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MASTER'S THESIS

Economic analysis of the tanker chartering market

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Disclaimer of authenticity

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Abstract

This master's thesis examines the tanker chartering market through an economic perspective, focusing on the key factors that influence freight rates, market equilibrium, and overall market performance. Given the central role of tanker shipping in the global transportation of crude oil and refined petroleum products, the study highlights the importance of understanding supply and demand dynamics within the sector. The analysis explores the structure of the tanker market, the main chartering arrangements, and the roles of principal market participants. Particular attention is paid to the distinction between clean and dirty tanker segments, as well as to the impact of global trade routes on tonne-mile demand. The thesis further investigates how macroeconomic conditions, oil price fluctuations, geopolitical developments, and environmental regulations affect rates and market volatility. The research is based on secondary data, drawing from academic literature, industry reports, and market indices. By reviewing historical trends and current market conditions, the study provides insights into the cyclical nature of the tanker chartering market and outlines key challenges and opportunities for shipowners, charterers, and investors.

Table of Contents

Economic analysis of the tanker chartering market	1
Disclaimer of authenticity	2
Abstract.....	3
Table of Contents.....	4
1. Introduction.....	6
1.1 Overview of the topic and its significance.	6
1.2 Research objectives.	7
1.3 Methodology and approach.	8
1.4 Structure of the thesis.	8
2. Literature Review.....	9
2.1 Introduction to the Maritime Industry and Tanker Market	9
2.1.1 Types and Roles of Tankers in Global Trade.....	11
2.1.2 Tanker Routes in the clean petroleum products (CPP) Market	19
2.1.3 Tanker Routes in the Dirty Petroleum Products (DPP) Market	25
2.2 Economic Theories Relevant to Shipping Markets	27
2.2.1 Basic Economic Principles: Supply in the Tanker Shipping Market.....	27
2.2.2 Demand in the Tanker Shipping Market.....	29
2.2.3 Supply dynamics	33
2.2.4 Basic Economic Principles: Market Equilibrium in the Tanker Shipping Market.	36
2.2.5 Economic theories for and against state intervention in international shipping and maritime transport	38
2.2.6 Public Goods and Externalities	40
2.2.7 The IMO, its structure and the chronicle of the creation and amendment of its Conventions.....	41
2.3 Understanding Charter Markets	43
2.3.1 Time Charter	45
2.3.2 Bareboat Charter.....	46
2.3.3. Tanker Charter Market.....	48
3. Analysis of Tanker Charter Markets.....	49
3.1 Historical Trends in Tanker Charter Markets	49
3.2 Current Market Dynamics	50
3.3 Key Drivers Influencing Charter Markets.....	55
3.3.1 Economic factors: global oil demand, bunker fuel prices, and freight rates.....	55
3.3.2 Political and regulatory factors: geopolitics, environmental regulations, and international trade policies.	61
4. Economic Analysis and Market Forecasting	66

4.1 Analysis of Key Economic Indicators	66
4.1.1 Macroeconomic Variables and Their Impact on the Tanker Charter Market	67
4.1.2 Microeconomic variables and their impact on tanker market	69
4.1.3. Factors impacting tanker charter rates and market performance.	71
4.2 Market Forecasting	72
4.2.1 The concept and importance of forecasting in the tanker shipping markets	72
4.2.2 Predictive Models and Analytical Approaches.....	74
4.2.3 Uncertainties and Variables Affecting Forecasts	75
4.2.4 Integrated Scenario-Based Forecasting Outlook	77
5. Conclusions and Recommendations –	78
5.1 Summary of Main Findings	78
5.2 Implications for Stakeholders (Shipowners, Charterers, Investors)	80
5.3 Strategic Recommendations for Market Participants.....	82
5.4 Suggestions for Future Research	85
References	85

1. Introduction

1.1 Overview of the topic and its significance.

On January 1, 2009, the worldwide tanker fleet had a deadweight tonnage (dwt) of 379.1 million dwt. This included around 3,605 ships with a dwt of more than 25,000 that were involved in extracting, transporting, and storing crude oil and refined petroleum products. The size of the fleet may make it seem like it would grow steadily over time, but the truth is that it has been far more unstable in the past. After the big shocks of the early 1970s, the industry took a long time to recover, but by the early 1980s, it had reached record levels of tonnage. Only until 1999 did the first boom in the tanker business happen because of economic factors, not because of political tension. To understand how the tanker business has changed over time, you first need to understand how the global oil industry has changed over time. This link is easy to see: most of the world's crude oil is shipped by sea from where it is produced to where it is used the most. About 95% of oil that moves between regions is done by ship. Pipelines, roads, and railroads only provide a tiny part of the demands for domestic distribution. In 2008, more than 2.7 billion tonnes of the 3.9 billion tonnes of oil produced across the world were exported. This means that shipping services were needed for over two-thirds of the world's oil production (Glen & Christy, 2010). Because the world's biggest consuming centers are net importers, their demand made it necessary to have safe, dependable, and cheap tanker transportation. In the 1940s and 1950s, purpose-built oil tankers were the backbone of a quickly growing energy value chain. Building oilfields, refineries, and distribution networks, notably in Western Europe and North America, took a lot of money and created an industrial structure that was mostly controlled by a few large multinational businesses. These businesses controlled every step of the process, from manufacturing to refining to distribution to transportation. They also kept spending a lot of money on tanker fleets. Shipyards delivered around 5% of the world's fleet each year, thus the market remained active. It was easy to get into since there was a strong second-hand market (Glen & Christy, 2010).

The industry was very concentrated by the end of the 1960s. The "Seven Sisters"—Esso, BP, Shell, Mobil, Texaco, and Gulf—along with state-owned companies like Total, ENI, and Petrobras—controlled worldwide supply chains, logistics, and

transportation. The existence of a number of refineries in Europe resulted in the diminishing of their power, the Rotterdam spot market to grow, and independent oil companies to urge a competition at a larger degree. The Arab-Israeli War of 1973 and the oil embargo that came after it were very important events. They raised the price of crude oil from \$1.80 to more than \$40 a barrel and ruined the concept of a stable, centrally managed market.

These factors had a huge impact on how the tanker industry operated. The balance of power in the globe altered when Western oil companies were nationalized and OPEC became more powerful. The deep recession that came after affected the long-term patterns of demand. Since the early 2000s, the economies of China and India have risen significantly, which has made the need for tanker transportation even larger (Glen & Christy, 2010).

The tanker market has changed a lot since then. In the previous 20 years, the main things that have affected its development have been economic and environmental variables, not political events. But geopolitical developments are still a persistent concern that might make the market change quickly.

