CERPA

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the award of the degree of Master of Science in Maritime Affairs

2023

Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): .....

(Date): **24.09.2023**

(Signature): .....

(Date): **24.09.2023**

by: **Dr. Satya Sahoo**

Supervisor's affiliation: **Assistant Professor of Shipping Management and Finance, Faculty of Shipping and Port Management, World Maritime University, Malmo, Sweden.**

Acknowledgements

We would like to offer our sincere gratitude to Dr. Satya Sahoo, our supervisor, for his help during this study, including his constant direction, counsel, and insightful observations. In terms of the research topic and methodology advice, he was invaluable. Additionally, we would like to thank Professor Dr. Dong-Wook Song, the Head of the SML specialisation, for allowing us to think critically about a subject and providing us with invaluable guidance during our study at WMU.

We would like to extend our sincere gratitude to AXS Marine for providing us the data which played a pivotal role in shaping the findings in this study. Without their generosity and support, this research would not have been possible.

I, Pankaj Kumar, would like to record my sincere gratitude and heartfelt thanks to my sponsor, ITF Seafarers' Trust, and my parent organisation, The Shipping Corporation of India Ltd. (SCI). I am eternally grateful to my beloved wife, Poonam, for her sacrifice and inspiration during the 14-month MSC program at WMU. Her constant encouragement and support helped me complete the program.

I, Juan Manuel, would like to especially thank Mr. Marco Antonio Cardenas of MKL Logistics for his unwavering assistance during my MSC program at WMU. Without his encouragement and financial assistance, the program would not have been possible for me to continue. I would also like to express my gratitude to my relatives Luz Miluska Fiorella Cardenas and Valentina Lucero Cerpa for their unwavering love, support, and inspiration during my time at the WMU.

We are extremely grateful for the assistance of our friends and all of the WMU faculty, the City of Malmo, Sweden, for making our stay comfortable and conducive for our professional development.

Abstract

Title of Dissertation: **Pricing Ocean Freight Services: A Bargaining Perspective**

Degree: **Master of Science**

The heterogeneity inherent in ocean freight services enables buyers and sellers to customize contract terms and associated pricing to suit their specific requirements. This flexibility fosters a conducive environment for trading freight services in an over-the-counter (OTC) market, characterized by a continual bargaining process to finalize contract terms and prices. Notably, the shipping industry is highly discreet and transactional data pertaining to freight fixtures are seldom accessible. This lack of data may account for the scarcity of academic research focused on understanding the pricing mechanisms of freight fixtures from a bargaining standpoint, despite the prevalence of such practices within the industry. This study aims to elucidate the determinants that enhance the bargaining power between ship operators and charterers during the negotiation of freight fixtures.

The bargaining dynamics between ship operators and charterers are subject to constant change, influenced by a myriad of factors. These include fluctuations in the global supply and demand within the shipping industry, the individual characteristics of the negotiating players, and the specifics of the agreed-upon freight contracts. Utilizing a price bargaining model for analysis, this research aims to provide stakeholders with an in-depth understanding of how these diverse variables shape negotiations in both dry bulk and tanker freight markets. Specifically, the study employs statistical modeling techniques to identify and quantify the surplus and discount factors that impact the bargaining process.

Preliminary findings indicate that the ship operator's discount factor generally rises in correlation with increases in the LIBOR, Operating Costs, prices of second-hand vessels, production, and import quantities. Conversely, a surge in bunker prices and fleet development strengthens the charterer's bargaining position, while diminishing the ship operator's negotiation efficacy. The insights gleaned from this research may hold significant relevance for a wide array of stakeholders involved in the freight

market, including traditional ship operators and charterers, ship brokers, investment banks, and governmental organizations with exposure to the freight market. Moreover, this research has the potential to catalyze further academic inquiry into the shipping literature, particularly concerning pricing mechanisms from a bargaining perspective.

KEYWORDS: Bargaining, Ship operators, Charterers, Freight Market, Negotiations,

Table of Contents

List of Tables

List of Figures

List of Abbreviations

AFRA	Average Freight Rate Assessment
BCI	Baltic Exchange Capesize Index
BDTI	Baltic Dry Tanker Index
BIMCO	Baltic and international Maritime council
CFR	Cost and Freight
CIF	Cost, Insurance and Freight
DF	Discount Factor
DWT	Dead weight tonnage
FCC	First class charterers
FR	Freight Rates
FOB	Free on Board
IMO	International Maritime organization
LIBOR	London Interbank Offered Rate
Mbpd	Million barrels per day
MOLCO	More or Less on Charterer's Option
MTS	Metric Tons
OPEX	Operational Expenses
SE	Standard Error
SF	Stowage Factor
UNCTAD	United Nations Conference on Trade and Development
USD	United States Dollar
VLCC	Very Large Crude Oil Carrier

Chapter 1 Introduction

1.1 Introduction

The Sea Transport Service consists of four markets with closely connected activities, trading in different commodities; freight market, sale and purchase market, new building market and demolition market. The freight market comprises shipowners, charterers, and brokers, and is divided into three sectors: voyage, time-charter, and freight derivative markets. Sea transport is purchased and offered in the freight market under two types of transactions: the freight contract, where the shipper buys the service on a price based on per ton of cargo, and time charter, where the shipowner is paid on a daily basis (Stopford, 2009). The charter party is a free contract between the shipowner and charterer, where the terms and conditions are subject to negotiations and agreements between them. Brokers are involved in the conclusion of these charter parties, and the finalisation of terms depends on the market situation and bargaining power of the shipowner and charterer (Ma,2021).

Bulk cargo (raw materials divided into liquid cargo and dry cargo comprise around two-thirds of the seaborne trade, and are transported primarily by tramp vessels, which cover approximately three-quarters of the world's feet. These vessels move around the world for commercial engagement around the globe. Bulk vessels generally carry one cargo in one vessel, at amounts negotiated separately between the shipowner and charterer, for the transport service provided (Kavussanos et al., 2021).

It can be concluded that freight rates fluctuate over time and are affected by several factors, such as the time charter market, fleet expansion, and crude oil price, based on studies on tankers and dry bulk transportation. However, a very small number of recent studies only briefly evaluated the quantitative effects of these external factors on tanker freight prices and fluctuations in tanker freight rates (Chen et al., 2022).

When examining the bulk freight market, it becomes clear that the significant and volatile freight rate variations that were seen during the rise of the freight market were

a direct result of the tense conditions in the freight market, as there was no spare capacity to look for marginally better trading opportunities in other geographic locations. The situation changed in the oversaturated freight market after 2011, when many ships pursued every perceived opportunity to increase on-the-spot revenue, even if it required risky repositioning or extended periods of inactivity. Owing to the excess tonnage, regional freight rate differences are kept to a minimum and quickly stabilise (Adland et al., 2017).

Several studies have been conducted to understand the volatility of the shipping market. Different models explain the factors that help understand freight rates. It has also been observed that the four different markets are related, and the effect on one market has a cascading effect on the other markets. There are cases where on the same date for similar places of loading and unloading, different ship operators have fixed their vessels at different rates which is significantly different from the average rate.

The developing trends of the growing importance of the maritime sector as a global supply chain is shaping the type, volume, and value of goods carried, and the route and arrangement of trade flows. Freight cost has been on average decreasing due to economies of scale and technological improvement. Finding and analysing the problems that now affect worldwide seaborne trade and demand for maritime transport is of utmost importance because the performance of a country's maritime transport systems heavily impacts its ability to compete internationally. A better understanding of the elements that influence a nation's capacity to engage in port- and shipping-related businesses is necessary. Additionally, the evolving patterns affecting the provision of goods and services for maritime transport highlight the need for additional research in this area (Valentine et al., 2013).

Bargaining is a common practice observed during any purchase between a buyer and a seller. The parties involved try to gather information about the product and the market and try to negotiate on the basis of the information available with them and the other factors prevalent during the period of sale. With the shift in the geography of trade, both developing and developed countries are users of maritime transport

services. In this highly competitive environment, it is essential for players to gain maximum advantage by making informed decisions while carrying out negotiations.

Rubin and Brown (2013), in their book “The social psychology of bargaining and negotiation” discuss the words “bargaining” and “negotiations” which appear in daily conversations frequently. To bargain is to discuss and agree upon the terms of a transaction, agreement, or contract, with the intention of establishing mutually beneficial agreements between the parties. To negotiate is to deal with or bargain with another person. As can be seen, the definitions of the two concepts negotiating and bargaining are essentially equal. There must be at least one other party involved in any negotiation or bargaining, and there must be some sort of transaction taking place between the parties with the end goal of reaching an agreement. Because of these clearly defined similarities, the terms bargaining and negotiations are used interchangeably throughout this study. The interaction between people regarding a sale or purchase seems to be what the term "bargaining" often refers to. In contrast, negotiation appears to be utilised most frequently in connection with interactions involving complex social units (such as unions, nations, etc.) and involves a number of concerns.

The negotiation positions of the shipper and the carrier are unequal. The factor which determines the balance of bargaining power depends on the supply demand relationship of the international shipping market. The disparity in the negotiating power between shippers and carriers changes as shipping technologies, modes of transportation, and competition policies progress (Hu., 2018). Ismail et al (2022) carried out research using the Rubenstein bargaining model in the sale and purchase market to estimate the surplus and identify the factors affecting the bargaining power of the seller and the buyers.

The bulk shipping freight market is assumed to be perfectly competitive; however, at the micro level, the fixture of the charterer (buyer) and the owners (seller) have an impact on the rate determination. Market conditions and routes are the most influential factors, but charterers, owners, and their groupings play a powerful role in individual contracts (Adland et al., 2016).

Understanding the factors that affect bargaining in the freight market for the dry bulk and tanker by applying a price bargaining model will support decision-makers. This will help them understand how various factors influence the negotiation. This study uses statistical data modeling techniques to establish and measure the relationship between the variables and other factors and indicators affecting the negotiation process.

1.2 Aims and objectives of the research

The charterer and ship operator negotiate during voyage fixtures for price and other carriage terms. There are offers and counter offers from both parties during communication through brokers. The available information and bargaining skills play a very important role in the completion of the contract of carriage. As discussed earlier, there is a lack of research and a standard procedure. Understanding the characteristics of bargaining and discount factors can help players complete the deal. In addition, players can negotiate for a better proportion from the surplus, depending on their situation in the process.

1.2.1 Aims

a) To understand the various factors affecting the bargaining power of charterers and ship operators during negotiations for voyage charter fixtures in Dry Bulk and Tankers.

b) To apply the price bargaining model to the analysis of negotiations in order to assist players in decision-making.

1.2.2 Objectives

a) To understand and analyze the impact levels of the factors of negotiations, their correlation, and the manner in which they influence the final fixture.

b) To measure the significance of these factors in freight rate negotiations.

Further, this study can motivate researchers to use the concept of bargaining in other vessel sizes, sectors, and trade routes to determine the factors affecting bargaining during charter party agreements.

1.3 Research questions

a) What are the factors influencing the final process of negotiation of maritime freight rate in the following sectors?

(i) Iron Ore fixtures for Capesize vessels between Tubarao (Brazil) and Qingdao (China) and

(ii) Crude Oil fixtures for Aframax vessels between the United Arab Emirates Ports and Mumbai (India).

b) How are these factors correlated, and how do they affect the bargaining power of ship operators and charterers during freight rate negotiations?

1.4 Contribution of the study

This research can contribute to understanding the negotiating powers of players (e.g., ship operators and charterers). As discussed earlier, there is literature available regarding the volatility and seasonality of the freight market; however, there is no research available to evaluate the trading surplus and discount factor during fixtures. First, this research can help better understand the factors that influence buyers and sellers' bargaining ability in the freight market. This study critically analysed the factors that affect the bargaining power of players in the freight market, such as player-, market-, and product-related characteristics. The freight fixtures are finalised through multiple negotiations, and the terms are agreed upon. The player with more bargaining power may be able to gain more surplus than the opponent player.

Second, this study examines how these factors affect the discount factor. This will assist players in developing their strategies and saving time and reducing delays. Delays in negotiation are not beneficial for any party. The ship operators and charterers can understand their position in the negotiation and agree to the

appropriate share of the surplus and reach an early agreement. This will help them reach an agreement in a faster and more efficient manner.

Third, as there are very few papers on bargaining in the maritime sector (except labour market negotiation), it is likely to present an opportunity for researchers to examine other sectors and commodities to better understand the models.

1.5 Brief finding of the dissertation

As discussed earlier in the aims and objectives of the study, this research attempts to understand the bargaining concept in the freight market for application by the players (ship operator and the charterer). First, the available literature on this topic was scrutinised. Data were collected, and the surplus and discounts of the players were calculated.

Second, data related to independent variables were collected and analysed to determine whether they had any significant impact on the dependent variables of surplus and discount factors, indicating the bargaining power of the players.

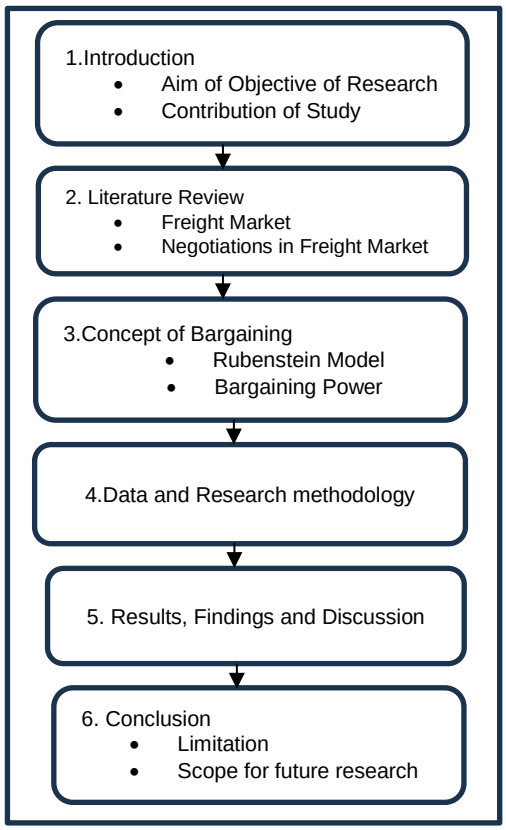
Finally, cross-sectional regression was carried out to verify the effect of the variables so that the ship operators and charterers can take action in order to take advantage of the bargaining process. The age of the vessel, operational costs, bunker cost, laycan time, time to load, London interbank offset rate), freight indices, production, import and export quantities, and price of second-hand vessels were considered as dependent variables. A few qualitative but important factors in bargaining, such as reputation, operational efficiency for the charterer and the operator, the vessel's technical performance, and inspection results, could not be used in the model. The seasonality of bargaining power was also analysed.

It was observed that in general when the LIBOR, operating cost, price of second-hand vessels, production and import quantity increase, the discount factor of ship operator increases and the bargaining power of charterer decreases. While there is an increase in the bunker price, fleet development increases the charterer's negotiating power and decreases the ship operator's ability to negotiate.

1.6 Structure of the dissertation

This dissertation is organised as follows: Chapter 1 briefly introduces the aims, objectives, and contributions of this study. It also details the research question and structure of the study. Chapter 2 provides a complete literature review of the interrelated literature related to the bargaining in the freight market. This chapter introduces the mechanism in the freight market, and the role of negotiation in final fixture. This chapter further specifies the price-bargaining model and theory. Chapter 3 deals with the concept of bargaining and the Rubenstein Theory. This chapter discusses the players in the freight market; ship operators, charters and the broker and their bargaining power. Moreover, it also introduces the factors affecting the bargaining power of the players. Chapter 4 covers the data and research methodology. Additionally, this chapter described the variables. Chapter 5 delivers an analysis of the empirical results of this research. This chapter examines the significance of the factors that affect the surplus and the discount factors in the freight market. It also covers a discussion on the findings. Chapter 6 concludes the research with limitations and scope for future research.

Figure 1 : Structure of the Dissertation



Chapter 2: Literature Review

2.1 Introduction

The shipping market can mainly be divided into four types: the markets for freight, sales and purchases, new construction, and demolition. Although these markets are distinct, they are connected. Understanding the fluctuations in freight rates is essential for ship managers because the freight market is regarded as a key source of income for ship owners (Stopford, 2008).

The aim of the study is to understand the bargaining in shipping market by creating a frame work and applying the concept to the freight market. In this chapter, the existing literature is reviewed to analyze the gap and to find an area for future research. By analyzing the pertinent literature already in existence, this chapter identifies the research needs and also explains the study's contribution to defining research importance and target measurements.

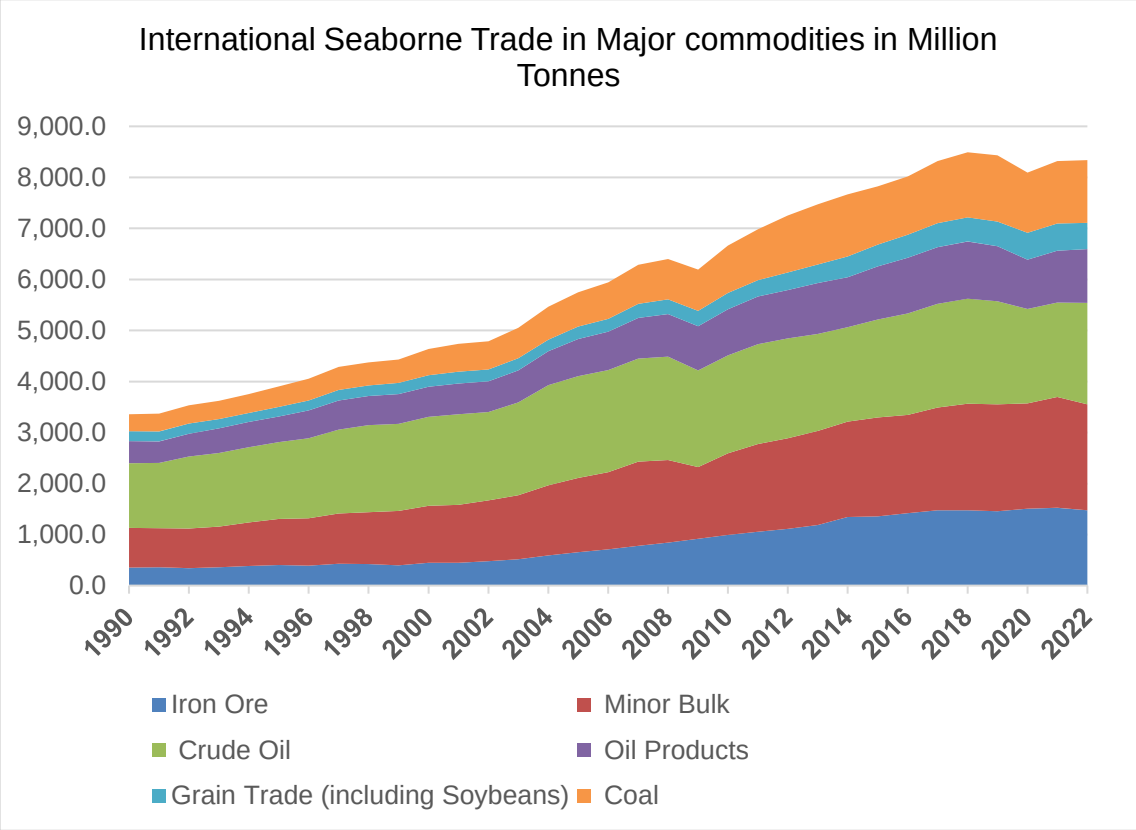
Nash, in his bargaining problem, states that a bargaining condition including two persons, who are rational and equal in bargaining ability, have a chance to collaborate for mutual benefit in more than one way. The equilibrium is based on strategy in which the outcome may be good for some or none (Nash, 1950). The bargaining for the freight rate of a particular cargo happens at the same time in different places, where information is available to everyone. The freight rate is finally agreed upon based on the overall demand and supply in the specific segment or total market. The bargaining power is not uniform among the owners and the charterers and can be described by a distribution, which may be slowly changing to macro influences. The relative bargaining power of the median charterer and the median owner would also be reactive to these factors (Karaktsos & Varnavides, 2014).

2.2 Freight market

The total volume of seaborne trade has been increasing due to the following three reasons; (i) the discovery of new sources of raw materials, (ii) advances in ship design leading to increasing size of the vessels and (iii) trade liberalization. Figure 2 represents the pattern of the international seaborne trade for different commodities.

The shipper's decision to hire vessels for the transportation of goods depends on three factors: i) type of cargo, ii) parcel size, and iii) route and port facilities at the loading and unloading ports. Different sizes of bulk carriers have contrasts in risks, returns and profitability which comes from the difference in their supply, demand, freight rate, and price. For tankers also, the size determines the operational flexibility routes, ports and cargo they carry. The lay-can (the window period for the vessel to report at the load port), loading and unloading time at berth, demurrage and dispatch are part of the charter party agreement (Alizadeh et al., 2009).

Figure 2 : International Seaborne Trade in Major commodities in Million Tonnes



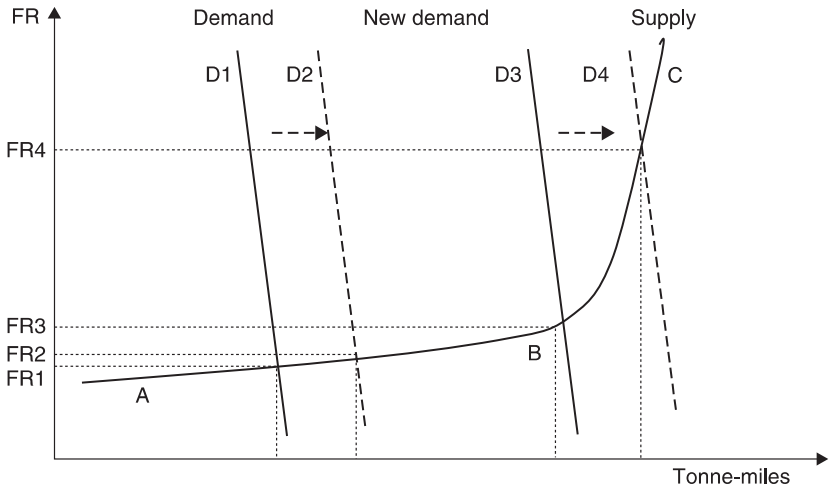
(Source: Developed by author based on data from Clarkson SIN)

90 % of charter parties for tankers and bulk carriers have been concluded on the basis of voyage terms. The demand for dry bulk shipping comes mainly from commodities trade, and for tankers, it depends on economic growth, the energy situation, and the price of oil (Ma,2021). One of the most popular maritime freight contracts is the

voyage charterparty (VCP), where stakeholders typically make decisions based on shared experiences rather than rational analysis (Sun et al., 2021).

The world economic growth, international seaborne trade, seasonal and cyclical changes regarding commodities transported by sea, and the distance between the place of production and the consumption influence the demand for shipping services (Stopford, 2009). The supply of shipping services, measured in ton-miles, is based on the amount of transportation provided by the fleet and is mainly influenced by the fleet availability, new shipbuilding, fleet productivity, scrapping rates, and market freight rates. Consequently, the freight rates reflect the balance of supply and demand at any time.

Figure 3 : Supply -Demand framework for freight rate determination



(Source - Alizadeh et al., 2009)

It is evident from Figure 3 that the supply of shipping services is highly elastic when the freight rates are low and becomes inelastic when it is at high level. This is due to the excess capacity during recession.

Freight rates have always been following an up-and-down trajectory over the years, reaching historically high prices at some time and then substantially decreasing as a result of the financial crisis, impacting the world's trade in commodities. The volatility of freight rates has been a major issue for shipowners, charterers, as well as shipping investors, shipyards, and financiers. High freight-rate volatility is undesirable from the standpoints of the shipowner and charterer since it can have an impact on the cash flow and profitability of operations and trade. The risk of default on shipping loans is

increased by high freight rate volatility, particularly when vessels are purchased at high prices (Alizadeh et al., 2011).

2.3 Freight market mechanism

The microeconomic models of freight rate determinants were extended to buyer and seller heterogeneity (due to differences in market knowledge, negotiation skills, quality or safety focus, or even fleet size) and their relationship with the freight rate for individual voyage charter contracts. Although it is difficult to assess the market knowledge of a given owner or the capacity of a charterer to negotiate the freight rate, such abilities and preferences are likely to be persistent over time. The market conditions and routes are the factors that have the greatest impact; the key finding is that charterers, shipowners, and their combinations have a significant impact on the freight rate level in specific contracts. This pattern is consistent across the two markets for the shipping of dry bulk commodities and crude oil. There was evidence of a significant fixed influence of the charterer in the VLCC market as well as significant match and charterer effects in the establishment of freight rates in the cape-size market (Adland et al., 2016).

Alizadeh and Talley (2011a), during their investigation of macroeconomic determinants of shipping freight rates found that tanker freight rates are positively and negatively correlated to the length of the laycan period and the utilization factor, respectively. They also witnessed that the freight rates and laycan periods change across shipping routes and the laycan periods of tanker freight contracts differ directly with freight rates and indirectly with freight rate volatility.

The risk preferences of charterers and shipowners and their actions in the spot market are closely related. A risk-averse charterer who is exposed to significant potential costs of disruptions in the supply chain for crude oil may seek to acquire tonnage as soon as is practical. On the other hand, a tanker owner who enjoys taking calculated risks can choose to fix his/her vessel as late as possible in order to benefit from a temporary spike in prices. As a result, when spot freight costs are high, charterers do try to fix earlier. The idea of "intertemporal substitution" discusses the significance of expectations in the interaction between charterers and shipowners. The spot freight

rates, which are only predictions of future pricing, can cause dramatic swings in spot freight rates for tankers. In the presence of intertemporal substitution, profit-maximizing owners will delay negotiations (thereby reducing the immediate supply), and cost-minimizing charterers will enter negotiations early (thereby increasing demand), resulting in an increase in freight rates, all other things being equal. A trend exists towards early negotiating and fixing activities during robust freight markets and later fixing during poor markets. Fundamental data such as fleet size and loaded cargo quantities do not have a significant impact on short-term spot rate dynamics once flexibility (in time and location) is introduced when to enter the spot market to match a cargo or a ship. Instead, risk preferences, heterogeneous and temporally variable expectations, and the relative bargaining strength of shipowners and charterers start to come into play (Prochazka et al., 2019).

For dry bulk vessels, the charterer decision while fixing the vessel affects the demand and the freight rate. There is always a risk of rising of the freight in a short period of time. The shipowner uses the information of the vessel and voyage specific factors in determining the freight and it in his investment, operation and deployment strategies. The shipowners and charterers negotiate freight rate premiums and discounts, with regard to specific routes and vessel characteristics. The freight rates and laycan periods for dry bulk shipping contracts are interrelated (Alizadeh &Talley, 2011b).

Bargaining plays a very crucial part in finalizing the price in the freight market. In the freight market, the charterer and ship owner engage in a number of negotiations to decide the freight rate. The price negotiation approach model can be applied in three of the major shipping sectors, namely dry bulk, tankers, and container vessels to understand the dynamics (Mohammad et al., 2022).

2.4 The Ship operator, the charterer and the broker

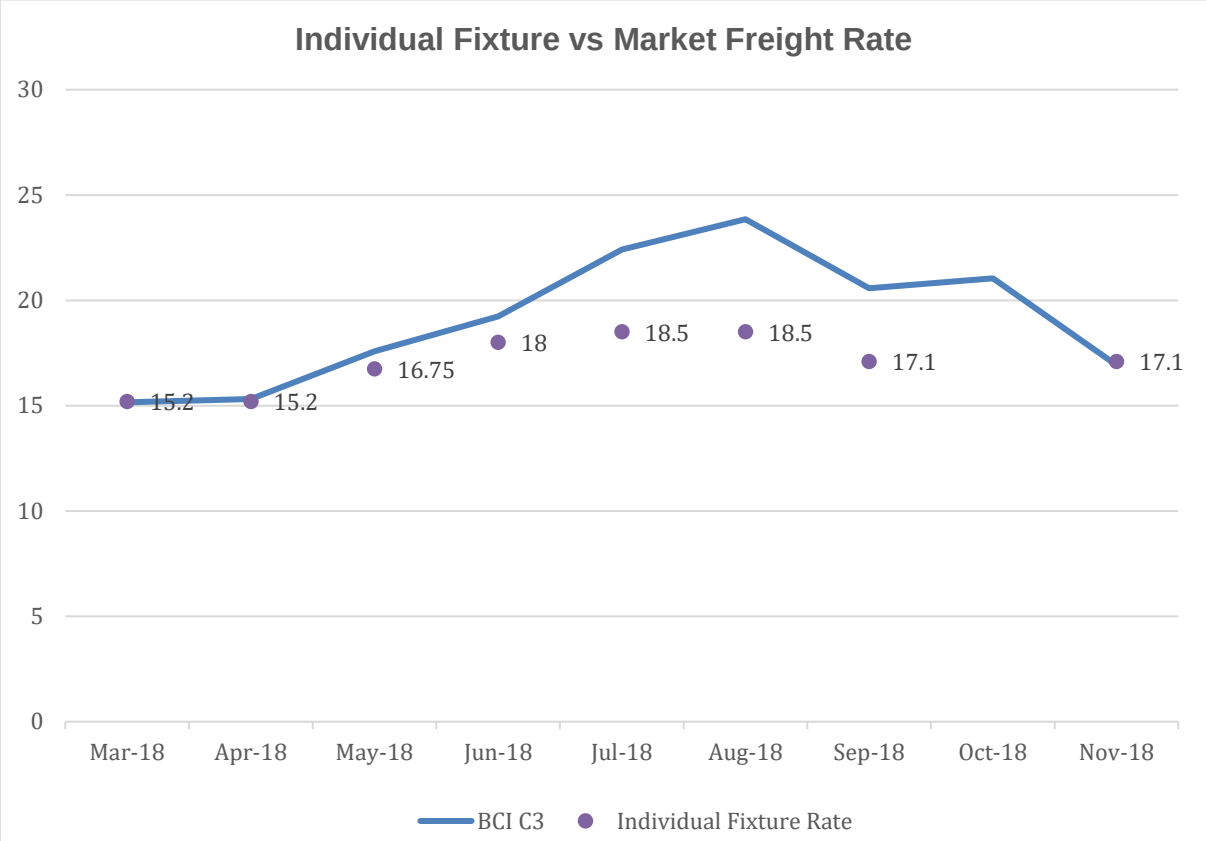
The economic model of shipping has two main components: supply and demand linked by freight rates, where the actions of shippers and shipowners bring the balance. The demand keeps changing rapidly; however, the supply changes slowly. The demand variables are the world economy, commodity trades, average haul, global events and the transportation cost. Supply side variables are world fleet,

productivity, shipbuilding, demolition and freight rates. The freight market consists of shipowner, charterer and brokers. The contractual legal agreement, the charter sets the terms of the deal (Stopford, 2009)

The larger number of cargo in the freight market is negotiated more or less secretly in direct talks between owners and charters through brokers in the spot market. The shipowner secures employment for the vessel between the available options of either voyage or by voyage or time. It considers the laycan, cargo size, duration of employment, conditions and risk in the region, and market conditions before deciding on the efficient and economical routing of its fleet (Gorton et. Al, 2011).

The bulk freight market is usually considered an example of a perfectly competitive market; however, at micro level the matching of a particular cargo to a suitable ship, the charterer and the owners become more obvious and have an impact on the formation of freight rate. There has been research to understand whether the age of the vessel has any premium in the dry bulk freight rate or the spatial aspect of tanker laytime and macroeconomic proxies represent the freight rate level and its volatility (Adland et.al, 2015). However, no studies have analysed freight services from a bargaining perspective with reference to the charterer and shipowner. It can be seen that the individual contract price differs from the average market price significantly. In Figure 4, the historical data for iron ore fixtures between Brazil and China are shown against the average market price BCI (Baltic Exchange Capesize Index) C3 for comparison.

Figure 4 : Individual Fixture Rate vs Market Average Rate



(Source: Developed by authors based on data from Clarkson SIN)

The broker is paid a commission called brokerage which is its remuneration for his work and is calculated as the percentage of gross freight (Gorton et al.,2009).

2.5 Negotiations in the freight market

A small sample survey carried out by Baboo and Thomchick (2003), revealed that the price negotiation strategies between shipper and carriers included entering into long-term agreements, concentrating on relationship-building measures, leveraging volume to reduce price, floating bids to obtain a competitive price from the existing base of carriers, consolidation of various lanes, density factors, size of the carrier, financial stability, and alliances the carriers had with other lines. Shippers conducted

negotiations with the selected carrier on a variety of aspects, including price, overall service, frequency of service, length of contract, and trade lanes.

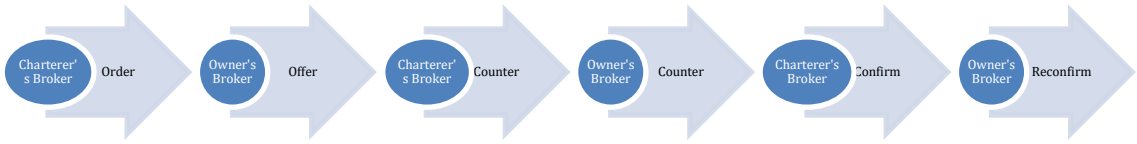
If a freight market complies with the following criteria, it is said to be perfectly competitive: First if the product is homogeneous. Second, there are a lot of charterers and owners. Third, both charterers and owners have complete knowledge of the present rate and the offers, and they are profit maximisers. Fourth, there are no transaction fees. Fifth, there are no exit or entry obstacles in the maritime sector (Karaktsos & Varnavides, 2014).

According to the conventional model, freight rates determine both the supply and demand for shipping services in a completely competitive market; however, the freight market features do not match those of ideal competition in which, both buyers and sellers are price takers, and their individual activities have little influence on the market. The freight market does not conform to the assumptions of perfect competition. Particularly, the assumption of a very large (and theoretically unlimited) number of buyers and sellers is not relevant, transaction costs are not zero, and there is not freedom of entry or leave and the product is also not homogeneous. Therefore, in the shipping market, where practically all transactions include direct physical contact between buyers and sellers, bargaining can be quite important to winning the negotiating process. Bargaining is a traditional way to interact and is not particularly complex. It is a game where one might lose by relying just on instinct and may get benefitted with better preparation for the negotiating process by gathering pertinent facts. Almost all contracts in the shipping sector are signed when two parties have reached an understanding and have faith in each other. Both sides engage in extensive negotiations, using a variety of strategies to secure favorable terms and conditions, including a higher price (Karaktsos & Varnavides, 2014).

Shipowner and charterer use their brokers as source of information, and for their negotiating skills. The brokers keep them informed about the market conditions and cargo and shipment potentials. An informal distinction is often made between freight brokers (who succeeds in contracting above the market rate) and charter party brokers (who contract at actual market rate but keep the charterparty clause to the

advantage of their principal). The charter parties are being refined by the Baltic and International Maritime Council (BIMCO) and distribute the legal and economic undertakings and responsibilities. The charterer has the option to enter the market with order immediately to commence freight negotiation or to collect information on different opportunities before starting the negotiations. The negotiation can be divided into two stages: first, for the main terms and second, for details of the clauses and remaining matters (Gorton et al., 2009).

Figure 5 : Individual Routine for negotiations



Source: Developed by Authors based on Shipbroking and Chartering Practice, (Gortorn et al., 2009)

The practice is to commence the negotiation with “offer” from the owners which the charterers may accept or decline or give “counter”. The negotiations continue by giving and taking until they reach a stage acceptable to both the parties. Figure 5 represents the negotiation routine (Gorton et al., 2009).

The chartering process can be divided into three stages; investigation, negotiation and follow up stage. The charterer enters the market with the order directly or through a broker. He may be prepared to commence firm freight negotiations or collect

suggestions for different transportation opportunities for evaluation purposes. The *cargo order* from the charterer represents its interest in a specific type of trade and specific type of vessel, whereas the position list from the shipowner includes particulars of the vessel, geographical location, and interest in specific types of charter.

According to Plomaritou et al. (2017), when the charterer is ready to enter into firm negotiations immediately, the order may commence with the following wording:

• FIRM . . .
• FIRM ORDER . . .
• CHARTERERS ARE NOW FIRM AS FOLLOWS . . .
• DEFINITE, FIRM AND READY TO GO . . .
• FIRM WITH LETTER OF CREDIT IN ORDER . . .

The minimum of information that is normally included at the cargo order of a voyage charter is the following:

• CHARTERER'S NAME AND DOMICILE

• CARGO QUANTITY AND DESCRIPTION OF THE COMMODITY

• LOADING AND DISCHARGING PORTS

• THE PERIOD WITHIN WHICH THE VESSEL IS TO BE PRESENTED FOR LOADING (LAY/CAN)

• LOADING AND DISCHARGING RATES AND TERMS

• ANY RESTRICTIONS REGARDING TYPE OR SIZE OF SHIP OR AGE OR FLAG

• C/P FORM ON WHICH THE CHARTERER WISHES TO BASE THE TERMS AND CONDITIONS

• COMMISSIONS TO BE PAID BY THE OWNER

The charterer may also mention his approximate expected freight level that he/she wants to have as a starting point for the negotiation (the charterer's freight estimation),

but such information is often deleted from the original order for purposes of negotiation strategies.

An example of a cargo order at a voyage charter is the following:

FCC REQUESTS OWNER'S COMPETITIVE RATES FOR THE FOLLOWING FIRM ORDER:

35–40 000 MTS 5% MOLCO COAL IN BULK, SF ABOUT 1.3

POL AT ANCHORAGE AT NEVELSK, SAKHALIN ISLAND RUSSIA

POD AT BERTH TAICHUNG OR TAIPEI OR KAOHSIUNG, TAIWAN IN CHOPT

LAYCAN 10–15 JUNE 2015, TRY VESSEL'S DATES IN JUNE

LD/DIS RATE 3000 MTS WWD SSHEX UU / 6000 MTS WWD SHINC LOADING AND DISCHARGING BY SHIP'S GEARS

FREIGHT INVITE OWNERS BEST FIOT GENCON '94 CPCOMM 2.5%

This order concerns a first-class charterer's (FCC) interest for a geared vessel to execute a voyage charter carrying in bulk coal of about 35,000–40,000 mt (MTS), 5% more or less on charterers' option (MOLCO), with about 1.3 stowage factor (SF ABOUT 1.3), from an anchorage at Nevelsk in Russia.

The owner expresses his intention presenting his ship and ability to meet according to meet the order providing a *freight indication.* The owner may give firm offer if the order from charterer is firm. The *offer* and *counter offer* from each side continue until everything is agreed upon. It is customary for the brokers to record the progress and details of bargaining in a "day book".