1.2 Research objectives.

The present thesis aims to provide a thorough economic analysis of the tanker charter market, putting an emphasis on the essential economic, regulatory, and geopolitical elements that influence its dynamics. In this regard, the research objectives are defined as follows:

Firstly, the thesis aims at analyzing the key maritime trade routes and the roles of significant actors in the tanker charter market, such as shipowners, charterers, and brokers.

Additionally, the second aim involves the evaluation of the factors that affect tanker charter prices. The third, involves the analysis of the way external factors affect the stability and performance of the market, such as risks (often geopolitical), environmental policies, and new technologies.

Furthermore, through the thesis there would be analysis of past market patterns to understand the way the tanker charter business has changed over time.

Other goals have to do with whether economic forecasting models may be used to predict how the market will change in the future and learn about possible trends. Additionally, there will be suggested strategic suggestions for industry players, such as shipowners, charterers, investors, and legislators, to help them make decisions and manage risks effectively.

1.3 Methodology and approach.

The current study relies on secondary data. Secondary research, literature review, preliminary research, historical research, background research, desk research, or library research are all terms for study that looks at or describes past research. Secondary research examines prior discoveries instead of producing new data to ascertain the boundaries of knowledge on a topic, recognize patterns or methodological frameworks, evaluate existing models, or corroborate facts. It also shows how important primary research is and helps other academic or professional projects by giving them proof and context (Paul V. Galvin Library, 2021).

Secondary research is the study of material that other people have previously gathered and published. It gives an overview of what is already known about a subject and points out areas that need further study. Professionals from many fields utilize secondary research throughout their careers since it may be used in many different situations. Even if you don't need to gather primary data, you still need to be able to do secondary research to evaluate evidence, help make decisions, and back up recommendations. When the main goal is primary research, secondary research is just as vital. It is vital to show that the planned study is unique and valuable, that it is not just a repeat of earlier work, and that there is a clear reason for research financing and design (Paul V. Galvin Library, 2025).

1.4 Structure of the thesis.

This thesis is organized into five primary chapters, detailed below. Initially, the present introductory chapter, presents an overview of the tanker charter market, delineates the

research objectives, outlines the adopted methodology, and provides a synopsis of the thesis structure. Afterwards, there would be presentation of the literature review whereby the maritime industry will be introduced putting an emphasis on the tanker charter market. The review will also present relevant economic theories applicable to shipping and explores various chartering arrangements alongside the defining characteristics of the market.

Following the literature review there would be an analysis of tanker charter markets. Firstly, there would be an examination of the historical market trends and past cycles within the tanker charter sector. There would be an analysis of the present market dynamics, including key freight indices such as the Baltic Dirty Tanker Index and the Baltic Clean Tanker Index. There is additionally identified major economic and regulatory factors that impact the market. Economic Analysis and Market Forecasting, assessment of the principal economic indicators impacting tanker charter rates and presentation of predictive modeling techniques to forecast future market developments will be presented.

Finally, there would be presentation of the conclusions and Recommendations in which there would be a synthesis of the study's key findings, a discussion of their implications for industry stakeholders including shipowners, charterers, and investors, and provision of strategic recommendations for navigating the tanker charter market effectively. It also recommends actions to be taken pertaining future research.

Last but not least, there would be presentation of the references used throughout the present thesis and the appendices that include supplementary materials such as data tables, graphical representations, charts, and additional documentation supporting the main text.

2. Literature Review

2.1 Introduction to the Maritime Industry and Tanker Market

The present global commercial fleet is only one aspect of the marine business. The tug and barge fleet, all port and terminal operations, pilotage, freight forwarding, chartering, intermodal services, industry regulations, passenger recreational services on specialty vessels, shipbuilding and repair, naval architecture and marine engineering,

marine training, government programs and shipping, ship classification, marine insurance, communications, pleasure boating, and more are all included in this industry. Every nation's economy has benefited from the marine sector, which has also subtly aided global economic growth. As the leader in the transportation sector, the shipping industry has been instrumental in the creation of contemporary global transportation networks and economic globalization. Using specialist boats to transfer commodities abroad is known as maritime transport in the marine sector (Munim, 2019; Marine Industry Learning Guide, 2018). Since the shipping sector is the main leader in the commerce sector, it is also synonymous with international trade (Struck, 2020). The marine sector is now confronted with both fresh prospects and problems. The shipping sector is the backbone of the global economy, as shown by the fact that ships and seaports handle more than 80% of all international commerce (Emad, Enshaei & Ghosh, 2021). Compared to other forms of transportation, this one is comparatively inexpensive and effective, and its significance is not anticipated to decline. Furthermore, the shipping sector has encountered a number of difficulties, including social, economic, and climate change issues, and—above all—rapid technology advancements. As a result, the business must be prepared to see these difficulties as opportunities rather than threats (Zaman et al., 2017). Therefore, marine difficulties may be addressed by the next generation of Industry 4.0 technology, such as autonomous ships (Gu et al., 2021).

With many players and a wide range of connections between them, Figure 1 depicts the complexity of the marine sector.

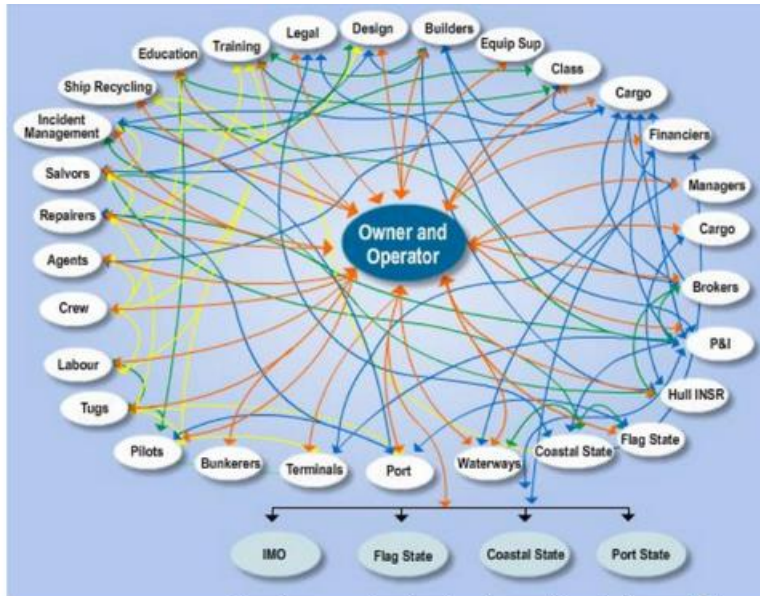


Figure 1. Participating organizations in the maritime industry [7]

Figure 1. Participating organizations in the maritime industry (Source: (Perunovic & Vidic-Perunovic, 2011))

2.1.1 Types and Roles of Tankers in Global Trade

Although many kinds of tankers are used to carry various products all over the world, the study conducted for this report will only look at oil, chemical, and gas tankers since that is what the corporation in question specializes in.