The fixture rate is determined by the following factors while negotiating:

• Condition of the vessel, its type and age and position;

• Present freight market conditions;

• Expectations of the parties;

• Charter period;

• Overall cost of providing the vessel;

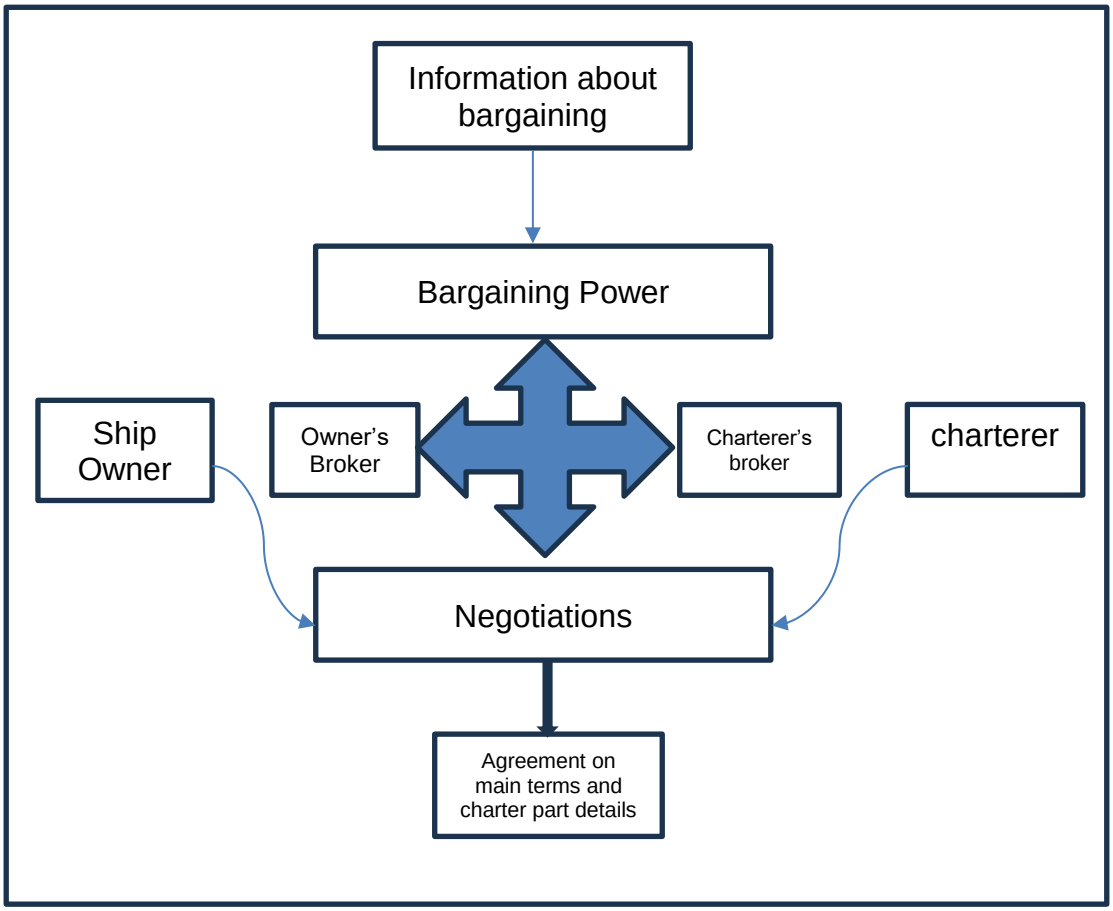
• Bargaining power of the parties;

• Chartering policy characteristics.

After both parties have agreed on each detail, a confirmation of the deal follows, declaring that: “HEREBY CONFIRM/RECONFIRM THE FIXTURE’.

It is uncommon for charterers to speak directly with owners during quote or contract negotiations. A typical way for an oil major to stay in touch with the market is through the chosen brokers, sometimes known as "panel brokers”. Environmental concerns are prevalent, and any pollution occurrence is likely to result in media criticism of oil enterprises. Many companies keep databases on the tankers they would potentially need to charter in order to lower their risk. This information is typically provided in the form of Sire reports (a database that tracks frequent inspections by oil firms, etc.) and by reviewing the ship's Q88, a very detailed questionnaire that provides all the most recent information on the ship. The oil companies are unable to afford to operate vessels that are below standard; therefore, they carry vetting inspection to verify the quality. The tanker market works fast. Charterers typically present their needs to the market in the morning and are frequently fixed by the closing of business on that day. The owner's brokers must be prepared to efficiently calculate their voyage expenses and, if necessary, offer their ships for an appropriate business within the hour (Palmer, 2016).

Figure 6 : Bargaining process in the freight Market



(Source: Developed by the authors)

Figure 6 explains the bargaining process where the charterer and the ship operator negotiate for the terms and condition of the charter i.e., contract for the carriage. This is based on the information available about the cargo and the various factors as well as the present financial, geographical, economic and political conditions. The communication is held through the brokers. Post negotiation involves multiple exchange of offers and counter offers until the final agreement is achieved.

2.6 Information and delay cost in the bargaining

The players involved in chartering and shipbroking receive and distribute information, the flow of which is necessary to understand current trends and conditions in the freight market. The sources of this information are market reports by organisations,

for example, BIMCO, Intertanko, ASBA (Association of Ship Brokers and Agents), or specialists Clarkson and Drewry (Plomaitou et al.,2017).

In their case study of coal and ore, Suh and Park (2010) observed that the ship owner and charterer, while bargaining, have different patience levels. The delay cost for the shipowner is a sum of operation cost and depreciation cost and for the charterer is the sum of inventory cost (dependent on the interest ratio and the commodity price) and the cost of custody per day (sourced from Port Corporation). They defined the discount factor as the delay loss cost in unit per day and per tonnage of the cargo and found that both charterers and ship-owner suffer from delays in negotiations.

In their study on the "delay costs effect" and the role of bargaining power as a moderator, Gago-Rodrguez et al. (2021) conducted simulations for buyer-seller sequential negotiations and discovered that buyers' bargaining power reduces the amount to which the delay costs reduce the initial bargaining gap and that buyers' bargaining power modifies the indirect effect that the setting's delay costs have on buyers' bargaining profits. Additionally, more powerful buyers have a tendency to consider the setting's delay costs less heavily while making decisions. For instance, a negotiator in a weak bargaining position should not anticipate the behaviour of a strong counterparty to be flexible in response to other external circumstances, such as delay costs. Therefore, less powerful negotiators may attempt to make their more powerful partners more aware of the delay costs to reach earlier agreements and decrease delay costs. Likewise, less powerful negotiators may lower the overall delay costs by commencing discussions sooner and/or making timely counteroffers when necessary, presuming that the delay costs are a constant function of time. Therefore, stronger buyers should assess the negotiating environment's important elements more objectively (such as delay costs) in order to decide whether the distributive bargaining technique driven by relative bargaining power is the appropriate course of action.

2.7 Factors affecting the bargaining power

Factors related to bargaining can be divided broadly under three categories: Players related, product related and market related. These influencing factors are summarized below:

Factors related to the Ship operators

1. Type of vessel: Bulk carriers show higher volatility and sharper fluctuations caused by changes in volume and pattern of trade. This unpredictable nature brings risks as well as opportunities for ship operators (Jing et al., 2008). A specific type and size of vessel can provide ship owners with better bargaining power in a specific trade.

2. Ship's condition, operating cost, and efficiency – Capacity, speed, fuel efficiency, and age–affect chartering opportunities and freight rate. Adland et al., (2017) in their research while investigating that whether fuel efficiency pays, found that the "market rate" for a standardized vessel has the most explanatory power, but vessel age, fuel prices, the location of delivery, and DWT are also important factors for determining freight. They also observed that when the sample is expanded in time and vessel size, the earlier conclusions on the energy efficiency premium in the literature are not reliable. They demonstrated that only 14–27% of fuel savings are reflected at a higher rate during normal market conditions, whereas the sign of the relationship changes during market "booms", causing energy-inefficient vessels to command a premium. They concluded by saying that fuel-efficient ships are likely to be picked up first in the spot market and have less idle time.

3. Bunker price: The price of fuel can affect the operational costs. Ship operators may demand higher freight for vessels which are on spot charters to compensate for themselves.

Factors related to the charterers

1. Commodity type and price: Oil price shocks cause volatility in the tanker freight market. Tanker freight rates which represent the transportation of oil, show

pronounced volatilities over time (Gavriilidis et al., 2018). A high volume of cargo and continued requirements can give the charterer better power for negotiation.

The inclusion of oil price shocks of different origins as exogenous variables in the model improves the forecast for spot and 1-year time-charter tanker freight rates. Research indicates that including oil supply shocks leads to modest improvements in forecasting volatility in tanker freight markets; however, including aggregate oil demand shocks and precautionary oil-specific demand shocks considerably increases the accuracy of the forecasts (Gavriilidis et al., 2018).

2. Charter period: Spot rates are more volatile than the time charter rate. Long term charters give ship owners firmness. A time charter agreement allows for the hedging and avoidance of freight rate risk. While examining the spot freight market's volatility by defining the relationship between time charts and spot freight rates, using three different types of dry bulk ships–Capesize, Panamax, and Supramax–it shows that the time charter and spot freight rates have two-way lead-lag correlations. A stronger price discovery function is produced by smaller ship sizes and longer voyages (Zhang & Zeng, 2015).

3. Charterer reputation: A charterer with a better reputation in the industry may demand a higher share of the trading surplus. He may be able to negotiate better terms and demand more from the ship operator. Similarly, ship operators who are considered energy efficient, safety conscious, and have performed previous voyages with cost and time efficiency may have higher negotiating power.

4. Efficiency at ports: In a spot charter, the ship operator may want the vessel to be released as soon as possible. Possible delays at the load port and the unloading port can reduce the bargaining power of the charterer. If the ports are known to have congestion and delays during cargo handling, the ship operator would like to negotiate for a higher price, as the vessel is locked for a longer period.

Market Conditions and Other Factors

1. Market anticipation and economic trends: The current state of the market and its anticipation are the most important and critical factors in determining freight rates

(Plomaritou et al., 2017). The supply and demand of goods and transport requirements have an impact on the players' discount factors. The players have information based on their research to make decisions. Demand for cargo results in a trade pattern, which in turn results in demand for transport.

Demand for maritime transport is affected by the state of the economy, which has a substantial impact on freight rates. Owing to China's astronomically high development rates and the need to acquire raw materials, bulk carriers are in high demand. The markets for shipping and goods declined after the second half of 2007, when the US financial crisis started to have an impact on the world economy. The dry bulk freight market is significantly impacted by economic factors (Tsioumas et al., 2021).

2. Political situation and other events: Geopolitics can play a major role in trade between countries, as seen in the past. A war or any other situation can create a very skewed bargaining power between the charter and ship operator. A ship operator may not like to go to such area or there may be requirement for additional insurance resulting in increased cost. Few routes may have higher demand and can affect the negotiations.

Trade and maritime transport are currently running in a very complex background due to various factors covering many global issues such as energy, sustainability, digitalization, market condition and industry association. The war in Ukraine and high operational costs in light of the most recent decarbonisation rules have affected the freight rates for dry bulk and oil tankers. As older tankers leave the market as a result of the International Maritime Organization (IMO) Energy Efficiency Existing Index (EEXI) and Carbon Intensity Indicator (CII) requirements, a decline in capacity is anticipated (UNCTAD, 2022). There exists a set of variables in a complex web that affects the volatility and seasonality of the demand for cargo transport.

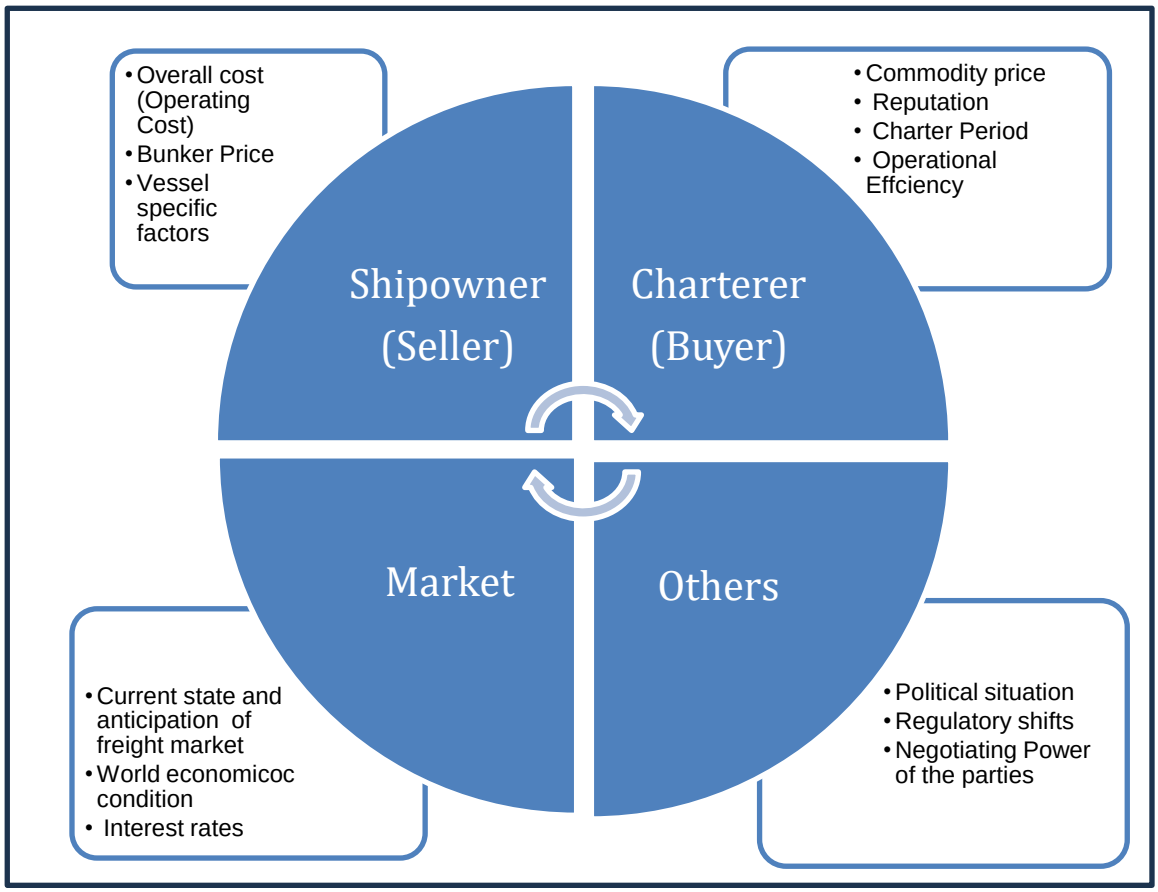
3. Cost of regulatory compliance: As discussed in vessel-related factors, the ship owner may incur additional costs in complying with more environmentally friendly fuel in specific routes and regulatory environments. Certain vessels may have advantages over others because of their technical capabilities. For example, the Sulphur Regulation impacted ship owners in many ways. Non-compliance led to monetary

penalties and reputational damage (Zis & Cullinane, 2020). In the future, decarbonisation compliance will impact the negotiating power of compliant vessels. The desire for greener shipping is intensifying, and one of the strategies to achieve this goal is to slow down ships. Given that fuel costs are a major factor in the operating costs of ships, speed has already been significant for economic reasons. Speed is a crucial component of the overall logistical operation of a shipping company. The fact that any fleet overcapacity has essentially been absorbed serves as confirmation that slow steaming is still in use today. In reality, there has been essentially no tanker and bulk carrier lay-up, according to Clarksons in 2011 (Psaraftis & Kontovas, 2013).

4. Negotiating power of the parties: A shipowner and charterer negotiate for a fixture during the chartering process. Numerous factors, such as the partners' financial condition, the moment, their long-term connections, and their wants or priorities, have an impact on this balance (Plomaritou et al., 2017).

From the above discussion, the factors related to parties, commodities, and the market function in a complex environment are not isolated. They are inter-related and can affect the bargaining power of both players in opposite directions. Figure 6 provides an overview of the factors discussed, with the factors related to the ship operator, charterer, market, and commodity. Some of these factors can be difficult to measure and exhibit lead lag because of their place in trade and transport. The economic policies of governments and the global situation can also affect the assessment.

Figure 7 : Bargaining factors in the freight Market



(Source: Developed by authors)

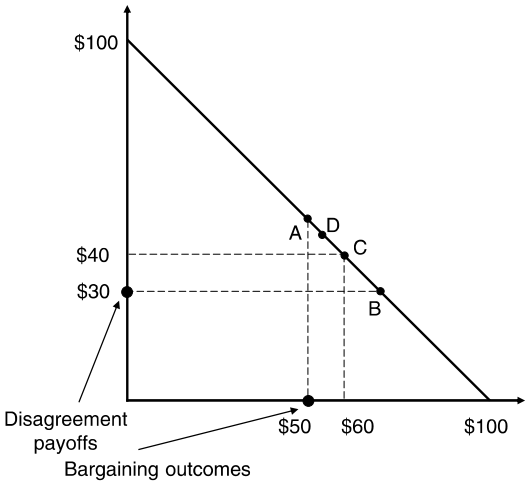
Chapter 3. Concept of Bargaining and Framework

Game theory is the study of mathematical representations of competition and cooperation amongst rational, intelligent decision-makers. Game theory offers general mathematical approaches for the purpose of analyzing scenarios in which two or more people make decisions that may affect one another's welfare; game theory offers general mathematical approaches. According to game theory, each player's goal is to maximize the expected value of his own pay-off (Myerson, 1981).

3.1 Bargaining as a concept

The practice of negotiation is common in social interactions. Bargaining theory and models study an issue in which rational entities who are in pursuit of their own benefits attempt to reach an agreement. The two pillars of bargaining discussed earlier are Nash's axiom theory, and Rubinstein's bargaining model. Contrary to neoclassical economics, where it is assumed that the "invisible hand" drives the exchange in the economy to a social equilibrium, bargaining theory deals with the division of surplus resulting from their cooperation. Nash bargaining solution, which is unique, should have four properties invariance, efficiency, balance and independence of unconnected substitutes. A variation of the Nash solution is that bargaining parties have unequal positions and different capabilities to negotiate, that is, different bargaining powers.

Figure 8 : Nash Bargaining Solution



(Source: Bargaining Models from the book "*The Palgrave Encyclopedia of Strategic Management* ")

In the above example, it is assumed that a surplus of $100 is to be divided between X and Y and the largest pay off without collaboration is $30 and $50, respectively. If the share of surplus be Sx and Sy and the bargaining pay offs be Sx X $100 and Sy X $100, the result of bargaining can be anyplace in the section AB. (Sx X $100 ≥ $30, Sy$ X100 ≥ $50 and Sx + Sy = 1. The Nash solution states that X receives a payoff of $30 + $10 = $40, whereas Y receives $50 + $10 = $60 (at point C in Figure 8 as the quasi-rents are $100 -($30 +$50) = $20. The generalized Nash bargaining solution is X gets $ 30 + α_x X $10 and Y gets α_y X $10 where α_x and α_y are bargaining powers of X and Y. (If $\alpha_x > \alpha_y$ then the solution should be at point D in Figure 8).

3.2 The Rubenstein's bargaining model

The main characteristic of this model is that it prescribes a fairly interesting method of bargaining, ie the players alternately make proposals to one another until an agreement is reached. Since making offers and counteroffers is at the core of many real-life discussions, this model has a lot of natural appeal. One perception is that if the bargaining process is frictionless i.e., nothing stops the players from making offers and counter offers as long as they desire since there is no cost associated with it. Another insight is that a player's bargaining power depends on the relative magnitude

of the players' respective cost of bargaining with the absolute magnitude of these costs being irrelevant to the outcome. The model has an enormous impact on providing basic framework for adaption, extension and modification while examining negotiations. The simplest model is one in which two players bargain over a surplus of a fixed magnitude. The analysis involves pay offs solution under unique subgame perfect equilibrium (Muthoo, 1995)

Rubenstein adds more structure to the bargaining issue and takes a strategic approach with reference to the negotiating maneuvers and specifying details (Augier et. Al, 2021).

Bacharach and Lawler (1981) base their theory of bargaining power in terms of the perceived joint comparative dependence of the players involved in the negotiation process. The function of power depends on the options for reaching the agreement and their dedication and capacity to perpetrate cost.

The availability of outside options influences the bargaining power of the parties and has an impact on the dynamics and the outcome of the negotiation. Since they provide an alternative, it adds to bargaining power, and on the contrary, an absence of the outside option can result in desperation to conclude the agreement (Muthoo,1995).

Ailin Leng (2023) conducted an experiment regarding bargaining in continuous time. A waiting period was defined before making a new offer or accepting another offer. The share was discounted by discount rate for the time. The result shows that a higher waiting period or lesser discount rate alone increases the actual pay off; however, the combination of two factors creates a weaker effect.

3.3 Price bargaining model and theory

By assuming that each economic actor operates in an "environment" that is somehow characterized by the collective behavior of all the other actors (sellers and buyers), the theory of markets has been able to conceptually address the interaction of numerous economic actors. A theoretical construct that depicts the behaviour of all important economic units that are not directly under his control is referred to as an environment in this context. It is evident that, in general, it is not mathematically

conceivable or conceptually beneficial to consider each pair of economic unit interactions separately. As a result, the creation of economic environments that exhibit different types of behavior can occasionally clarify the character of the individual (Coddington, 2010).

During a bargaining process between two players who have to reach an agreement on the division of a pie size 1, once an offer has been made by one, the other may accept or reject and continue to bargain. Every player bears a fixed bargaining cost for each period (c_1 and c_2). Rubinstein applied the theorem to the fixed bargaining cost and fixed discounting factor model and concluded that if (i) $c_1<c_2$ the only Perfect Equilibrium partitions (P.E.P.) gives all the pie to 1; (ii) $c_1>c_2$ the only P.E.P gives to 1 only c2. In case where the players have fixed discounting factor ($\delta_1$andδ_2), the only P.E.P. is (1-δ_2)/ (1-$\delta_1\delta_2$). If $c_1=c_2$ any partition of the pie from which 1 receives at least, c_1 is P.E.P.

More complicated questions and conditions may be discussed during negotiations, such as delivery dates, payment options, service levels, compound items and services. One of the branches of game theory is bargaining theory. Following the fundamental and abstract bargaining model put forth by Nash, in order to explore more realistically, researchers have added more elements to Nash's basic framework, for instance, defining bargaining processes by taking into account bargaining costs, breakdown risk, and outside and/or internal options and examining information completeness (Jin, 2006).

Individual contracts differ from the average freight rate index. The bargaining theory perspective can help in understanding the discrepancies and using the research findings in price determination in the freight market.

3.4 Bargaining power

The share of surplus obtained by a player in the negotiation reflects his/her “bargaining power”. A player’s bargaining power decreases with a decrease in the discount rate and increases with his/her opponent’s discount rate. If the cost of negotiation is identified, a player’s bargaining power decreases in his/her cost of bargaining and increases in the opponents’ cost of bargaining. In the alternating offer game, if a player makes a counter offer, he/she incurs a cost of waiting which is dependent on his/her discount rate. If the discount rate is smaller, the smaller is the

cost associated with waiting and the higher is the patience conferring greater bargaining power (Muthoo, 1999).

The power the players have with respect to each other is based on the difference between their substitute outcome source weighted by the value and the payback; they can suffer if they do not make sufficient discounts during the negotiation. Alternate options will have an opportunity cost as well as a payback cost.

Bargaining power is the players comparative ability to sway terms and prices in their favour. The player with higher bargaining power would receive higher share of the surplus. Research indicates that the bargaining power of a player is mainly influenced by the proposal, patience, past repute, amount of information, signaling, and readiness of the outside option. Signaling is the information passed intentionally to other players which helps them bargain proficiently and make decisions (Martin 1992; Farrell & Gibbons, 1989).

It has been demonstrated that the presence of fixed characters significantly alters the techniques and results of negotiating. A study by Compte and Jehiel (2002), demonstrates how the impact of bargaining inflexibility may be neutralized by external possibilities. They demonstrated that there is a particular Perfect Bayesian Equilibrium in which each party presents itself as rational as soon as possible when opting out is preferable to accepting the inflexible demand of the other party when parties have access to stationary outside possibilities. Similar conclusions apply when only one party has access to an outside alternative or when those options may not be available until a later time.

The player with higher patience and higher reputation will have greater bargaining power. The outside option and opportunity costs also affect the negotiating strategy.

3.5 Bargaining model in the freight market

The number of players and amount of information are important parameters for the development of the model for creating scenarios for the division of surplus during the bargaining process. These two parameters can result into four scenarios. If the

numbers of players are represented on the x-axis and the amount of information on the y-axis, the resultant four quadrants are as follows:

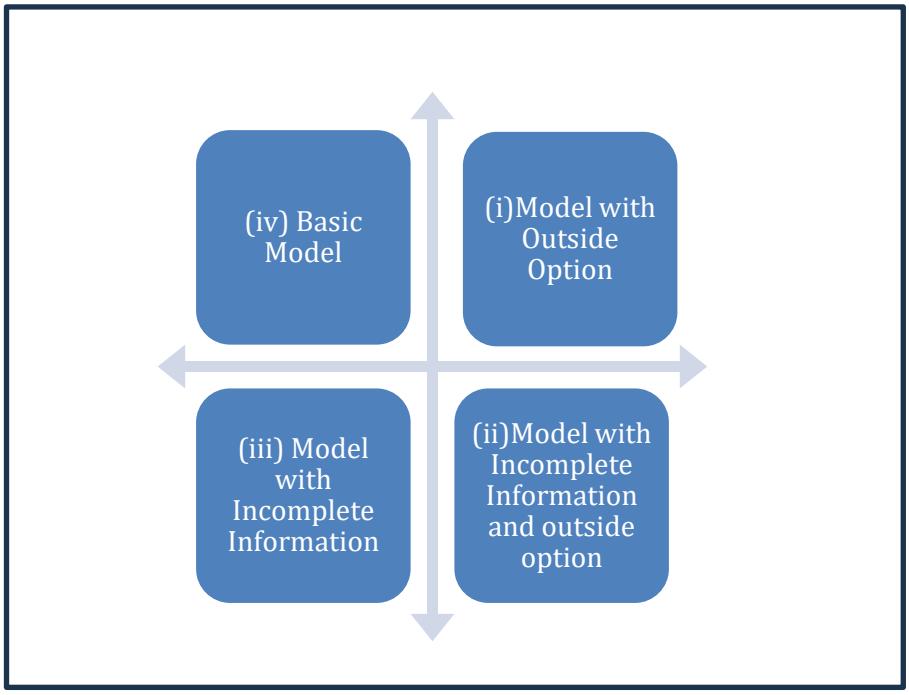
i) High Information and high number of players

ii) Low Information and high number of players

iii) Low Information and low number of players

iv) High Information and low number of players

Figure 9 : Bargaining Models



Source: (Sahoo, 2023). *Review of bargaining and transactional prices: future avenues for shipping studies* [Working paper]

When there are many buyers, the seller is in a position to switch between the buyers; however, the strategy will depend upon the delay cost. When there is no delay cost, while switching it plays with a take-it or leave-it approach, alternately, in a situation where there is a delay cost, it makes several offers to the buyer before switching

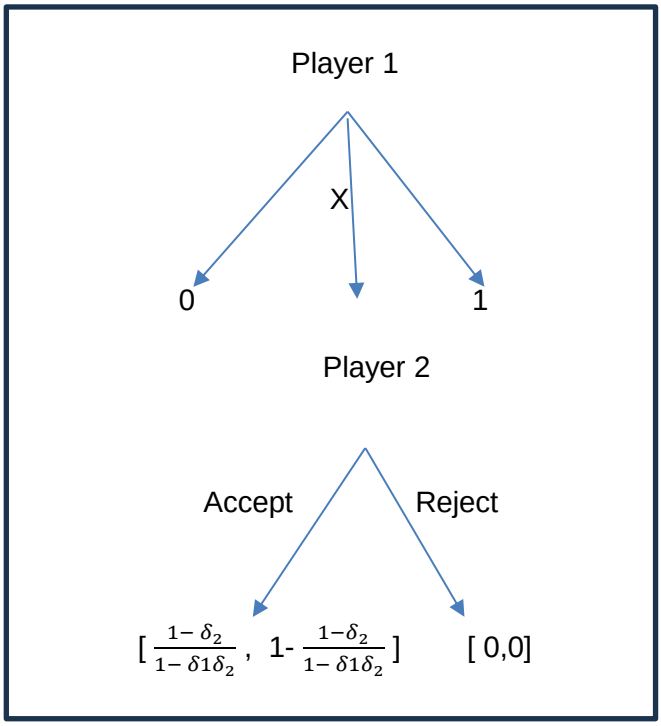
(Fundenberg et al., 1987). Roson and Hubert (2015) explains how the overall economic surplus found in markets is distributed among network agents based on the factors that influence bargaining power, such as the situation of each agent in the network, cooperation arrangements, market biases, and outside options.

In the case of low information with a large number of players, Chatterjee and Lee (1998) investigated a model of bargaining in which the seller creates offers and the buyer can explore an outside option at a cost. The outside option cannot be realistically conversed, and the seller's offer can be recalled by the buyer for one period. It analyzes two equilibria; immediate resolution and search equilibrium. It is found that under incomplete information, the seller is worse off compared to the case where the buyer can correspond their outside option.

In the case of high information with a small number of players during bargaining, the proposal is either accepted or a counterproposal is made. The negotiation continues until an agreement is reached; however, the delay reduces the actual payoffs for both players in view of the discounted cash flow. This is a very simple and basic model for estimating the division of surplus between the players.

Figure 10 represents the simple Rubenstein Model in the game tree form with the pay off.

Figure 10 : Rubenstein Bargaining Model – Game Tree



Source: (Sahoo, 2023). *Review of bargaining and transactional prices: future avenues for shipping studies* [Working paper]

The game model is a condition in which it is in the interest of the players that an agreement is reached quickly. However, no one wants to arrive at a quick agreement by proposing all to a rival. At the start even round player 1 faces precisely the same position he/she faced at the start of the game, except that the available surplus is less. Player 2 faces exactly the same situation he/she faced at the commencement of round 1excpet that the surplus has been reduced. In the Rubenstein bargaining model, pay offs in the future are lower as the surplus to be divided decreases over time (Schecter & Gintis, 2016).

Chapter 4. Data and Research Methodology

4.1 Introduction

In the previous chapters the negotiating practices in the freight market have been reviewed along with the principles of bargaining. To continue the bargaining concept and apply it on the fixtures data for Capesize Bulk carriers (Dry Bulk fixtures) and Aframax Oil tankers (Average Freight Rate Assessment (AFRA), a tanker rate system) fixtures will be collected. The data has been collected from AXS Marine and Clerksons, the top data collection center for shipping business and trade. This chapter also introduces the research design.

Data have been used to estimate the relationship between various factors and the bargaining power of the ship operator and charterer during a fixture. Data sets are available in different varieties: cross-sectional, time-series, and panel. A cross-sectional dataset is composed of samples of individual units taken at a given point in time. The data at times do not match exactly at the same time. The assumption with cross-sectional data is that they have been obtained by random sampling from the population. Different variables occasionally relate to different time period in cross sectional data set. A time series is a set of data taken on a variable over time. The data frequency can be daily, weekly, monthly, quarterly and annually. A panel data comprises a time series for all the cross-sectional member of the data set (Wooldridge, 2020). Since data are provided by AXS Marine on a random basis without time series, a cross-sectional data analysis is adopted to assess the correlation between the variables.

4.2 Calculations

In this section, the bargaining principle is applied to the discussion in the previous section to understand the estimated freight rate by the charterer. A charterer who wants to trade iron ore from Brazil to China using a Capesize Bulk carrier has been considered. Since there are few players and less uncertainty, the simple Rubinstein (1982) bargaining model will be applied to estimate the individual freight price. Moreover, both the players need to calculate the trade surplus and their discount factors.

The few terms widely used in the transportation of goods are discussed below.

Free on board (FOB) – The cargo is delivered on board a ship by the seller at a port mentioned in the contract and the risk of loss or damage is transferred from the seller to buyer once the goods pass the ship's rail.

Cost and freight (CFR) – The Seller pays the costs and necessary freight to bring the goods to the destination, but the risk to the goods and any cost increase is transferred from seller to buyer when the goods pass to the ship's rail.

Cost, insurance and freight (CIF) – It is similar to CFR but in addition seller has to buy the insurance for the goods against the risk of loss or damage during the transportation.

Surplus calculation: In the case of the voyage charter fixtures, the maximum freight rate the charterer would pay is the difference between the CIF (cost insurance and freight) prices and FOB (free on board) prices for the iron ore, while the minimum freight rate the ship operator would be willing to accept zero in an extreme situation, considering the ship operator does not have any other options available. Hence, the bargaining surplus can be calculated as follows:

$$S_b = P_d^{CIF} - P_l^{FOB} - 0 \quad (1)$$

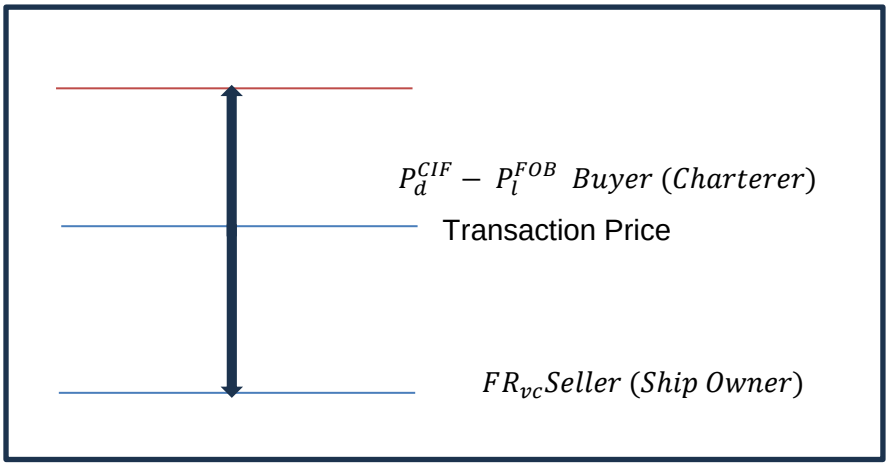
Where, S_b is the trade surplus, while P_d^{CIF} is the CIF price of iron ore in unloading country, China and P_l^{FOB} is the FOB price of iron ore in the load country – Brazil or Australia. Therefore, the character's surplus and ship operator's surplus from the freight fixtures can be as follows:

$$S_c = S_b - FR_{vc} \quad (2)$$

$$S_{so} = FR_{vc} \quad (3)$$

Where S_c and S_{so} represents the charterer's and ship operator's surplus, respectively and FR_{vc} denotes the voyage charter freight rates. The share of surplus between the charterer and the ship operator can be calculated as $\frac{S_c}{S_b}$ and $\frac{S_{so}}{S_b}$ respectively.

Figure 11 : Trading Surplus



Source: (Sahoo, 2023). *Review of bargaining and transactional prices: future avenues for shipping studies* [Working paper]

Discount factor calculation: The charterer would like to know the minimum freight rate that he/she could propose, acceptable to the ship operator. By the discussion held earlier regarding game theory, the discount factor is proportional to the bargaining power; the lower discount factor results in low share of the surplus for the player. Hence, the charterer would observe the ship operator's operating history to understand the operator's minimum acceptable discount factor. The surplus of players is $\frac{1-\delta_2}{1-\delta_1\,\delta_2}$ and $1-\frac{1-\delta_2}{1-\delta_1\,\delta_2}$ by Rubinstein (1982).

Since the charterer proposes the split of surplus, the charterer is player 1 and the ship operator would be player 2. The surplus particular ship operator had given to any charterer is:

$$\frac{S_c}{S_b} = \frac{1-\delta_2}{1-\delta_1\,\delta_2} \quad (4)$$

Considering the discount factor of the charterer (δ_1) as a unit matches to the minimum acceptable discount factor (δ_2) for the ship operator. Hence, the minimum acceptable discount factor for the ship operator is:

$\delta_2 = 1 - \frac{S_c}{S_b}$, when $\delta_1 = 1$ (5)

Substituting Eq (1) and Eq (2) in Eq (5):

$$\delta_2 = \frac{FR_{vc}}{P_d^{CIF} - P_l^{FOB}} \quad (6)$$

A simple regression in δ_2 (minimum discount factor acceptable for the ship operator) estimated from Eq (6) on various shipping markets, contracts, and vessel specific factors can be used evaluate the current minimum discount factor of the ship operator. The charterer can calculate the minimum acceptable spot freight rate for the particular ship operator in a given market condition. Correspondingly, the ship operator can also calculate the minimum discount factor acceptable for the charterer. Thus, the minimum discount for both the ship operator and charterer from the counter player's perspective can be generated.

In order to calculate the minimal and maximum freight rates for both parties, they may use their respective vessel operators' or charterers' least discount factors relating to a specific consignment. If the charterer proposes a split of the surplus, the minimum freight rate should be achieved and the maximum freight rate is achieved when the rate is proposed by the ship operator. Therefore, the estimation of prices limits can be carried out under this concept of price bargaining.

As discussed in the previous chapter, the surplus is divided into the player as per Rubenstein Model where the offers and counter offers are alternately given till a player accepts the offer. The delay due to the negotiation has a delay cost associated and it decreases the pay off. As the discount factor approaches close to 1, the player is less compelled for time.

The surplus and the discount factors will be considered as the dependent variables and observe their relation with the independent variables to find if there exists any relationship.