A) Tanks for chemicals

The market for bulk liquid chemical transportation by sea is known as the chemical tanker market (Hammer, 2013). There are 1,144 pure chemical tankers and 6.2 million DWT in the fleet as of 2012. ISL (2012) In order to transport inorganic and organic chemicals, vegetable and animal oils, molasses, and other specialist cargo, chemical tankers are often smaller tankers up to 60,000 DWT with more tanks and unique coating. Jeffersonies (2013). Chemicals like methanol, xylene, and ethylene glycol are represented by the biggest section, organic chemicals (Hammer, 2013). It is essential to remember that IMO grade iii chemical tankers are considered to be a component of the product fleet as they may transport refined petroleum products. Jeffersonies (2013).

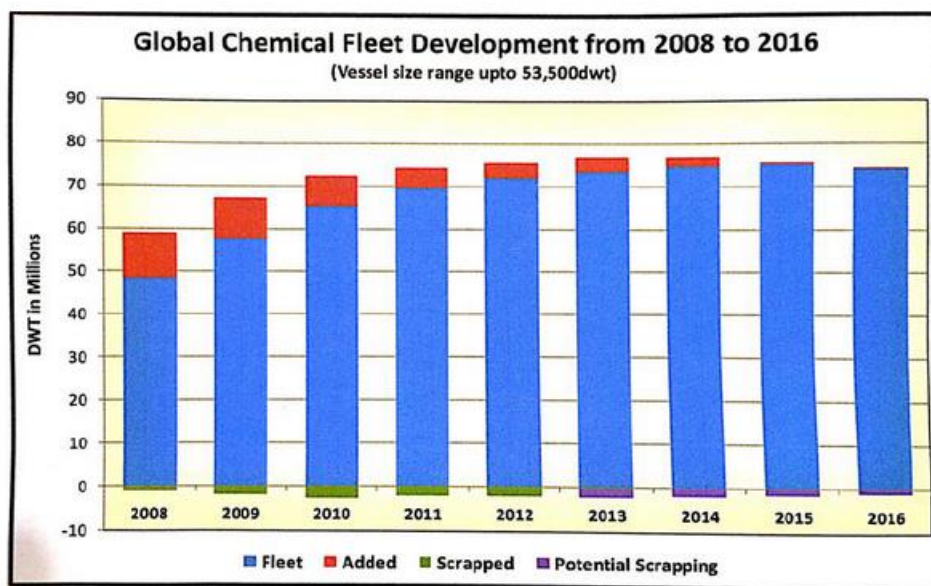
Chemicals are transported by sea in every country in the globe, according to Eitzen Chemical ASA (2012, pp. 9). The primary chemical supply regions in the United States, Northwest Europe, Singapore, and the Arabian Gulf region are connected to the key chemical importing regions in Europe, Asia, and South America via the most crucial long-haul trade lanes for chemical tankers. There are also significant commercial routes from the Middle East to Europe and North America. The expansion of chemical plants and petroleum refineries in the Middle East and Asia is anticipated to make these areas more significant in the chemical trade. Due to the large number of commodities engaged in the seaborne chemical trade, demand for chemical tankers is impacted by a variety of factors, including worldwide economic demand. One of the primary forces behind the need for chemicals is global industrial output and GDP development, which are also often seen as key indications of the demand for chemical tankers (Eitzen Chemical ASA 2012, pp. 12). In the tanker market, chemical tankers saw a growth of roughly 41% DWT in the order book between 2002 and 2007. However, a decline in demand due to the 2008–09 financial crisis resulted in noticeably low growth rates, as new buildings were rarely contracted during the crisis, which accounts for the growth rate of 4.4% in 2012 according to Hammer (2013).

However, according to Marine Money, the dynamics of supply and demand in the chemical tanker market have been getting better, and the growth of refineries in the Middle East is predicted to make things even better in the near future. Additionally, the expansion of the U.S. natural gas supply, which is increasing chemical exports to Asia and attracting demand for specialist boats that transport these goods, was predicted to have contributed to a 12% rise in revenues for chemical tankers in 2014.

However, Lee Hong Liang (2014) notes that despite some improvements, the global chemical tanker business is predicted to continue to be difficult over the next years because of low demand and freight rates that remain below viable levels. Furthermore, no one has seen a protracted rebound. They think that a drop in order book, slight, if not negative, fleet growth, and additional tonne miles from the Middle East as a result of refinery construction will support the market. (2014, Tradewindsnews)

To elaborate, Stolt-Nielson (2014) tells marine traders worldwide that "the market is in a difficult situation right now. While there are often too many ships in other shipping sectors, the chemical tanker market is experiencing too few cargoes, with volumes not

anticipated to increase in 2014 or 2015. Market circumstances are difficult. Once again, the price of new buildings increased somewhat. This indicates that the present market circumstances have made it difficult to get finance for new structures, and the new construction costs in comparison to the existing shipping rates do not justify the procurement of new ships (O'Reilly, 2014). Because businesses have been compelled to reduce expenses and their investment in new construction, this has also contributed to the reduction of the chemical tanker order book (O'Reilly, 2014).



Source – SPI Marine

Figure 2: Global Chemical Fleet Development from 2008 – 2016 (Source: Ozobu, 2015)

Due to the expected scrapping and the small number of new fleets entering the market, Figure 2 illustrates how the global chemical fleet may continue to decline in the years to come. Additionally, the freight market has a significant impact on the choice to scrap. The proportional level of scrapping is greater in a weaker market (Eitzen Chemical ASA 2012, pp. 11).