The most crucial tool an econometrician has is regression analysis, to describe and assess the relationship between a given variable and one or more other variables. This method is used to precisely explain changes in a variable by comparing those

changes to changes in one or more other variables (Brooks, 2019). A realistic model with random disturbance term is

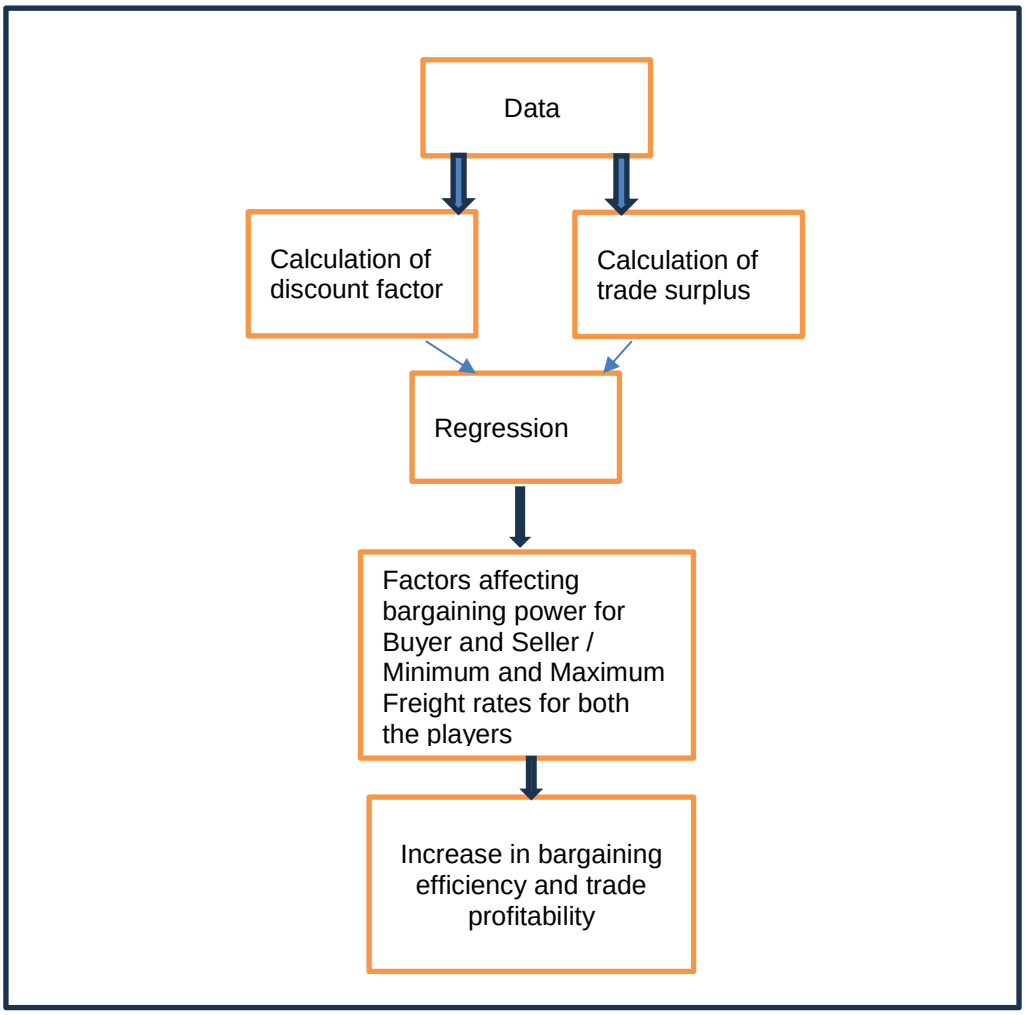
$$y_t = \propto + \beta x_t + u_t \text{ , (where t denotes the observation number)}$$

A fitted linear regression model object is called a Linear Model. The relationship between a response and predictors is described by a regression model. It gives information about coefficient estimates and the summary statistics which is used to assess and visualize the linear regression model as well as forecast responses.

4.3 Research design

Based on the above discussion a research design has been developed. The research design is an outline or plan that is generated to answer the research questions. To better understand a setting that is of interest, research is the methodological process of gathering, analysing, and interpreting information data (Leedy et al.,2019). Data will be collected for quantitative research, where variables are calculated and analysed according to the research design.

Figure 12 : Research Design



(Source: Developed by authors)

The difference between the buyer's maximum price and the seller's minimum price at which they are willing to purchase the same item at the same time is calculated (in the present case, the charterer, who is the buyer, and the ship operator, who is the seller).The research also calculated buyers' and sellers' discounts, considering the surplus and the lowest and maximum prices that the players are ready for. The results of the study were analysed and statistically examined using Microsoft Excel. Additionally, MATLAB software was used to perform regression analysis to determine the components that influence the bargaining power of the players.

4.4 Data and the variables for the dry Vessels

For the purpose of this study, monthly freight fixture data covering the period from 2013 to 2023 of Capesize (595 fixtures), from a specific lane from Brazil to China, including commodity type (Iron Ore), vessel information, size of the vessel, year of build, and charterer information were collected from the AXS Marine database, which is considered the leading data storage centre for all aspects of shipping and trade.

Lim et al. (2019), while carrying out their research to understand freight market volatility classified explanatory variables as supply factors, demand factors and financial market factors. For supply factors, they considered fleet growth, fleet development, and order book; for demand factors, they used variables that reflect world seaborne trade and world economic activity, for example Industrial Production, Imports, and for financial markets factors: Exchange Volatility Index and Forward Freight Agreement Rates.

Table 1: Data and Source (Bulk Carrier)

Variables	Unit	Definition	Source
Dependent Variables			
Freight Fixture	$/Tonne		AXS Marine
FOB Price of Iron Ore in Brazil	$/Tonne		UN Comtrade
CIF Price of Iron Ore in China	$/Tonne		
Independent Variables			
Operating Cost of Vessel	$/day	Cape size Operating Costs (OPE X)	
Cost of Bunker	$/Tonne	HSF 180cst Bunker Prices (3.5% Sulphur), Fujairah	SIN Clarkson
LIBOR	$m	5 Year $10m Finance based on Libor 1st yr	
Lay-can Period	Days	Difference between Lay and Can days	AXS Marine
Time to load	Days	Time left for loading day	
Seaborne Trade	Billion Tonne-miles	World Seaborne Iron Ore Trade	
Cape size 5-year-Old Price	$m	Capesize 5 Year Old Secondhand Prices (Long Run Historical Series)	SIN Clarkson
BCI Index	$/Tonne	BCI C3: Tubarao/Qingdao, 160,000 or 170,000 mt	
Fleet Development	DWT million	Capesize Bulkcarrier Fleet Development	

The world dry bulk shipping market is divided into three submarkets: capesize, panamax, and handy size. The source of cargo for cape size is steady, and they are mostly engaged in voyages between different continents (Jing et al., 2008).

Capesize: Gearless bulk vessels between 100,000 and 400,000 dwt. They transport coal and iron ore over a variety of long-distance routes, including those from Australia or Brazil to China. Their names are derived from the fact that they sail around the "Cape of Good Hope" or "Cape Horn" because, due to their size, they cannot transit through the Panama Canal. Brokers occasionally employ subcategories for this class in daily correspondence, such as "Small Capes" for ships up to 150,000 dwt, "Normal Capes" for ships between 160,000 and 180,000 dwt, and "Large Capes" for capacities exceeding 180,000 dwt (Plameritou, 2017).

4.4.1 Dependent variables

Freight Fixture

The worldwide iron ore import competition pattern is tight, unbalanced, and increasing. Australia and Brazil are major export rivals. Competition for iron ore imports generally exists between Europe and Asia, as well as within the European and Asian markets. In this study, the iron ore trade from Brazil to China through capesize vessels was considered. Tubarao is the most important port for loading in Brazil, and Qingdao is the unloading port in China. The actual fixture of each voyage was extracted for comparison with other variables.

Iron ore price

The FOB price for iron ore in Brazil and the CIF price in China were collected from the UN Comtrade on a monthly basis for the period of research to determine the maximum trading surplus for the buyer which is the difference in both prices. The difference is the motivating price for the trade to buy the freight services from the ship operator.

4.4.2 Independent variables

Age of the vessel

Adland (2015), in his research on the influence of charterers and owners on bulk shipping freight while examining the capesize freight rate, observed that the freight of the vessel is not sensitive to its age. Tamvakis and Thanopoulou (2000) also while examining different fixture observed no statistically significant difference in rates paid for older and younger tonnage, with the exception of a very small number of occurrences. Hence, in this study, the age of the vessels was not considered as an independent variable (Hao et al., 2018).

Operating cost of the vessel

Operating costs are the costs associated with the day-to-day operation of the ship; these costs include crew, supplies, and maintenance and are incurred regardless of the trade in which the ship is involved. The operating costs cover all ongoing costs associated with maintaining the ship on a daily basis, including fuel costs, which are included in voyage costs, as well as the budget for minor repairs and maintenance (but not for major dry dockings, which are handled separately). They make up around 14% of total expenses (Stopford, 2009)

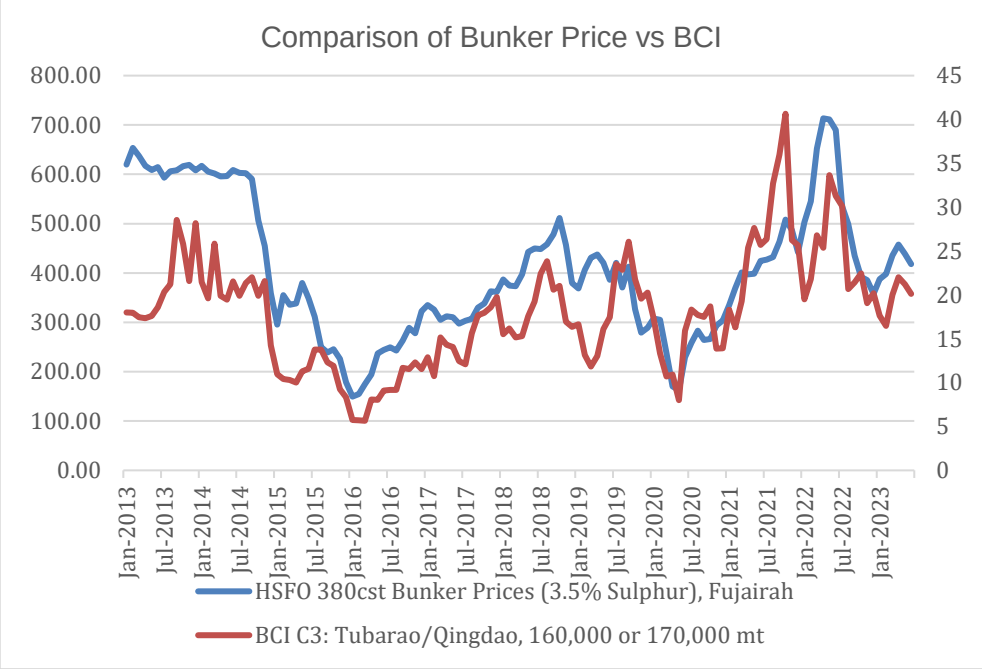
Cost of bunker

Bunker cost is the single most important item in the voyage costs. Technological development has resulted in efficiency and economies of scale. The vessels which are fuel efficient will have higher bargaining power than those which are old and less efficient.

The major part of a voyage charter's operating expenses is related to the fuel cost, and the selection of bunkering locations and volumes by ship owners is critical. The cost of a bunker is significant because it affects more than just variables, such as cargo capacity and sailing speed, and also has an impact on the advantage created during the voyage. Consequently, the entire revenue of a voyage charter is

determined by bunker costs (Jia et al., 2012). Figure 13 indicates qualitatively that the bunker price and freight rates are positively correlated.

Figure 13 : Comparison of Bunker Price and the Freight Index



(Source: Developed by author based on data from Clarkson SIN)

LIBOR

The London interbank offered rate (LIBOR) is one of the best-recognised and most significant interest rates in the world. This is the rate at which banks believe they can borrow. The US dollar is the most important of the world's currencies; therefore, the US dollar LIBOR rates are probably the most widely used and cited (imf.org).

Lay-can period

The difference between the lay and cancellation dates plays an important role in freight fixtures. The difference was tabulated using data from AXS Marine for each fixture. In addition, laycan and dry bulk freight differ among different transport lanes.

Time to load

The time to load was calculated based on the fixture and probable loading dates. It may have an impact on the freight rate negotiation, as the ship operator and charterer may perceive the time delay to their advantages and disadvantages depending on the market condition and future prediction.

Seaborne trade

Clarkson Research provides data for seaborne trade which can be used as “barometer” to understand the trade in various commodities. To understand the growth of the iron ore trade and its impact on trade negotiations, the data were used in the analysis to check whether it has any major influence on the fixtures.

Cape size 5-year-old price

The sale of secondhand vessels is an important aspect of shipping. In the case of demand, the market becomes very active as the ship operator looks for vessels to meet the transportation demand, as the new ship building takes time.

BCI Index

The Baltic Exchange Capesize Index (BCI) provides an index for 10 different routes (six voyage routes and four trip charter routes), which are compiled from the data provided by the brokers. The most important iron ore routes are C3 and C5, C3 reflects cargo movements from Tubarão in Brazil to China (Alizadeh, 2009). The empirical results indicate the presence of a bidirectional lead–lag association between the BCI and the price of iron ore and coal, respectively (Tsioumas & Papadimitriou, 2018)

Fleet development

Historical data on fleet development are used to analyse whether it has an impact on the determination of freight rate negotiations.

4.5 Data and the variables for tanker vessels

For the purpose of the study, freight fixture data covering the period from 2013 to 2023 of Aframax and Suezmax (Part Cargo up to 1,30,000 Mt) loading from a UAE ports and unloading at Mumbai ; vessel information, size of the vessel, year of build, charterer information has been collected from the AXS Marine database

According to their deadweight, tankers can be categorized into six groups: general-purpose, Handymax, Panamax, Aframax, Suezmax tankers, and VLCCs. The design of an Aframax ship is based on the Average Freight Rate Assessment (AFRA), with the ship's deadweight tonne being determined by the best revenue point for freight income and expense. The Aframax ship is also referred to as a "freight ship" as a result. Aframax tankers are frequently employed and easily acceptable in the ports of many oil-exporting nations due to draught constraints of port facilities. As a result, Aframax ships are in high demand on the global tanker market (Chen et al., 2019).

Table 2: Data and Source (Tankers)

Variables	Unit	Definition	Source
Dependent Variables			
Freight Fixture	World Scale		AXS Marine
FOB Price of Crude in UAE	$/Tonne		UN Comtrade
CIF Price of Crude Oil in China	$/Tonne		
Independent Variables			
Age of the vessel	Years		AXS Marine
Operating Cost of Vessel	$/day	Aframax/LR2 Operating Costs (OPEX)	SIN Clarkson
Cost of Bunker	$/Tonne	HSFO 180cst Bunker Prices (3.5% Sulphur), Fujairah	
LIBOR	$m	5 Year $10m Finance based on Libor 1st yr	
Tanker Index	WS	BDTI TD8: 80,000mt, Crude and/or DPP Heat 135F, Kuwait to Singapore	
Time to load	Days	Time left for loading day	AXS Marine
Middle East Oil Production	Mbpd	Oil Production	SIN Clarkson
Fleet Development	DWT million	Aframax Fleet Development	

4.5.1 Dependent variables

Freight fixture

The actual fixture of each voyage for loading from the ports in UAE was extracted to understand the bargaining power of the ship operator and charterers with other variables.

Crude oil price

The CIF price of crude oil in UAE and the FOB price in India were collected to determine the difference in surplus.

4.5.2 Independent variables

Age of the vessel

The age of a vessel can be a critical factor in a charter's decision. The cost of maintenance and efforts of compliance with safety and other regulatory measures increase as the vessel becomes older. This can have an impact on the negotiating power of players, and needs to be examined.

Operating cost of the vessels

As stated in Section 4.4.2, the operating cost is an important factor for the ship operator, as it will have direct bargaining on its revenue.

Cost of bunker

The cost of bunker fuel is a major factor in the operating costs of a vessel. Tanker owners try to achieve a trade-off between fuel savings by reducing speed and loss of revenue due to slow steaming. The results of the models developed by Ronen (1982) can be used in charter party negotiations (speed, cost, and delivery dates) in addition to determining ship speed, which influences voyage time and bunker costs, and to estimate the profitability of operating, selling, or laying up ships.

LIBOR

As stated in Section 4.4.2, LIBOR was taken as an independent variable to understand its impact on freight rate fixtures.

Tanker index

The Baltic Dry Tanker Index (BDTI) is an important indicator of the crude oil market. It helps the shipping company determine future trends in the market and formulate their strategy accordingly. The rates are quoted in world scale. Seasonality is more important in the tanker market compared to the dry market.

Time to load

The time to load is the difference in days between the fixture date and loading date. It has been calculated to determine if it has an impact on the freight rate negotiation

Middle east oil production

Clarkson Research provides data for Middle East Oil Production, which is related to the supply of crude oil in the area. To understand its impact on the trade negotiations the data have been used in the analysis to check whether there is any influence on the fixtures.

Fleet development

Historical data on fleet development of Aframax vessels were taken to investigate their impact on the determination of freight rate negotiations.

4.6 Data description

Tables 3, 4, and 5 show descriptions of the variables for dry fixtures, and Tables 6, 7, and 8 show descriptions of the variables for tanker fixtures.

Table 3: Description of the variables (Dry Vessels)

Variables		Description
Dependent	Y1	Ship's Operator surplus
	Y2	Charterer's surplus
	Y3	Ship Operator's discount factor
	Y4	Charterer's discount factor
Independent	X1	OPEX
	X2	Bunker
	X3	LIBOR
	X4	Lay - Can Diff
	X5	Time to Load
	X6	World Seaborne Trade Iron Ore Billion Ton Mile
	X7	Price of 5-Year-Old Cape Size Vessel
	X8	BCI C3
	X9	Fleet Development no
	X10	Brazil Iron Ore Exports
	X11	China Total Iron Ore Imports

Table 4: Descriptive Statistics (Dry Vessels)

	Mean	Median	Standard Deviation	Skewness	Minimum	Maximum	Count
Y1	19.171	18.300	5.964	0.595	5.200	39.950	431
Y2	17.971	16.330	13.068	0.955	0.021	65.280	431
Y3	0.567	0.551	0.208	0.210	0.106	0.999	431
Y4	0.433	0.449	0.208	-0.210	0.001	0.894	431
X1	6681.861	6419.000	384.569	0.755	6303.000	7303.000	431
X2	431.859	401.125	145.039	0.284	162.600	713.400	431
X3	2.090	2.040	0.089	1.217	2.016	2.360	431
X4	8.111	9.000	4.526	2.080	0.000	39.000	431
X5	26.397	25.000	12.625	1.119	1.000	82.000	431
X6	7967.527	8187.700	579.319	-0.854	6981.400	8557.000	431
X7	36.554	35.000	6.544	0.526	23.750	53.000	431
X8	20.099	19.295	5.711	0.646	5.649	40.648	431
X9	1731.476	1748.000	131.928	-0.281	1508.000	1936.000	431
X10	30251.073	30773.000	3883.798	-0.436	18656.000	37473.000	431
X11	88520.122	90529.090	13037.654	-0.340	56415.000	112648.190	431

As shown in Table 4, the data are normally distributed and not skewed for analysis.

Table 5: Correlation Analysis – Dry Vessels

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
X1	1.000										
X2	0.792	1.000									
X3	-0.234	0.014	1.000								
X4	0.168	0.048	-0.065	1.000							
X5	0.059	-0.001	-0.066	0.528	1.000						
X6	-0.905	-0.678	0.093	-0.168	-0.049	1.000					
X7	0.148	0.487	-0.117	-0.066	-0.022	0.171	1.000				
X8	0.173	0.577	-0.007	-0.029	0.048	-0.075	0.662	1.000			
X9	-0.750	-0.415	0.094	-0.188	-0.050	0.900	0.445	0.196	1.000		
X10	-0.357	-0.390	0.264	-0.004	-0.015	0.235	-0.209	-0.038	0.118	1.000	
X11	-0.821	-0.737	0.054	-0.131	-0.045	0.841	0.020	-0.112	0.758	0.451	1.000

A correlation test was conducted for the independent variables in the analysis. A threshold of 0.9 was used. Variables X6 and X9 were found to be correlated and were subsequently dealt with during the regression analysis.

Table 6: Description of the variables for Tankers

Variables		Description
Dependent	Y1	Ship's Operator surplus
	Y2	Charterer's surplus
	Y3	Ship Operator's discount factor
	Y4	Charterer's discount factor
Independent	X1	(Age of the vessel)2
	X2	OPEX
	X3	Bunker
	X4	Libor
	X5	Freight Index
	X6	Time to load
	X7	Middle East Oil Production
	X8	Fleet Development DWT
	X9	Aframax Demand
	X10	5-Year-Old Second Hand Price of Aframax

Table 7: Descriptive Statistics (Tanker Vessels)

	Mean	Median	Standard Deviation	Skewness	Minimum	Maximum	Count
Y1	5.821	5.552	1.447	0.499	3.450	9.312	55
Y2	1.755	1.378	1.713	1.932	0.040	7.735	55
Y3	0.788	0.822	0.155	-0.956	0.348	0.994	55
Y4	0.212	0.178	0.155	0.956	0.006	0.652	55
X1	444.800	441.000	193.503	-0.044	64.000	841.000	55
X2	7502.127	7385.000	335.048	0.661	7145.000	8272.000	55
X3	426.273	401.130	95.908	0.588	262.700	617.400	55
X4	2.105	2.080	0.093	0.781	2.020	2.290	55
X5	104.923	99.460	28.491	1.661	60.930	208.310	55
X6	10.345	11.000	5.045	0.028	0.000	21.000	55
X7	25.255	25.590	1.557	0.096	22.590	28.630	55
X8	398.035	389.580	33.660	-0.228	340.240	450.830	55
X9	50.874	51.410	3.063	-0.236	46.400	55.930	55
X10	36.036	34.000	5.494	1.210	29.000	57.000	55

The data for tankers are also normally distributed and not skewed much for the analysis.

Table 8: Correlation Analysis – Tankers

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	1.000									
X2	0.048	1.000								
X3	-0.248	0.416	1.000							
X4	0.366	-0.348	-0.367	1.000						
X5	0.010	-0.004	0.011	0.352	1.000					
X6	0.024	-0.453	0.125	-0.074	-0.188	1.000				
X7	0.488	0.000	-0.442	0.483	0.415	-0.027	1.000			
X8	-0.257	-0.719	-0.143	-0.171	0.057	0.507	-0.063	1.000		
X9	0.349	0.460	-0.005	0.328	0.289	-0.200	0.649	-0.274	1.000	
X10	-0.356	-0.139	0.350	-0.253	0.412	0.168	-0.073	0.628	0.039	1.000

A correlation test was conducted for the independent variables. A threshold of 0.9 was used. None of the variables were found to be correlated.

Five common statistics—the smallest value, lower quartile, median, upper quartile, and greatest values–are used to summarise the quantitative distribution of the box plots. The box plot of surplus for the ship operator and the charterers for iron ore and crude oil fixtures is given in the Appendix. The surplus for drycargo vessels shows more outliers, indicating that fluctuations and variations are more evident in the capsizing market.

Kavussanos and Alizadeh (2001) examined the seasonality of dry bulk freight rates and compared them across different vessel sizes (Capesize, Panamax, and Handysize), contract lengths (spot, 1-year, and 3-year time charters), and market conditions (peaks and troughs). The deterministic seasonality in goods rates was observed to vary from 18.2% to 15.3% in specific months within a year, notwithstanding the absence of evidence for stochastic seasonality. Although

differences in seasonal fluctuations between sectors are minimised as the contract term increases, spot rates for larger vessels exhibit stronger seasonal fluctuations than those for smaller vessels. In addition, as the contract period increases, seasonality decreases for each vessel size. Seasonal fluctuations in freight prices that are asymmetric under different market conditions include the high and low elasticities of supply expected under different market conditions. Therefore, a study of seasonality was conducted during regression analysis.

Chapter 5. Finding and Discussion

This chapter presents the results from the linear regression models to understand how the principles of bargaining can be used to measure negotiating practices in the freight market from the point of view of surplus and discount factors. After computing the buyer and seller trading surplus and discount factors, the chapter presents a systematic description of all the outcomes dependent on each stage in terms of relevance, precedence, and the impact they would have on the final fixtures.

The data were statistically examined using Microsoft Excel in the previous chapter, including a correlation test. Now, this study will use MATLAB software to do regression analysis with the dependent variables and independent variables to determine the component that influences the discount factor and the surplus to understand the bargaining power.

5.1 Regression A: bargaining power in dry vessels (capesize)

Cross-sectional regressions were run to establish the model using 431 observations with 409 degrees of freedom to determine the significant variables affecting the dependent variables.

Since X6 was found to be correlated to X9, the regression was run by removing both the independent variables separately. The results for the regression with X9 were found to be able to explain the relations between the variables in a better way; therefore, X6 was excluded from the further analysis.

Table 9 represents the effect of independent variables on the ship operator's surplus. Among the variables, the LIBOR(X3), second hand price of 5-year-old capesize(X7) and the fleet development(X9) significantly affect the surplus of the ship operator. The p-value of these variables are 0.003, 0.055 and 0.028; which means they are significant at 95%, 90% and 95% level, and the estimated coefficients are -12.987 with LIBOR, -0.200 with second hand price and 0.016 with the fleet development. This result indicates that the first two significant variables have a negative correlation whereas fleet development has a positive correlation. The results indicate that as the

LIBOR increases the surplus for the ship operator reduces where the estimate is -12.987. In addition, the model conveys that the surplus is negatively related for May, June, September, and October when compared to the surplus in January, indicating that the surplus is reduced in these months.

Table 9: Variables affecting the surplus for the ship-operators

	Estimate	SE	tStat	pValue
(Intercept)	6.769	27.642	0.245	0.807
X1	0.002	0.003	0.911	0.363
X2	-0.003	0.007	-0.358	0.721
X3	-12.987	4.318	-3.008	0.003*
X4	-0.078	0.074	-1.055	0.292
X5	0.042	0.026	1.580	0.115
X7	-0.200	0.104	-1.928	0.055*
X8	0.171	0.114	1.497	0.135
X9	0.016	0.007	2.200	0.028*
X10	0.000	0.000	1.422	0.156
X11	0.000	0.000	-0.719	0.473
X12_2	0.405	1.633	0.248	0.804
X12_3	-0.531	1.380	-0.384	0.701
X12_4	-1.477	1.716	-0.861	0.390
X12_5	-3.526	1.640	-2.150	0.032*
X12_6	-4.343	1.497	-2.901	0.004*
X12_7	0.211	1.397	0.151	0.880
X12_8	0.337	1.395	0.242	0.809
X12_9	-3.259	1.652	-1.973	0.049*
X12_10	-3.980	1.532	-2.599	0.010**
X12_11	0.388	1.529	0.254	0.800
X12_12	0.551	2.080	0.265	0.791

Number of observations: 431, Error degrees of freedom: 409
Root Mean Squared Error: 5.66
R-squared: 0.143, Adjusted R-Squared: 0.0987
F-statistic vs. constant model: 3.24, p-value = 2.69e-06

Notes*:* *95% significance level, **90 % significance level

Table 10: Variables affecting the surplus for the Charterers

	Estimate	SE	tStat	pValue
(Intercept)	75.133	45.707	1.644	0.101
X1	0.001	0.004	0.161	0.872
X2	0.038	0.012	3.069	0.002
X3	-92.245	7.140	-12.919	2.9E-32*
X4	0.089	0.122	0.734	0.463
X5	-0.079	0.043	-1.823	0.069**
X7	-1.057	0.171	-6.173	1.6E-09*
X8	0.093	0.189	0.491	0.623
X9	0.108	0.012	9.131	3.2E-18*
X10	0.001	0.000	4.921	1.3E-06*
X11	-0.001	0.000	-5.801	1.3E-08*
X12_2	-9.273	2.701	-3.433	0.0007*
X12_3	-16.914	2.283	-7.410	7.3E-13*
X12_4	-9.782	2.837	-3.448	0.001*
X12_5	-11.078	2.712	-4.086	5.3E-05*
X12_6	-15.737	2.476	-6.357	5.5E-10*
X12_7	-14.912	2.310	-6.456	3.0E-10*
X12_8	-13.990	2.306	-6.066	3.0E-09*
X12_9	-13.896	2.732	-5.087	5.5E-07*
X12_10	-25.545	2.533	-10.087	1.6E-21*
X12_11	-17.338	2.528	-6.859	2.6E-11*
X12_12	-13.384	3.440	-3.891	0.000*

Number of observations: 431, Error degrees of freedom: 409
Root Mean Squared Error: 9.36
R-squared: 0.512, Adjusted R-Squared: 0.487
F-statistic vs. constant model: 20.4, p-value = 3.86e-51

**Notes*:* *95% significance level, **90 % significance level

The regression results (see Table 10), using the charterer's surplus as the dependent variable associated with 11 predictors, indicate that there are 7 significant variables; bunker price(X2), LIBOR(X3), No of days left for loading(X5) , price of second hand vessels(X7), fleet development (X9), Brazil iron ore export (X10) and China total iron ore imports (X11). The LIBOR has a very high negative correlation with the charterer's

surplus indicating that when the interest rate is high, the charterers surplus is reduced. Additionally, the second-hand price negatively impacts the charterer's surplus.

Table 11: Variables affecting the surplus for the Ship Operator

	Estimate	SE	tStat	pValue
(Intercept)	0.218	0.872	0.250	0.802
X1	0.000	0.000	-0.503	0.615
X2	-0.001	0.000	-2.761	0.006*
X3	1.108	0.136	8.134	5.0E-15*
X4	-0.003	0.002	-1.424	0.155
X5	0.002	0.001	2.534	0.012
X7	0.014	0.003	4.410	1.3E-05*
X8	0.002	0.004	0.604	0.546
X9	-0.001	0.000	-5.973	5.1E-09*
X10	0.000	0.000	-1.543	0.124
X11	0.000	0.000	2.445	0.015*
X12_2	0.058	0.052	1.135	0.257
X12_3	0.136	0.044	3.127	0.002*
X12_4	0.026	0.054	0.477	0.634
X12_5	0.139	0.052	2.692	0.007*
X12_6	0.087	0.047	1.843	0.066**
X12_7	0.098	0.044	2.227	0.027*
X12_8	0.095	0.044	2.169	0.031*
X12_9	0.048	0.052	0.919	0.359
X12_10	0.225	0.048	4.650	4.5E-06*
X12_11	0.163	0.048	3.385	0.001*
X12_12	0.111	0.066	1.692	0.091**

Number of observations: 431, Error degrees of freedom: 409
Root Mean Squared Error: 0.179
R-squared: 0.301, Adjusted R-Squared: 0.265
F-statistic vs. constant model: 8.38, p-value = 2e-21

**Notes*:* *95% significance level, **90 % significance level

The regression examination was also run to find evidence about the discount factor of the ship operator. Here it was observed, from the result, that the bunker price(X2) and fleet development(X9) have a positive effect of the discount factor, on the other hand LIBOR(X3), number of days left for loading(X5) and China total iron Ore(X11) imports have a negative impact on the discount factor of the ship-operator. The lay

can difference(X4) is not found to impact the discount factor. The estimate for the bunker price on the discount factor is positive; however, it is very low with 1% increase in the number of days for loading results in 0.002% rise in the discount factor and the bargaining ability of the ship operator. The seasonality verification indicates that in October, the ship operator has the highest discount factor, indicating that its bargaining power increases for the month.

Table 12: Variables affecting the discount factors for the Charterers

	Estimate	SE	tStat	pValue
(Intercept)	0.782	0.872	0.897	0.370
X1	0.000	0.000	0.503	0.615
X2	0.001	0.000	2.761	0.006*
X3	-1.108	0.136	-8.134	5.0E-15*
X4	0.003	0.002	1.424	0.155
X5	-0.002	0.001	-2.534	0.012*
X7	-0.014	0.003	-4.410	1.3E-05*
X8	-0.002	0.004	-0.604	0.546
X9	0.001	0.000	5.973	5.1E-09*
X10	0.000	0.000	1.543	0.124
X11	0.000	0.000	-2.445	0.015*
X12_2	-0.058	0.052	-1.135	0.257
X12_3	-0.136	0.044	-3.127	0.002*
X12_4	-0.026	0.054	-0.477	0.634
X12_5	-0.139	0.052	-2.692	0.007*
X12_6	-0.087	0.047	-1.843	0.066**
X12_7	-0.098	0.044	-2.227	0.027*
X12_8	-0.095	0.044	-2.169	0.031*
X12_9	-0.048	0.052	-0.919	0.359
X12_10	-0.225	0.048	-4.650	4.5E-06*
X12_11	-0.163	0.048	-3.385	0.001*
X12_12	-0.111	0.066	-1.692	0.091**

Number of observations: 431, Error degrees of freedom: 409
Root Mean Squared Error: 0.179
R-squared: 0.301, Adjusted R-Squared: 0.265
F-statistic vs. constant model: 8.38, p-value = 2e-21
**Notes*:* *95% significance level, **90 % significance level

In this regression (see Table 12), the relationship between the charterer's discount factor and various independent variables has been analyzed. Similar to the discount factor of the ship operator, bunker price (X2), LIBOR (X3), number of days left for loading(X5), fleet development (X9) and China total iron ore imports (X11) were found significant with the opposite sign to the estimate, indicating these variables impact the discount factor in the opposite manner.

5.2 Regression B: bargaining power in the tanker vessels (Aframax)

As explained in the previous chapter, data were collected for the transport between UAE Load port and Mumbai, India. Part cargo carried on the Suez Max vessels were also added to the data for analysis. Cross-sectional regressions were run to establish the model using 55 observations with degree of freedom of 33 to find out the significant variables affecting the dependent variables.

Four regression analysis have been performed on tanker data to determine the factors that may affect the bargaining ability of the players in the freight market.

Table 13 shows the effect of independent variables on the ship operator's surplus for the tankers. Among the variables the fleet development(X8) and the second- hand price of the 5 years old Aframax vessels(X9) significantly affect the surplus of the ship operator. The p-value of these variables are 0.026 and 0.040; which means they are significant at 5% level This result indicates that the first significant variable has a negative correlation whereas second hand price has a positive correlation. The model also conveys that the surplus is negatively related for the month of March to August when compared to the surplus in the month of January.

Table 13: Variables affecting the surplus for the ship-operators

	Estimate	SE	tStat	pValue
(Intercept)	24.564	31.368	0.783	0.439
X1	-0.001	0.001	-1.184	0.245
X2	-0.001	0.002	-0.564	0.577
X3	0.002	0.002	0.840	0.407
X4	3.790	5.479	0.692	0.494
X5	0.009	0.011	0.844	0.405
X6	0.023	0.034	0.672	0.506
X7	-0.121	0.269	-0.450	0.656
X8	-0.050	0.021	-2.332	0.026*
X9	-0.002	0.183	-0.011	0.991
X10	0.164	0.077	2.136	0.040*
X11_2	-0.571	0.405	-1.410	0.168
X11_3	-1.544	0.458	-3.368	0.002*
X11_4	-1.758	0.538	-3.269	0.003*
X11_5	-1.689	0.540	-3.128	0.004*
X11_6	-2.109	0.850	-2.480	0.018*
X11_7	-2.212	0.823	-2.688	0.011*
X11_8	-1.624	0.683	-2.376	0.023*
X11_9	-0.903	0.532	-1.699	0.099
X11_10	-0.307	0.559	-0.550	0.586
X11_11	-0.780	1.148	-0.679	0.502
X11_12	0.297	1.124	0.264	0.793

Number of observations: 55, Error degrees of freedom: 33
Root Mean Squared Error: 0.694
R-squared: 0.86, Adjusted R-Squared: 0.77
F-statistic vs. constant model: 9.62, p-value = 9.29e-09

Notes*:* *95% significance level, **90 % significance level

Table 14: Variables affecting the surplus for the charterers

	Estimate	SE	tStat	pValue
(Intercept)	150.090	55.504	2.704	0.011
X1	-0.001	0.001	-0.928	0.360
X2	-0.015	0.004	-3.299	0.002*
X3	0.008	0.004	2.054	0.048*
X4	-26.402	9.695	-2.723	0.010*
X5	-0.025	0.020	-1.262	0.216
X6	-0.082	0.059	-1.383	0.176
X7	-1.088	0.476	-2.287	0.029*
X8	-0.079	0.038	-2.105	0.043*
X9	1.344	0.324	4.150	0.000*
X10	0.181	0.136	1.333	0.192
X11_2	-1.814	0.716	-2.533	0.016*
X11_3	0.165	0.811	0.203	0.840
X11_4	-1.048	0.952	-1.101	0.279
X11_5	2.462	0.955	2.577	0.015*
X11_6	3.863	1.505	2.568	0.015*
X11_7	-0.776	1.456	-0.533	0.598
X11_8	3.389	1.209	2.802	0.008*
X11_9	1.541	0.941	1.638	0.111
X11_10	2.240	0.989	2.266	0.030*
X11_11	3.709	2.031	1.826	0.077**
X11_12	5.065	1.988	2.547	0.016*

Number of observations: 55, Error degrees of freedom: 33
Root Mean Squared Error: 1.23
R-squared: 0.686, Adjusted R-Squared: 0.487
F-statistic vs. constant model: 3.44, p-value = 0.000751

Notes*:* *95% significance level, **90 % significance level

After running the regression model for the characters' surplus (see Table 14), the following variables are significant: Operating cost for the vessel (X2), bunker cost (X3), freight index (X4), Middle East Oil Production (X7), fleet development (X8) and the demand for Aframax (X9). Operating cost for the vessel (X2), freight Index (X4) and Middle East Oil Production(X7) have negative impacts on the buyer's surplus.

This indicates that buyers get less surplus when the operating cost (X2) and the freight Index (X4) are going high.

Table 15: Variables affecting the discount factor for the ship operators

	Estimate	SE	tStat	pValue
(Intercept)	-11.201	5.248	-2.134	0.040
X1	6.7E-05	0.000	0.568	0.574
X2	0.001	0.000	2.821	0.008*
X3	-0.001	0.000	-1.953	0.059
X4	2.248	0.917	2.452	0.020*
X5	0.002	0.002	1.194	0.241
X6	0.008	0.006	1.444	0.158
X7	0.082	0.045	1.821	0.078**
X8	0.006	0.004	1.595	0.120
X9	-0.105	0.031	-3.423	0.002*
X10	-0.014	0.013	-1.058	0.298
X11_2	0.126	0.068	1.859	0.072**
X11_3	-0.089	0.077	-1.160	0.254
X11_4	0.018	0.090	0.204	0.839
X11_5	-0.206	0.090	-2.278	0.029**
X11_6	-0.397	0.142	-2.788	0.009*
X11_7	0.047	0.138	0.339	0.737
X11_8	-0.381	0.114	-3.329	0.002*
X11_9	-0.149	0.089	-1.675	0.103
X11_10	-0.207	0.093	-2.216	0.034*
X11_11	-0.319	0.192	-1.660	0.106
X11_12	-0.439	0.188	-2.335	0.026*

Number of observations: 55, Error degrees of freedom: 33
Root Mean Squared Error: 0.116
R-squared: 0.656, Adjusted R-Squared: 0.438
F-statistic vs. constant model: 3, p-value = 0.00232

Notes*:* *95% significance level, **90 % significance level

Table 15 represents the variables that affect the Ship-operator's discount factor. Among the variables, OPEX (X2), LIBOR (X4), Middle East Oil Production (X7) and

demand for Aframax (X9) significantly affect the dependent variable. LIBOR (X4) once again has a positive influence on the bargaining power of the ship operator.