Therefore, it is advised that the firm looking to develop and grow its tanker fleets leave its chemical tanker fleets unaltered until the global economy improves and the demand and supply balance for chemical tankers shifts, which will ultimately result in a rise in the order book. Freight prices are expected to rise when supply and demand balance in

favor of operators (Eitzen Chemical ASA 2012, pp. 12). Furthermore, charter prices and vessel values may drop if new construction increases tanker capacity supply but does not boost demand for tanker capacity, which would then impact the business's operations (Ardmore Shipping Corporation 2013, pp. 5).

b) TANKERS FOR OIL

There are two types of oil tankers: product oil tankers, which carry refined oil, and crude oil tankers, which carry unprocessed oil (Jefferies, 2013). The dead weight tonnage (DWT) of a crude oil tanker ship is used to group them. Clarksons Research (2014) says that Ultra Large Crude Carriers (ULCC) are the biggest group. They usually have capacities between 320,000 and 550,000 dwt. Very Large Crude Carriers (VLCC), on the other hand, usually have capacities between 200,000 and 320,000 dwt. Product oil tankers are split into three groups: LR1, LR2, and MR. These tankers are similar to Aframax, Panamax, and Handymax crude oil tankers. The main difference is the coating on the tanks, which makes it possible to move "cleaner," more corrosive oil products (Jefferies 2013). Also, as the requirement for oil transportation is based on the global flow of oil from producers to consumers, the current status of the oil market might be used to judge the current situation of the oil tanker industry (Shi et al., 2013). The price of oil has plummeted by about 20% since the end of 2014. This is due to a variety of things, including the fact that there is too much oil in the globe and not enough demand for crude oil (Miller, 2014). The oil tanker business might be affected in several ways by this big drop in oil prices. Teekay Tankers (2014) says that this has led to more oil being bought for both strategic storage and use, which has caused a lot of oil to move and a boom in oil tanker traffic. Right now, the product tanker sector saw the biggest fleet growth, with the oil tanker fleet growing by 0.3 percent. Teekay Tankers (2014) says that the Suezmax and uncoated Aframax fleets have lost two and thirteen boats, respectively, in the first nine months of the year. On the other hand, the global VLCC fleet has gained seven boats. As a result of what was said above, the current oil price is predicted to cause a boom in the product oil tanker business. This is because increased consumer demand for oil would boost demand for product tankers, which would create more jobs for product tankers. Also, product tankers may now be able to operate their

own ships for less money since the cost of fuel for fleet operations has gone down. Even Nevertheless, reduced oil prices might have both favorable and bad effects on the market for crude oil tankers. On the other hand, a decline in the price of oil is bad news for producers and exporters. This might imply less money for producers since it costs more to generate oil, which could lead to reduced output to make up for the loss or a higher price throughout the world (Kindergan, 2014). So, if production goes down, fewer items would need to be moved, which would mean fewer crude oil ships would be needed (Crompton and Harris, 2014). "CONTANGO" might help the market for crude oil tankers by lowering oil prices. Flower (2010) says that "a contango is when the producer puts the commodity into storage waiting for the prices to improve before selling." When prices don't reflect the real value of a commodity, the market goes into contango. In other words, investors keep the commodity instead of selling it immediately away if they think they may make more money from it in six months. Because the present situation could not last, crude oil tankers might gain from more people wanting to employ their services to store these oils until prices go up and they can sell them for a bigger profit margin. Saul, Milhench, and Sheppard (2015) say that some of the largest oil companies in the world have already chartered supertankers to store oil at sea. Others have booked crude tankers for up to a year to do the same thing: retain excess crude at sea till prices go up. Teekay Tankers (2014) also says that "a combination of a declining mid-size crude tanker fleet and a continued increase in tanker tonne-mile demand, as an increasing amount of crude oil moves long-haul from the Atlantic to Pacific basins, is expected to drive an increase in tanker fleet utilization and spot tanker rates during the remainder of 2014 and 2015." This suggests that the oil tanker sector's forecast for the tanker market is still good. The market is currently seeing positive changes overall (BIMCO 2014). This is because more tankers are being used to move the same amount of cargo over longer distances. Short-distance hauls will be replaced by longer international hauls, and an increase in the demand for oil will benefit oil tankers. There is also a higher need for tankers, especially those that transport crude oil. BIMCO (2014) says that the new orders have increased the amount of crude oil tanker capacity available for delivery in 2016 by 16%. Because of the reasons given above, a company like this would make money by putting money into Long Range (LR) Double Hull (DH) product oil tankers. The decline in oil prices has helped these tankers, which are in high demand yet have higher freight costs.

The spot market and time charter pricing for LR product tankers went up from \$8,000 in 2013 to \$27,000 and \$16,000 to \$19,000, respectively, according to ACM Shipping, London (2015) (Koenigcie.de, 2015). On the other hand, the corporation may rent out its present crude oil ships to investors who might require them for long-term storage of crude oil. Buying LR DH product tankers has other benefits as well. For example, lower fuel prices mean lower operating costs, and higher freight rates give the business a competitive edge. DH makes ballasting easier in emergencies, and less salt water ballasting is used in cargo tanks, which cuts down on corrosion and maintenance costs that the business would likely have to pay. Compared to the single hull design, this design is less likely to leak oil, and it can also be used to transport other items (Shippingherald.com, 2013). Companies get more money since cargo is unloaded faster and easier, which gives the tankers more time to continue their voyage. Still, there are some problems with it, such as the following. The market is very competitive because there are so many oil tankers in use. Building is more expensive, canals and ports cost more, ventilating ballast tanks is hard, ballast tanks need to be watched and maintained all the time, there is more transverse free surface, and there are more surfaces to maintain. Even if there are more pros than cons in this scenario, the firm should nonetheless lower its risk by buying LNG and product oil ships to some level. We shall talk about this in greater depth later.

c) LNGs

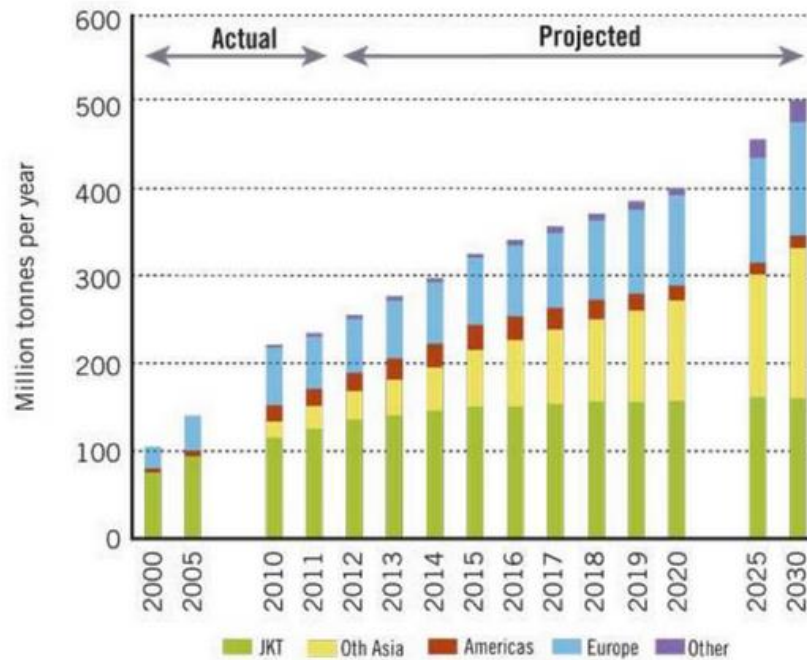
The main types of gas that are shipped by sea include liquefied petroleum gas (LPG), LNG, and other petrochemical gases (UK P&I Club, n.d.). LNG transportation has gotten a lot more attention in the last several years, but the gas trade still uses a lot fewer ships than the oil trade. This means that just a few firms and sailors know a lot about how this market works.

The LNG fleet is the main topic of this part. Natural gas that has been cleaned and then cooled to a liquid condition is called liquefied natural gas (LNG). This makes it much smaller and easier to carry by ship across great distances (Shukman, 2014). There are roughly 380 LNG ships in the world, and they are usually about 155,000 m³ in capacity. However, as the market changes, new ships are being built with bigger capacities of

about 170,000 m³ (Timera Energy, 2014). Shipping goods along trade routes including the Middle East–Asia corridor, Australia–East Asia, and Africa–Southern Europe promotes LNG ship demand.

The LNG transportation industry suffered in 2013. Domestic gas output rose due to unexpected liquefaction plant shutdowns, making Europe more reliant on piped gas (Jones, 2014). Since pipeline transit is cheaper, island economies like Japan or long-distance commerce without pipelines can afford LNG shipping. Long-term charters cost \$61,000–\$100,000 per day from 2009–2013. Timera Energy (2014) announced a \$50,000 cut. The industry has too many ships with 108 ordered in 2013 (Jones, 2014). Bhushan (2014) reported falling short-term charter prices in 2013 and 2014 owing to oversupply, low cargo, and declining trade growth. Despite these challenges, most people think the LNG business has medium-to-long-term promise, attracting investors. LNG exports from the US and Angola may boost shipping (Wright, 2015).

Figure 3 – Global LNG demand



Source – Nijoka and Mellen 2013.

Figure 3: Global LNG demand (Source: Nijoka & Mellon, 2013)

As it is depicted in Figure 3, the main source to cover LNG demand international is JKT area (Japan, South Korea, and Taiwan), something which is anticipated to go on for the next several years (Nijoka & Mellon, 2013). The number also reveals that the world will need more LNG, especially through 2020. Most industry experts think that growth will be 5–6% every year until 2020, and then 2–3% per year after that. The graph in Figure 3 supports the idea that LNG demand has both significant historical momentum and long-term structural growth. As large liquefaction projects in Australia and North America go live and the rate of new vessel orders slows, demand is projected to rise even more. This combination makes it more likely that there will be a scarcity of ships in the next several years (Bhushan, 2014). Ship & Broker (2014) notes that LNG shipping demand has dropped in recent years, but the long-term view shows that supply will become tighter as demand grows.

Because it usually takes two to three years to build anything, the market cycle implies that a business that buys LNG ships now might profit from better circumstances when the ships are delivered (Timera Energy, 2014). Early investments put companies in a good position to meet the growing demand for transportation and take advantage of predicted rises in freight rates.

It is also predicted that stricter enforcement of rules against gas flaring would help LNG shipping. This is because less flaring means that more gas gets liquefied and enters global commerce flows. There are many other benefits to buying LNG vessels, such as: In places where political conflicts threaten overland energy channels, sea transit is frequently more dependable than pipelines. This is why LNG is often chosen at first. The world is moving toward natural gas as a cleaner energy source, which will boost the long-term need for LNG carriers. Compared to oil and chemical tankers, there isn't much rivalry because of the technological specialty needed (UK P&I Club, n.d.). LNG carriers are among of the safest kinds of ships since they have double hulls and separate systems for holding cargo. Even still, exporting LNG is not without its problems. First, the cost of building is quite expensive, more than \$200 million for each ship (Jones, 2014). In addition, larger pipeline networks in the future may lower the need for LNG at sea. Market optimism is based on the expected expansion in demand, which is always unpredictable. LNG cargoes are more likely to catch fire or explode, and keeping ships

in good shape is expensive and hard. Based on the current market research and the demand trend shown in Figure 3, LNG shipping is likely to rise gradually. As global consumption and trade volumes grow, this puts LNG-focused transportation businesses in a good position to make a lot of money in the long run.

2.1.2 Tanker Routes in the clean petroleum products (CPP) Market

As quantities increased and CPP started to be sold across greater distances, growth in seaborne commerce emerged. This change was mostly caused by the demand for gasoline in the United States. The United States started importing a lot of gasoline from Europe and the Caribbean due to the legal and environmental barriers to building new refineries in the country and the rapid increase in oil consumption from the early 1980s to a high in 2005. Medium-range product tankers, or "MRs," provided services for this local commerce.

Asia's growing status as a global manufacturing powerhouse, which began with Korea and Japan and expanded to encompass China and numerous other nations in the 1990s, became the second significant driver of seaborne CPP commerce. LPG and naphtha are used as feedstock for petrochemical plants that make polymers. The amount of naphtha that Asian refiners may produce is restricted. Refineries in the Gulf area of the Middle East were the main source of the shortage, and CPP tankers formed to provide this long-haul traffic with long-range product tankers (also known as "LR1s" or "LR2s") (TORM PLC, 2023).



Figure 4: Key historic CPP trades (Source: TORM PLC, 2023)

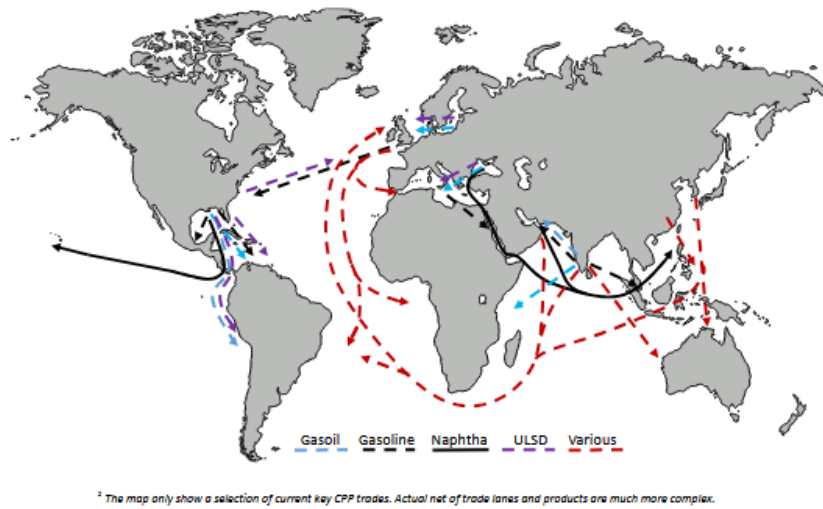


Figure 5: Selection of Current Complex Trade Patterns for CPP (Source: TORM PLC, 2023)