Table 16: Variables affecting the discount factor for the charterers

	Estimate	SE	tStat	pValue
(Intercept)	12.201	5.248	2.325	0.026
X1	-6.7E-05	0.000	-0.568	0.574
X2	-0.001	0.000	-2.821	0.008*
X3	0.001	0.000	1.953	0.059
X4	-2.248	0.917	-2.452	0.020*
X5	-0.002	0.002	-1.194	0.241
X6	-0.008	0.006	-1.444	0.158
X7	-0.082	0.045	-1.821	0.078**
X8	-0.006	0.004	-1.595	0.120
X9	0.105	0.031	3.423	0.002
X10	0.014	0.013	1.058	0.298
X11_2	-0.126	0.068	-1.859	0.072**
X11_3	0.089	0.077	1.160	0.254
X11_4	-0.018	0.090	-0.204	0.839
X11_5	0.206	0.090	2.278	0.029*
X11_6	0.397	0.142	2.788	0.009*
X11_7	-0.047	0.138	-0.339	0.737
X11_8	0.381	0.114	3.329	0.002*
X11_9	0.149	0.089	1.675	0.103
X11_10	0.207	0.093	2.216	0.034*
X11_11	0.319	0.192	1.660	0.106
X11_12	0.439	0.188	2.335	0.026*

Number of observations: 55, Error degrees of freedom: 33
Root Mean Squared Error: 0.116
R-squared: 0.656, Adjusted R-Squared: 0.438
F-statistic vs. constant model: 3, p-value = 0.00232

Notes*:* *95% significance level, **90 % significance level

The above regression shows that the same variables that are significant for the ship operator's discount factor are significant for the charterer's discount factor. It is evident that the production in the Middle East and the bargaining power of the charterer is negatively correlated indicating that as the production rises the bargaining

power reduces. Seasonality verification indicate that in the month of May, June, August, October and December the charterer has a higher discount factor indicating its bargaining power increases for these months.

5.3 Discussion

Price negotiation is a significant factor in determining freight in the freight market. However, there is no established framework for applying this idea in the freight market. Considering this and continuing the bargaining concept, the study has taken four independent variables that could impact the ability of the participants. The study found that the four features—buyer and seller (surplus and discount factors), market conditions, and elements relating to the product—all have an impact on the freight price. The charterers' and ship-operators' discount factor was looked at as a measure of bargaining in order to estimate the bargaining surplus of the trade.

As discussed earlier Bargaining Power has been taken as a dependent variable and independent variables includes operational costs, fuel cost, laycan time, interest rates, freight indices, production, import and export quantities. For the capesize vessel the lay can difference was calculated to check whether it affects the bargaining power.

Owner’s reputation, vessel operational efficiency, economic strengths, trade pattern and volume, fleet demand and availability indicating the demand for transportation could not be used in the model. For tankers the nature of charter (whether time or voyage) and the demurrage charges also influence the decision taken by the parties when fixing the vessel.

The total surplus is the difference between the cost the charter is ready to pay and the price difference in the CIF at the unloading port and FOB at the load port.

Age of the vessel

As discussed in Chapter 4, the age of the vessel did not affect the freight rate fixtures. The regression results for the Aframax tankers also show that the age of the vessel is not significant with respect to the surplus or discount factor of the ship operator and

charterer. However, the age of the vessel has an impact on efficiency and technical performance. The ship operator for older vessels, knowing the inherent age-related defects, is in a weaker position to negotiate. In addition, it is always possible for newer vessels to be employed earlier than older vessels. In view of the above, ship operators with old vessels should not delay the fixture.

Operating cost of the vessel

Operating cost was not found to be a significant variable for Capesize bulkers; however, it was observed to be significant for tanker fixtures. It was found to be negatively correlated with the discount factor of the charterer, indicating that the bargaining power of the charterer reduces and that of the ship operator increases with an increase in the operating cost. As shown in Table 15, a 1 % increase in the operating cost will give rise to a.001 % rise in the discount factor of the ship operator.

Bunker price

The cost of the bunker was found to be positively significant for the charterer's surplus and discount factor for dry vessels and tankers. This indicates that when bunker prices rise, charterers tend to have a higher surplus and discount. This could be due to the fact that in voyage charter the ship operators arrange for the bunker. When the bunker price is high, the overall cost for the ship operator increases. However, they are potentially unable to bargain for higher freight, thus losing negotiating power. This means that they are not able to pass the bunker costs to charterers. The coefficient for both type of vessel for the predictor of bunker is around 0.001, indicating that 1 % rise in the cost of bunker increases the discount factor of the charterer by 0.001%.

LIBOR

LIBOR is also a significant independent variable for surplus and discount factors in freight market determination. It is negatively related to the charterers' discount rate both in the dry and tanker regressions, indicating that when the interest rates are high, the charterers will experience reduced bargaining power and the ship operator can push for an increase in the share of the trading surplus. The coefficients for the dry and tanker vessels for the predictor of LIBOR is around -1.1% and -2.2% respectively,

indicating that 1 % increase in the rate decreases the discount factor of the charterer by 1.1% and 2.2%, respectively. When LIBOR rates increase, the ship operator must try to negotiate a higher surplus during the fixture.

Freight index

The Baltic indices for the capsize and the Aframax for the respective routes were taken as independent variables and were found not to be significant for the trading surplus and discount factor. Smith and Geman (2012) analysed shipping markets and freight rate for the Baltic Dry Index considering commodity volume and the major actors in the dry shipping world. They observed that shipping rates exhibit large swings and volatility, as they are related to the world economy, commodity consumption, weather, bunker prices, and other issues. They observed a break and proposed a mean-reverting form for their model. The authors' model may need to be corrected for other factors and the time lag to establish the relationship between freight indices and the bargaining power of ship operators and charterers correctly.

In addition, it has been observed that BDI does not seem to respond as an economic indicator, and the computation method has been altered several times in recent years. It has been criticised and advised to change based on new and consistent data (Sahoo & Karamperidas, 2019).

In addition to supply and demand, geopolitical issues primarily drive the tanker indices. In 2016, crude oil prices declined, which was followed by high refinery margins. Due to the increased demand, freight rates for all kinds of dirty and clean tanker vessels increased (Ajith et al., 2023)

Time left for loading

The time left for the loading dates was higher for the iron ore fixture than for the crude tankers, indicating that the tanker vessels were fixed closer to the date of loading; however, the bulk carriers were fixed earlier. These factors were found to be insignificant for the tanker fixture for discount factors. The regression results show that the number of loading days is positively correlated with the ship operator discount

factor, conveying that as the number of days is greater, the charterers are in a better bargaining situation.

Second hand price of the vessel

The dry bulk shipping industry is a crucial part of global trade and commerce. To make appropriate long-term strategic decisions, it is crucial for players in the shipping market to comprehend market dynamics and price transmission mechanisms over time. This is because newbuilding and second-hand vessels are frequently traded as assets, and the freight rate is the main factor influencing the vessel price. Based on empirical findings, each market sector, including cape-size, panamax, handymax, and handy-size, has a substantial impact on the transmission of volatility. In addition, the way market volatility is transmitted differs depending on the vessel type (Dai et al., 2015).

For the cape-size vessel, the second had the price of the vessel being correlated with the surplus and the discount factor. Both the ship operator's and charterer's surplus are negatively connected with the second-hand price; however, the discount factor of the ship operator increases with an increase in the price of the old vessel. The charterer negotiating power decreases with the increase in price for the second-hand vessel, indicating that the ship operator starts demanding a higher share of the discount factor. A 1 % rise in the price of the second- hand vessel decreases the discount factor of the charterer by 0.014%.

Fleet development

Fleet development is related to surplus and discount factors. Both the ship operator and charterer's surplus are positively connected with fleet development; however, the discount factor of the ship operator decreases with fleet development. The charterer negotiating power increases with an increase in fleet development, indicating that the charterer starts demanding a higher share of the discount factor. When fleet development occurs, the charterer knows that there are a greater number of vessels to choose from; therefore, he/she is in a better situation to negotiate.

Middle east oil production

The bargaining power of ship operators is positively significant for production in the Middle East. This indicates that a charterer's ability to negotiate decreases with an increase in production. The cargo is available for transportation; therefore, the charterer needs more vessels. The ship operator is in an improved state to bargain. This is indicated by the regression result indicating that 1% increase in the production of crude oil results in increase of 0.08 % in the discount factor for the ship operator.

China total iron ore import

Similar to oil production, when the import of iron ore increases to China, the bargaining power of the ship operator increases and the charterers negotiating power decreases as their discount factor is negatively correlated to total imports. The greater availability of cargo ensures that the vessel is utilised, and the ship operator can bargain more.

After analysing the results of bargaining power in relation to the predictors used in this study of individual fixtures, it can be seen that there is space for negotiation in all transactions. The knowledge gained from this study can be beneficial to both charterers and shipowners. The study also confirms that the discount factor of the charterer is higher in case of capesize vessel compared to Aframax tankers.

This study identifies that charterers and ship operators must keep an eye on the characteristics of the market. The demand for and supply of vessels and commodities have a major impact on players' bargaining power. As explained earlier, the cargo-carrying space can be marginally altered in the short run by changing the route of the vessel and using second-hand vessels. The other factors to monitor are the cost of the bunker, interest rates (LIBOR), operating cost of the vessel, price of the second-hand vessel, and total production or import quantities of the commodities. For example, when the charterer knows that the interest rates are rising, he/she would lose part of its discount factor and allow the ship operator to gain a bit to conclude the process. Similarly, when the production of the transported commodity rises, demand rises, as the supply cannot significantly alter the negotiating power of the ship operator. Ship operators should monitor the production and price of the commodities

to be transported. When production or transportation demand rises, they must try to negotiate for a better pie from the trading surplus. The charterers must also be aware of this fact and not try to delay negotiations for a very long period.

For better readability, a few exemplar cases are presented to apply the findings in practice.

Case 1: The FOB price of the iron ore in Brazil is 95 $/ ton and CIF price in China is 130 $/ton. The present freight rate is 10$ / ton

The discount factor for ship owner is 10 / (130 – 95) = 10/45 = 0.222
The discount factor for charterer is (1-0.22) = 0 .778

If the bunker price rises by 10% from 600 $/ton to 660 $/ton;
(The estimate for dependent variable bunker cost with dependent variable ship operator's discount factor is 0.001)
The shipowner should expect the rise in freight (10 X 10 X 0.001) / 100 (Freight rate x rise in bunker price x co-efficient) = 0.00
Therefore, he/she can estimate a freight rate of 10 + 0.001 = 10.001 $/ton.

Case 2: The FOB price of crude oil in the UAE is 20 $/ ton and CIF price in Mumbai (India) is 30 $/Ton. The present freight rate is 7$ / ton

The discount factor for ship owner is 7/ (30-20) = 0.7
The discount factor for charterer is (1-0.7) = 0 .3

If the Middle East Oil Production rises by 10% from 25 million barrel per day to 27.5 million barrel per day;
The charterer should expect the rise in freight rate by (7 X10 X 0.082) /100 (Freight rate x rise in Middle East Oil Production x co-efficient) = 0.057
(The estimate for dependent variable production in Middle East is -0.082 for the charterer)
Therefore, he/she can estimate a freight rate of 7 + 0.057 = 7.057 $/ton.

Case 3: The FOB price of the iron ore in Brazil is 95 $/ ton and CIF price in China is 130 $/ton. The present freight rate is 10$ / ton

The discount factor for ship owner is 10 / (130 – 95) = 10/45 = 0.222
The discount factor for charterer is (1-0.22) = 0 .778

If the LIBOR rises by 10% from 2% to 2.2%, the charterer should expect the rise in freight (10 X 10 X 1.108) / 100 (Freight rate x rise in bunker price x co-efficient) = 1.108
(The estimate for dependent variable LIBOR with dependent variable charterer's discount factor is -1.108)
Therefore, he/she can estimate a freight rate of (10 + 1.108) = 11.108 $ / ton

These examples demonstrate that the analysis of the discount factor and how it is affected by various dependent variables can be useful for charterers and ship operators in deciding on the middle ground during the bargaining process and benefit.

Although, as discussed earlier, these freight markets are also subject to the global situation and different policies of governments, all the factors must be considered before finalising the price and terms of the contract of carriage. It is very important to understand the discount factor and how it is affected by independent variables. At times, an incorrect assumption can result in a loss of time and opportunity to enter into the contract.

There may be an opportunity to take advantage of this surplus through bargaining by understanding the effects of the variables. Moreover, a lack of information and poor bargaining skills may result in a lost opportunity. Patience also plays an important role in gaining surplus to players. Through their empirical analysis, Kousser and Phillip (2009) predicted that a player who can exhibit more patience and is ready for a longer battle can gain more from the surplus than its counterpart.

Chapter 6 Summary and Conclusion

6.1 Summary

The shipping freight market consists of shippers and ship operators negotiating for better bargains. The fixtures are completed through interactions between the parties and the brokers. The parties use all available information while securing the deal. The factors considered by the charterer are related to commodities, economic and political situations and freight rates. The ship operator considers, for example laycan, geographical location, risks, anticipated market conditions and duration while agreeing to the contract.

This dissertation studied two sub sectors, namely capesize vessels carrying iron ore between Tubarao (Brazil) to Qingdao (China) and Aframax carrying crude oil between UAE ports and Mumbai (India). The research considered no outside options and complete information, assuming that the parties were well informed while negotiating with each other. The basic Rubinstein dynamic bargaining model was used to determine the surplus and discount factors to understand their significance during negotiation. The aim of this research was to establish a model to guide players during negotiations and save time.

The study examined various factors in both sectors (e.g., OPEX, LIBOR, second-hand price, fleet development, production, import, and export quantities) to determine the effect. It may be noted that the freight rate for cape-size dry vessels were settled close to charterers levels, whereas in case of tankers they were close to the ship-operators demand. The discount share from the total trading surplus is higher for the charterers in the bulk sector and higher for the ship operator in the tanker trade.

The regression results were analysed. The findings of this research indicate that the age of the vessel does not play any role in the determination of the freight rate for both vessel types and routes. For bulk carriers, the operating cost made no difference in bargaining; however, for tankers, the charterers were in a disadvantageous situation as the cost of operating the vessel increased. The bunker cost had an impact on the negotiation for the dry vessels only and showed charterers in a better situation.

Interest rates were found to be significant and reduce charterers' bargaining power. The BDI was not observed to be correlated with the surplus and discount factors in either sector. Fleet development has a positive correlation with charterers, and a negative correlation with the bargaining power of the ship operator. An increase in the supply of crude oil and the import of iron ore to China was observed to reduce charterers' power to negotiate, indicating an increase in demand for transport. By understanding their position during the negotiation based on the effect of the change in the factors, players can determine how much their position has changed with respect to the trading surplus, that is, how much can they bargain in view of the change.

6.2 Conclusion

The four markets that make up the ocean transport service— freight, sale and purchase, new buildings, and demolition— engage in closely related activities. While fixing a voyage charter, a ship operator makes an "offer" to charterers, who can accept, reject, or "counter", therefore negotiations continue until both parties agree on the contract.

The study considered various factors, and a regression was carried out to determine their relationship with players' surplus and discount factors. By understanding the effect of these factors, the players (ship operators and charterers) would know their positions during the negotiation and would not delay the bargaining process. This is beneficial for both parties. Delays in negotiations can result in a reduction in the surplus or non-fixing of the contract.

The characteristics of the charterer and operator may have an impact on the final fixture; however, this could not be analysed in this study. Technical efficiency and safety standards maintained by ship operators also create value for the vessel and operator; however, the significance was not verified empirically during this research.

Bargaining occurs in every fixture, as there are back and forth negotiations before the actual terms are agreed upon; however, there has been no systematic study to understand if the process follows a standard pattern for the players to use the concept

in the freight market. Further studies may enhance the shipowner's and charterer's ability to negotiate better and faster.

6.3 Research contribution

The study found that the ship operator's discount factor increases with the LIBOR, operating cost, second-hand vessel prices, production, and import quantities. The findings also reveal that an increase in the bunker price and fleet development increases the charterer's bargaining power and reduces the ship operator's effectiveness in negotiations. This research may benefit ship operators, charterers, ship brokers, investment banks, and government agencies with freight market exposure. This study may also promote academic research on shipping pricing mechanisms, particularly bargaining-based pricing mechanisms.

6.4 Limitations

Data collection for this research was a significant challenge. One of the crucial issues was the identification of the owner or operators of the vessel to determine the effect of the owner's reputation on the individual fixture. Therefore, the effect of owners and the correlation between owners and charterers could not be assessed. Another issue was to measure and quantify the operational advantage of the vessels, which is dependent on their technical capabilities, for example, fuel efficiency and level of compliance with safety standards. Vessels are also vetted by oil majors (in the case of tankers) and recently vetting of bulk carriers commenced, where they are rated based on their performance during inspections. These reports which also include the Port State Inspection results, are one of the major factors during fixtures. Owner/operator- and charterer-specific information was not used during this research.

The data provided by AXS Marine are present without a time series; hence, a cross-sectional analysis was carried out. In addition, in some fixtures, the rates were not disclosed, leaving the researcher with no option but to exclude the data. The data available for few variables on Clarkson were based on monthly frequency and were cross referred to the data analysis. More detailed data with specific information could have improved the model.

The tanker market is also based on geopolitical factors which regulate the directional flow of oil. These strategic decisions are made by countries based on their individual interests and are not purely economic decisions. Similarly, geopolitical situations and alliances between trading countries based on their preferences can alter the demand for commodities, and hence, the demand for transportation.

6.5 Scope for future research

This dissertation focuses on fixtures for iron ore carried between Brazil and China and crude oil carried between the UAE and Mumbai (India). However, they may not represent all bargaining practices in the freight market. Other vessel sizes and major trade routes may be analysed to study, compare, and substantiate the findings. Hence, the bargaining model can be applied to fixtures on other commodities. This principle can also be used to understand time charter fixtures and container vessel charters. Further, the owners and charterers' specific information can be added with quantitative measures to analyse their impact on individual fixtures.

References

Adland, R., Alger, H., Banyte, J., & Jia, H. (2017). Does fuel efficiency pay? empirical evidence from the drybulk timecharter market revisited. *Transportation Research. Part A, Policy and Practice, 95*, 1-12. https://10.1016/j.tra.2016.11.007

Adland, R., Bjerknes, F., & Herje, C. (2017). Spatial efficiency in the bulk freight market. *Maritime Policy and Management*, 44(4), 413-425. https://10.1080/03088839.2017.1298864

Adland, R., Cariou, P., & Wolff, F. (2016). The influence of charterers and owners on bulk shipping freight rates. *Transportation Research. Part E, Logistics and Transportation Review, 86*, 69-82. https://10.1016/j.tre.2015.11.014

Ajith, P. J., Raju, T. B., Gupta, R., & Kulshrestha, N. (2023). Volatility in tanker freight markets. *Case Studies on Transport Policy*, 12, 100993. https://10.1016/j.cstp.2023.100993

Alizadeh, A. H., & Nomikos, N. K. (2011). Dynamics of the Term Structure and Volatility of Shipping Freight Rates. Journal of Transport Economics and Policy, 45(1), 105–128. http://www.jstor.org/stable/25801416

Alizadeh, A. H., & Talley, W. K. (2011). Microeconomic determinants of dry bulk shipping freight rates and contract times. *Transportation*, *38*, 561-579. https://doi.org/10.1007/s11116-010-9308-7

Alizadeh, A. H., & Talley, W. K. (2011). Vessel and voyage determinants of tanker freight rates and contract times. *Transport Policy*, *18*(5), 665-675. https://doi.org/10.1016/j.tranpol.2011.01.001

Alizadeh, A.H. & Nomikos, N.K. (2009). Shipping Derivatives and Risk Management. Palgrave Macmillan Books. https://doi.org/10.1057/9780230235809

Augier, M., & Teece, D. J. (2021). *The Palgrave encyclopedia of strategic management*. Palgrave Macmillan. https://doi.org/10.1057/978-1-349-94848-2

Baboo, P. & Thomchick, E. (2003). Price negotiation strategies adopted by shippers of international air and ocean transportation. *Journal of Transportation Management*, 14(2), 61-74. https://doi.org/10.22237/jotm/1062374760

Bacharach, S.B. & Lawler, E, J. (1981) *Bargaining: Power, Tactics, and Outcomes, ERIC*

Brooks, C. (2019). *Introductory econometrics for finance*. Cambridge University Press. https://doi.org/10.1017/9781108524872

Chatterjee, K., & Lee, C. C. (1998). Bargaining and search with incomplete information about outside options. *Games and Economic Behavior*, 22(2), 203-237. https://doi.org/10.1006/game.1997.0586

Chen, J., Xue, K., Song, L., Luo, J. X., Mei, Y., Huang, X., Zhang, D., & Hua, C. (2019). Periodicity of world crude oil maritime transportation: Case analysis of aframax tanker market. *Energy Strategy Reviews*, 25, 47-55. https://10.1016/j.esr.2019.100363

Chen, J., Zhao, R., Xiong, W., Wan, Z., Xu, L., & Zhang, W. (2022). Influencing factors of crude oil maritime shipping freight fluctuations: A case of suezmax tankers in europe-africa routes. *Maritime Business Review*. https://10.1108/MABR-04-2021-0033

Coddington, A. (2010). *Theories of the bargaining process*. Routledge Taylor and Francis.