Trade in CPP has changed over the last several decades from being mostly regional to becoming global and diverse. With CPP trading internationally based on international price differentials, or arbitrage trading, demand for product tankers is now speculative in nature in addition to being based on regional surplus supply or demand for a certain refined product. International fuel requirements, including ultra-low sulphur diesel ("ULSD"), have been developed and adopted, enabling oil companies and merchants to transport goods throughout the world more and more. This increases the amount of time that boats are used and the distance that product tankers travel. Given that tonne-miles, which are calculated by multiplying the number of tons carried by the distance traveled in nautical miles, are often used to express the demand for product tankers, an increase in the distance traveled equals Mr. MR/LR1Mr. Different Types of Gasoline Naphtha Gasoil Gasoline Naphtha ULSD 1 Only a few of the most important CPP deals that are now occurring are shown on the map. Real net-of-trade items and lanes are much more intricate. favorable for the demand for tankers. Likewise, a rise in carried quantities will also result in an increase in vessel utilization and tonne-miles.

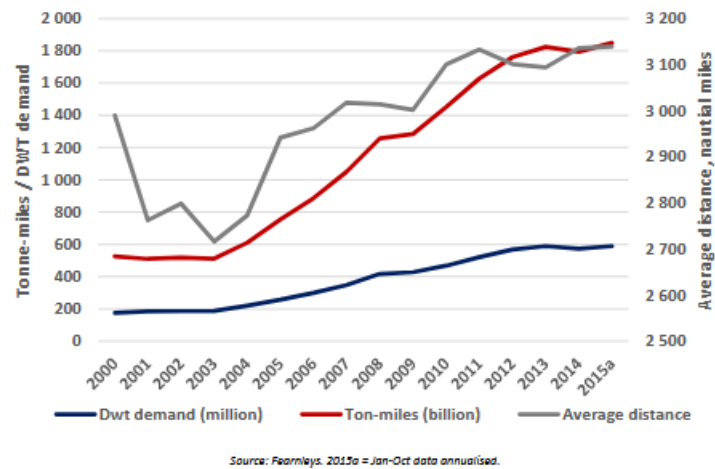


Figure 6: Growth in Demand for +50,000 dwt Product Tankers, 2000-2015

Research on crude oil tankers began in 2005 (Laulajainen, 2010) and has since extended to include product tankers hauling light and medium (“clean”) oil distillates—an area that remains regionally underexplored (Stopford, 1997). One of the main goals of this research stream is to chart the movements of ships and make routing patterns more logical. This is very reliant on the quality and availability of real-world data. There has been modest improvement for tankers up to Panamax size (60,000 dwt), but data availability drops off significantly for bigger vessel classes, which makes it harder to do in-depth geographical research. In the past, product movements were thought to be too modest and spread out across regions to be worth studying on a global basis. Before, dry bulk literature was the main source of methodological advice. Isserlis (1938) looked at 12,491 trips made by UK-registered dry cargo ships. At that time, British navy constitutes 27% of the world's tonnage. Nossun (1996) built on this study by monitoring worldwide dry bulk flows from 1945 to 1990 and changing the minimum vessel size criteria as the industry grew. His work, although more descriptive than analytical, showed that large-scale mapping is possible and also showed the data limits that come with changing markets. Literature concerning short sea transport and port networks is mostly geographically constrained and economically focused (Wijnolst et al., 1993; Musso & Marchese, 2002), while studies of port forelands address only restricted groups of ports (Matheson, 1955; Laulajainen, 2011). Laulajainen's (2006) analysis of Handysize dry bulk ships

serves as the most relevant methodological comparison, illustrating that current data challenges are enduring and not limited to tanker shipping. Two assumptions have traditionally contributed to the marginalization of clean-product tanker research. First, it was thought that refineries were usually built close to big markets for oil and gas to cut down on handling losses and meet regulatory requirements. Improvements in refinery technology and economies of scale made this idea more stronger (Stell, 2003). This perspective, however, is too reductive. Refineries are made up of production units that have set sizes and capabilities that can't be changed, even if consumption changes all the time. It costs money to change the mix of feedstock and products. So, a lot of shipping is still needed to fix the quality differences between what refineries produce and what is needed in different areas. Refineries also sell feedstocks like naphtha to petrochemical companies that don't need to be in the same place (Chapman, 1991; Laulajainen & Stafford, 1995). Location restrictions make things much more difficult. Refineries are bad for the environment and not very popular with politicians. This is why they are mostly found around coasts, where they compete with tourists and new homes. For instance, a lot of refining capacity in the United States was moved to the Caribbean and the Canadian coast (Cellineri, 1976). Similar pressures in Europe and Asia led to the growth of refineries in the Middle East Gulf (MEG), where manufacturers want to get the most value out of their products. This is why the biggest product flows, which may be up to 120,000 mt, go from MEG to Asia Pacific. Most shipments, on the other hand, are much smaller, usually about 30,000 mt. Because of these problems, it is still hard to chart the movements of product tankers throughout the world. To figure out the pattern of trade flows, competitive positioning, and logistical profitability, you need to integrate vessel data with information about refineries and ports. Functions obtained from dry bulk and "dirty" tanker studies may be applied to assess clean-product transactions, with vessel size–distance connections backed by datasets such as those from Amsterdam and LMIU.

The winter market of 2024 has been quite hard for clean tankers, and IFCHOR Galbraiths (2024) points to a number of reasons for this short-term difficulties. These changes are the foundation for early predictions for 2025, especially when it comes to predicted changes in regional demand, fleet use, and rate recovery.

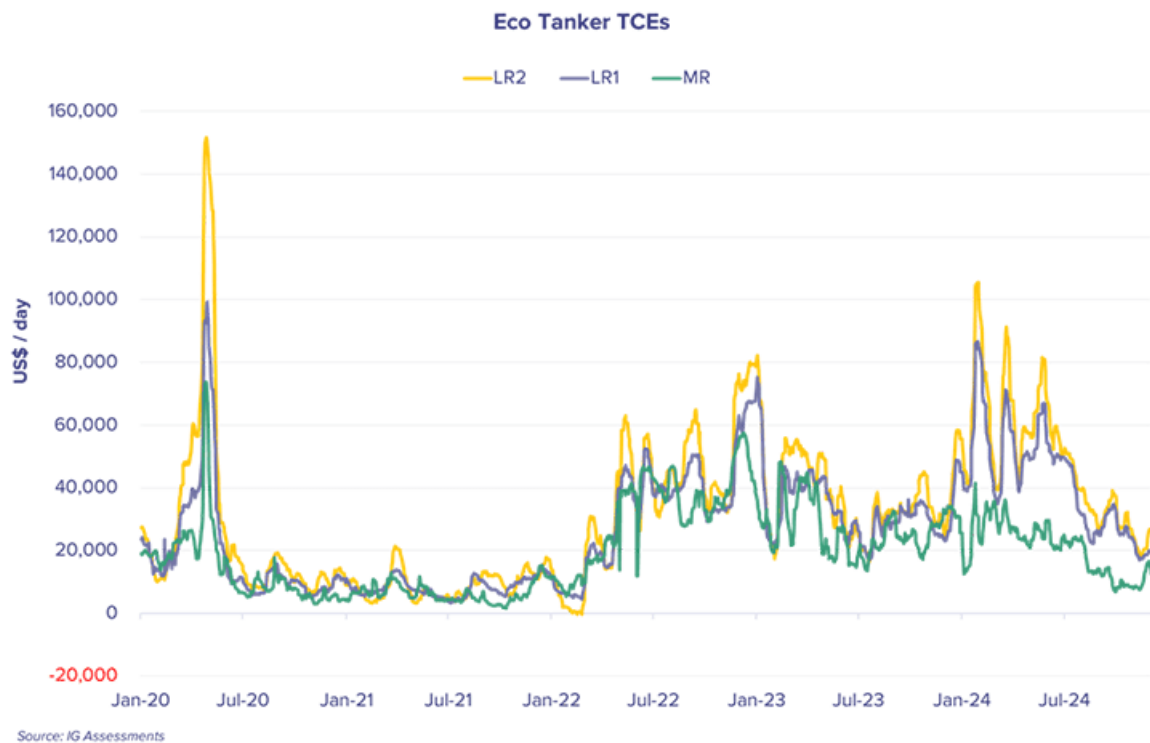


Figure 7: Eco Tanker TCEs (Source: IFCHOR Galbraiths, 2024)

Clean tankers faced a difficult early winter market with freight and profitability under a lot of strain after such a robust market in the first half of 2024. As of this writing, the weighted average basket profits for eco LR2, LR1, and MR tankers are US\$ 26,000 per day, US\$ 19,000 per day, and US\$ 12,000 per day, respectively. Although the difficult market has not just affected clean tankers—crude has also seen a considerably poorer than expected winter period—the decline compared to the first half of 2024 has been far more noticeable on the CPP side. As of this writing, the average eco earnings for MRs have decreased by 47%, while the average eco profits for a VLCC have decreased by around 30% from 1H2024 to 2H2024. Because CPP tankers, particularly those traveling east to west, were severely hit by the lengthier trip lengths to avoid the crisis in the Red Sea, this decline has been made worse in part by the significant surges seen earlier in the year (IFCHOR Galbraiths, 2024).

The recent months have seen a decline in the clean market due to a few other causes. Throughout most of 2024, demand growth stalled, placing pressure on refinery profitability. Even though it has rebounded in recent months, the Brent crack is still much below the levels seen in most of 2022–2023. It fell to little under US\$1/bbl at the

end of August. Economic run-cuts combined with seasonal refinery maintenance have resulted in lower reported throughput levels, with the IEA reporting a low point of 81.8 m b/d in October. This has placed strain on the availability of cargo for CPP ships (IFCHOR Galbraiths, 2024).

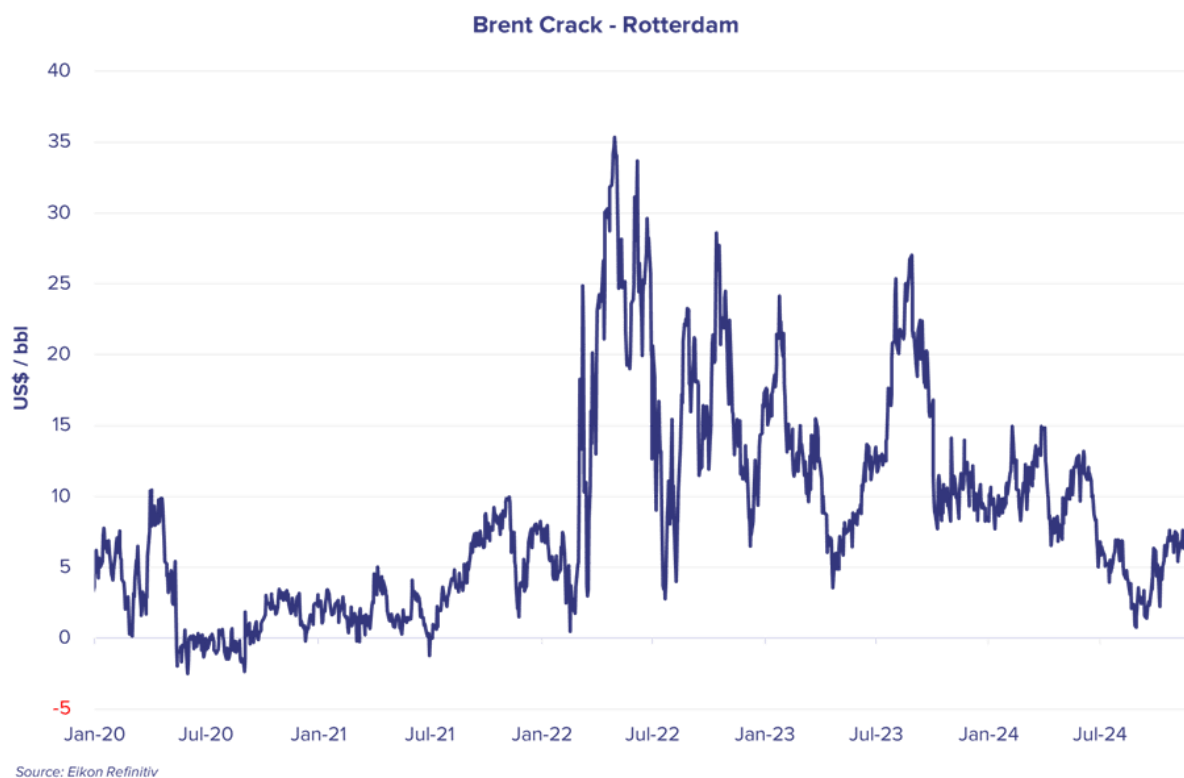


Figure 8: Brent Crack – Rotterdam (Source: IFCHOR Galbraiths, 2024)