Compte, O., & Jehiel, P. (2002). On the role of outside options in bargaining with obstinate parties. *Econometrica*, 70(4), 1477-1517. https://doi.org/10.1111/1468-0262.00339

Dai, L., Hu, H., & Zhang, D. (2015). An empirical analysis of freight rate and vessel price volatility transmission in global dry bulk shipping market. *Journal of Traffic and Transportation Engineering (English Edition)*, 2(5),353-361. https://10.1016/j.jtte.2015.08.007

Farrell, J., & Gibbons, R. (1989). Cheap talk can matter in bargaining. *Journal of economic theory*, *48*(1), 221-237. https://doi.org/10.1016/0022-0531(89)90125-7.

Fudenberg, D., Levine, D. K., & Tirole, J. (1987). Incomplete information bargaining with outside opportunities. *The Quarterly Journal of Economics*, 102(1), 37-50. https://doi.org/10.2307/1884679

Gago-Rodríguez, S., Márquez-Illescas, G., & Núñez-Nickel, M. (2021). Bargaining power as moderator of the “delay costs effect” in supply chain negotiations. *Management Accounting Research, 51*, 100737. https://10.1016/j.mar.2021.100737

Gavriilidis, K., Kambouroudis, D. S., Tsakou, K., & Tsouknidis, D. A. (2018). Volatility forecasting across tanker freight rates: The role of oil price shocks. *Transportation Research. Part E, Logistics and Transportation Review, 118*, 376-391. https://10.1016/j.tre.2018.08.012

Geman, H., & Smith, W. O. (2012). Shipping markets and freight rates: an analysis of the Baltic Dry Index. *The Journal of Alternative Investments*, *15*(1), 98-109. https://doi.org/10.3905/jai.2012.15.1.098

Gorton, L.J., Ihre, R., & Sandevärn, A. (2009). *Shipbroking and Chartering Practice*. Informa London. https://doi.org/10.4324/9781315087979

Hao, X., An, H., Sun, X., & Zhong, W. (2018). The import competition relationship and intensity in the international iron ore trade: From network perspective. *Resources Policy, 57*, 45-54. https://10.1016/j.resourpol.2018.01.005

Hu, X. (2018). Equality of bargaining power in contracts for international liner shipping. *WMU Journal of Maritime Affairs, 17*(3), 347-375. https://10.1007/s13437-018-0152-5

Islam, M. M., Balasanyan, A., & Mohamed, M. M. (2022). Shipping asset pricing: a Rubinstein bargaining approach. [Dissertations] World Maritime University. https://commons.wmu.se/all_dissertations/2080

Jia, P., Sun, X., & Yang, Z. (2012). *Optimization research of refueled scheme based on fuel price prediction of the voyage charter*. Elsevier BV. https://10.1016/s1570-6672(11)60229-8

Jin, N., & Tsang, E. (2006, July). Co-adaptive strategies for sequential bargaining problems with discount factors and outside options. In *2006 IEEE International Conference on Evolutionary Computation* (pp. 2149-2156). https://doi.org/10.1109/CEC.2006.1688572

Jing, L., Marlow, P. B., & Hui, W. (2008). An analysis of freight rate volatility in dry bulk shipping markets. *Maritime Policy and Management, 35*(3), 237-251. https://10.1080/03088830802079987

Karakitsos, E., & Varnavides, L. (2014). *Maritime Economics*. Palgrave Macmillan UK. https://doi.org/10.1057/9781137383419

Kavussanos, M. G., & Alizadeh-M, A. H. (2001). *Seasonality patterns in dry bulk shipping spot and time charter freight rates*. Elsevier BV. https://10.1016/s1366-5545(01)00004-7

Kavussanos, M. G., Tsouknidis, D. A., & Visvikis, I. D. (2021).*Freight Derivatives and Risk Management in shipping*. Palgrave Macmillan London. https://doi.org/10.1057/9780230235809

Kousser, T., & Phillips, J. H. (2009). Who blinks first? legislative patience and bargaining with governors. *Legislative Studies Quarterly, 34*(1), 55-86. https://doi.org/10.3162/036298009787500321

Lawler, E. J., & Bacharach, S. B. (1987). Comparison of dependence and punitive forms of power. *Social forces*, 66(2), 446-462. https://doi.org/10.1093/sf/66.2.446

Leedy, P. D., Ormrod, J. E., & Johnson, L. R. (2019). *Practical research: planning and design* (12th ed.). Pearson

Leng, A. (2023). A rubinstein bargaining experiment in continuous time. *Games and Economic Behavior*, 140, 115-131. https://10.1016/j.geb.2023.03.005

Lim, K. G., Nomikos, N. K., & Yap, N. (2019). Understanding the fundamentals of freight markets volatility. Transportation Research. Part E, *Logistics and Transportation Review*, 130, 1-15. https://10.1016/j.tre.2019.08.003

Ma, S. (2020). Economics of Maritime Business (1st ed.). Routledge. https://doi.org/10.4324/9781315658124

Martin, R. (1992). *Bargaining power*. Oxford University Press.

Myerson, R. B. (1991). *Game theory: analysis of conflict*. Harvard university press.

Muthoo, A. (1995). On the strategic role of outside options in bilateral bargaining. *Operations research, 43(2),* 292-297. https://doi.org/10.1287/opre.43.2.292

Muthoo, A. (1999). The Rubinstein Model. *In Bargaining Theory with Applications* (pp. 41-72). Cambridge University Press. https://doi.org/10.1017/CBO9780511607950.004

Nash, J.F. (1950). *Econometrica: Journal of the econometric society*, 155-162. https://doi.org/10.2307/1907266

Palmer, F. (2016). *Tanker Chartering.* Institute of Chartered Shipbrokers.

Plomaritou, E., & Papadopoulos, A. (2017). *Shipbroking and chartering practice*. Taylor & Francis. https://doi.org/10.4324/9781315689609

Prochazka, V., Adland, R., & Wolff, F. (2019). Contracting decisions in the crude oil transportation market: Evidence from fixtures matched with AIS data. *Transportation Research*. Part A, Policy and Practice, 130, 37-53. https://10.1016/j.tra.2019.09.009

Psaraftis, H. N., & Kontovas, C. A. (2013). Speed models for energy-efficient maritime transportation: A taxonomy and survey. *Transportation Research. Part C, Emerging Technologies, 26*, 331-351. https://10.1016/j.trc.2012.09.012

Ronen, D. (1982). The effect of oil price on the optimal speed of ships. *Journal of the Operational Research Society*, *33*, 1035-1040. https://doi.org/10.1057/jors.1982.215

Roson, R., & Hubert, F. (2015). Bargaining power and value sharing in distribution networks: A cooperative game theory approach. *Networks and Spatial Economics*, 15, 71-87.

Rubin, J. Z., & Brown, B. R. (2013). *The social psychology of bargaining and negotiation*. Elsevier.

Rubinstein, A. (1982). Perfect equilibrium in a bargaining model. *Econometrica: Journal of the Econometric Society*, 97–109. https://doi.org/10.2307/1912531

Sahoo, S., & Karamperidis, S. (2019). The dynamic baltic dry index: an approach to improve the freight market index. In Panayides, P. M. (Eds), *The Routledge Handbook of Maritime Management,* pp 270-282. Routledge.

Sahoo, S. (2023). *Review of bargaining and transactional prices: future avenues for shipping studies* [Working paper]. Maritime Business Review

Schecter, S. & Gintis, H. (2016). *Game Theory in Action: An Introduction to* Classical *and Evolutionary Models*. Princeton University Press. https://doi.org/10.2307/j.ctvcszzvz

Stopford, M. (2009) Maritime Economics. (3rd Edition), Routledge, London. https://doi.org/10.4324/9780203891742

Suh, S. C., & Park, N. K. (2010). The Charter Fixing Negotiation Procedure with Asymmetric Impatience in a Game Theory Framework: Case Studies in Coal and Ore Transactions. *The Asian Journal of Shipping and Logistics*, 26(2), 247-261. https://doi.org/10.1016/S2092-5212(10)80004-5

Sun, Q., Meng, Q., & Chou, M. C. (2021). Optimizing voyage charterparty (VCP) arrangement: Laytime negotiation and operations coordination. *European Journal of Operational Research, 291*(1), 263-270. https://10.1016/j.ejor.2020.09.032.

Tamvakis, M. N., & Thanopoulou, H. A. (2000). *Does quality pay? the case of the dry bulk market*. Elsevier BV. https://10.1016/s1366-5545(00)00005-3

Tsioumas, V., & Papadimitriou, S. (2018). The dynamic relationship between freight markets and commodity prices revealed. *Maritime Economics & Logistics, 20*(2), 267-279. https://10.1057/s41278-016-0005-0

Tsioumas, V., Smirlis, Y., & Papadimitriou, S. (2021). Capturing the impact of economic forces on the dry bulk freight market. *Maritime Transport Research, 2*, 100018. https://10.1016/j.martra.2021.100018

United nations conference on trade and development, (2022). *Review of Maritime Transport.* https://unctad.org/system/files/official-document/rmt2022_en.pdf

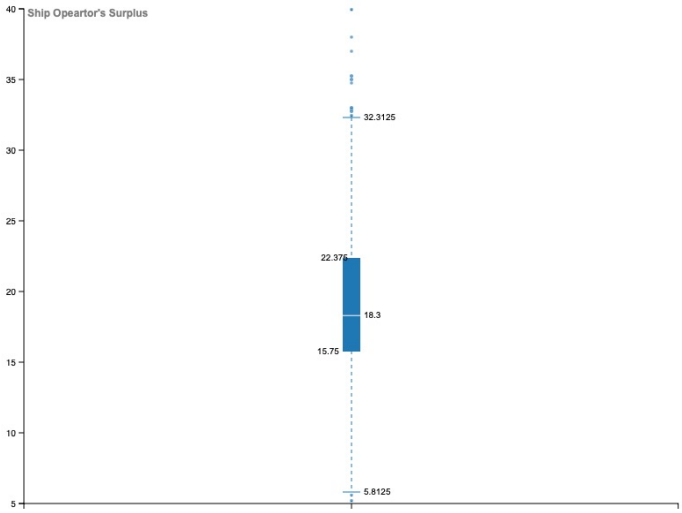
Valentine, V. F., Benamara, H., & Hoffmann, J. (2013). Maritime transport and international seaborne trade. *Maritime Policy & Management*, 40(3), 226-242. https://doi.org/10.1080/03088839.2013.782964

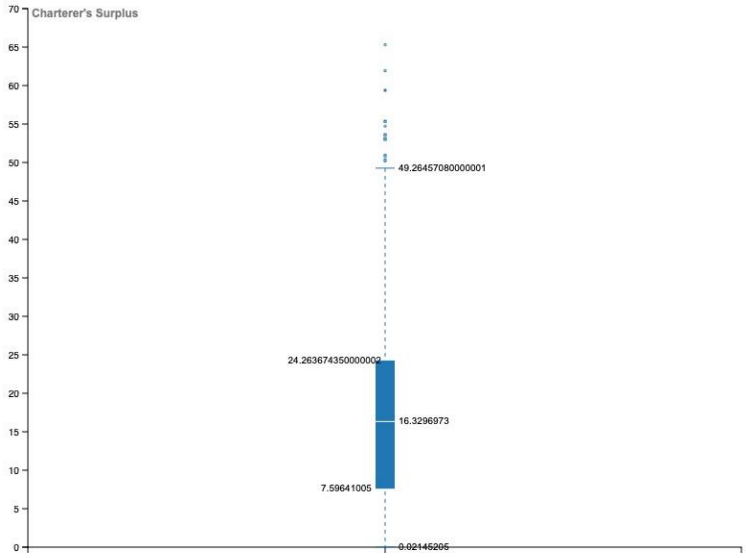
Wooldridge, J. M. (2020). *Introductory Econometrics: A Modern Approach*. Cengage Learning.

Zhang, H., & Zeng, Q. (2015). A study of the relationships between the time charter and spot freight rates. *Applied Economics*, 47(9), 955-965. https://doi.org/10.1080/00036846.2014.985371

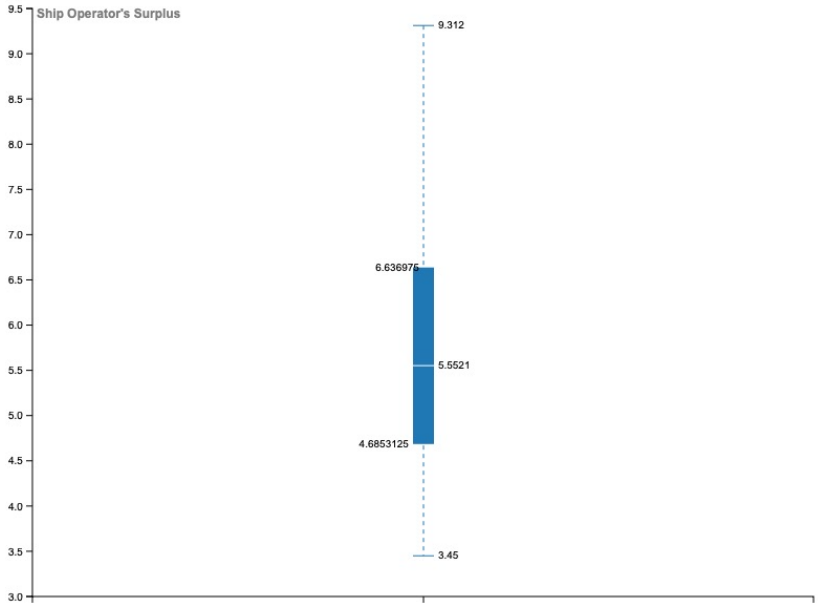
Zis, T. P. V., & Cullinane, K. (2020). The desulphurisation of shipping: Past, present and the future under a global cap. *Transportation Research. Part D, Transport and Environment, 82*, 102316. https://10.1016/j.trd.2020.102316

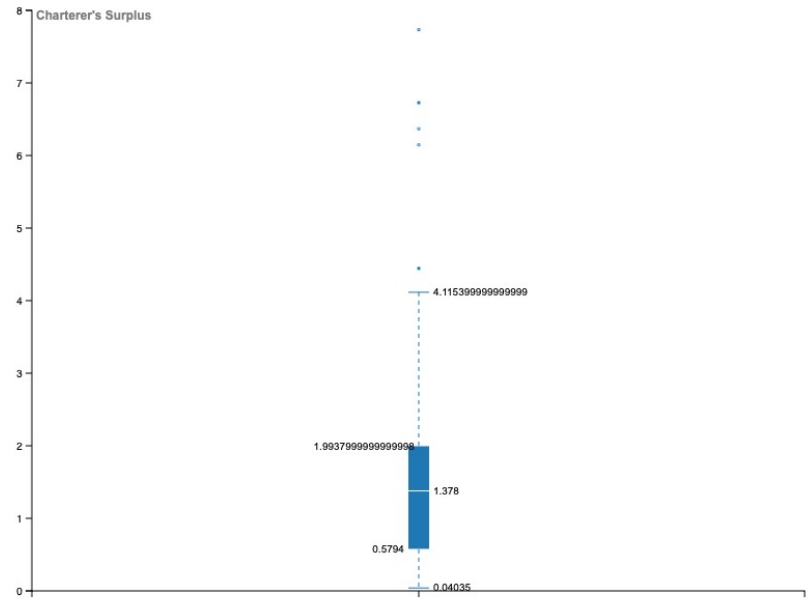
Appendix A: Box Plot for Surplus for Ship operator's and Charterers for Iron Ore Fixtures (CapeSize)



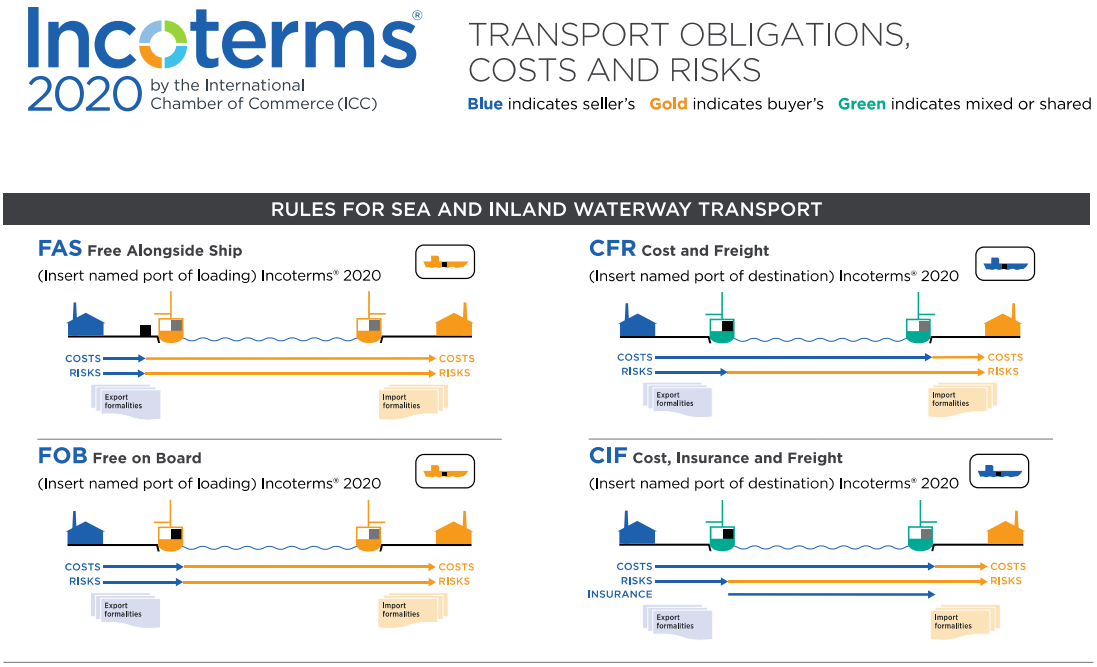


Appendix B: Box Plot for Surplus for Ship operator's and Charterers for Crude Oil Fixtures (Aframax)





Appendix C: Incoterms (Rules for Sea and Inland water transportation)



(Source: International Chamber of commerce, ICC)