In 2024, there has been a growing tendency of big crude tankers "cleaning-up" to carry clean cargoes and avoiding regular markets where they are weak. With each VLCC opting to participate in this transaction, the equivalent of three LR2 cargoes have been removed, significantly reducing the cargo available for CPP tankers. Further cannibalization of clean cargoes should be limited by the now-weaker CPP market and long-haul demand growth from crude tankers from significant non-OPEC Americas cargo growth in 2025, particularly once the now further delayed OPEC barrels begin to return to the market starting in April 2025. There will still be some challenges in the early months of next year, including a rise in tanker deliveries compared to 2024's lowest point and ongoing worries about the state of the world economy. Throughout 2025, it is anticipated that the world's oil demand would rise by just under 1 million barrels per day. However, a huge difference in

refinery capacity between east and west of Suez will be a major factor in CPP tanker demand. According to the IEA, net nameplate capacity in the Atlantic basin is predicted to decrease by 207,000 barrels per day, while 450,000 barrels per day will be added east of Suez, potentially providing some notable east-to-west flows in 2025. Clean tankers should benefit from this in some way, especially the bigger ones that are used for longer journeys (IFCHOR Galbraiths, 2024).

2.1.3 Tanker Routes in the Dirty Petroleum Products (DPP) Market

Crude (or "dirty") tankers are an important part of the global supply chain since they transport unprocessed oil and other heavy oil products. The Baltic Dirty Tanker Index (BDTI) is a standard way to keep an eye on market circumstances in this area. It shows current freight prices for important crude oil routes. A key subject in the literature is how filthy tanker freight rates and the strength of the U.S. currency are related, because the dollar is so important in international commerce and commodity pricing.

Hakkio and Whittaker (1985) say that the U.S. dollar (USD) is the most prevalent currency used to buy oil across the globe. The price of oil in countries that don't use dollars goes up or down as the value of the dollar changes. This is because crude oil prices are usually given in dollars. When the US dollar loses value, oil becomes less expensive for importers. This leads to more demand and, in many cases, more crude oil being shipped by sea (Farley, 2024). But a stronger USD makes oil more expensive in local currency terms, which might dampen demand for oil and oil sent by sea. Research has shown that changes in the value of the dollar impact global oil prices not just by altering how individuals value oil, but also by affecting how much oil people desire to purchase and how much oil is in stock (Coudert & Mignon, 2016). The price of oil affects the expenses of running tankers since oil is the major fuel for tankers. These two channels make things harder. reduced oil prices imply reduced bunker costs, which implies a weaker USD. This might imply that tankers make more money. But it might also imply increased demand for oil and larger shipments, which could retain or boost freight prices. But the way operating costs move up or down isn't always the same as the way freight prices do. When there is increased demand for oil transportation but the fleet is small or the tonne-mile lengths are longer, freight rates may go up even if bunker prices go

down. There is a lot of proof of this non-linear and asymmetric link in the energy and shipping industries, where changes in price in either direction have different impacts on freight rates. Because of this, some think that asymmetric econometric models are preferable for looking at the link between the USD and tankers. People in the industry need to pay close attention to economic indicators like the dollar index because they assist them make better forecasts and strategic choices (Karamperidis et al., 2013). Shipowners use these types of indications to forecast how fuel costs will vary, which helps them make better plans for their budgets and manage risks (Okudan Soytürk & Açık, 2024). It is particularly important to be able to estimate operating expenses in the tanker sector, which requires a lot of money and is very susceptible to fluctuations in energy prices and currency rates. Shippers also utilize leading indications to make their scheduling, route planning, and contract negotiations better. By guessing how transportation costs will fluctuate, they may modify their pricing strategy and keep the supply chain going. Governments also utilize macroeconomic data to figure out how much trade will happen, what tariffs to set, how much to provide in subsidies, how to make trade treaties, and how to plan improvements in port infrastructure (Okudan Soytürk & Açık, 2024). A lot of research has been done on how changes in the value of the US dollar affect global oil prices (Sadorsky, 2000; Lizardo & Mollick, 2010; Beckmann & Czudaj, 2013; Coudert & Mignon, 2016; Kisswani et al., 2019), but not much on how these changes affect the tanker shipping industry, which is very important for moving oil. Changes in fuel costs, currency rates, and tonne-mile demand have a big effect on tanker markets. Understanding the connections between these elements might provide shipowners, charterers, investors, and policymakers useful information. This analysis offers a distinctive contribution to the practical dynamics of tanker transportation by analyzing USD–oil–freight interactions via an asymmetric lens. Knowing that changes in oil and currency prices affect freight rates in various ways makes it easier to model how the tanker market works.

2.2 Economic Theories Relevant to Shipping Markets

In order for marine transportations to be effective as soon as they constitute an important aspect pertaining economic growth, they must abide by rules, regulations and protocols concerning the operations and safety of the transporters. As such, it is essential to highlight the need of state involvement in public international law with reference to actions that must be followed to ensure a safe and sustainable marine transportation system. Through an understanding of the ideas of public goods and externalities that arise from marine transportation, it is essential that it be understood that there is a link between shipping and economic theory. The most significant maritime conventions and acts (MARPOL, SOLAS, STCW, COLREG, OPA 90, and UNCLOS) are then presented, together with an explanation of the function of the International Maritime Organization (IMO).

2.2.1 Basic Economic Principles: Supply in the Tanker Shipping Market

Maritime economics has looked at the behavior of supply in the tanker shipping market in great detail. Tinbergen (1931) and Koopmans (1939) were the first to connect the creation of freight rates to the interplay of supply and demand. Subsequent research, notably Zannetos (1966), established the theoretical underpinnings of cyclical behavior in tanker markets, whilst contemporary marine economics (Stopford, 2009) underscores the significant volatility and pronounced cyclicity inherent in tanker transportation.

Recent empirical research confirm that tanker freight costs exhibit considerable volatility due to economic and geopolitical disruptions. Glen (2006) says that tanker markets are quite unpredictable and that even little changes in the quantity of tonnage available or the amount of transport demand may cause prices to vary a lot. Microeconomic factors such as fleet size, vessel speed, scrapping options, and operating efficiency interact with macroeconomic conditions, commodity price volatility, and geopolitical disruptions, leading to persistent instability (Alizadeh & Talley, 2011). These situations often lead to extreme freight rate outcomes that significantly deviate from long-term standards, making tanker markets riskier than many financial assets (Coles et al., 2001; Laulajainen, 2008).

Recent studies assert that conventional equilibrium-based models are insufficient owing to substantial variations in the tails of the freight rate distribution. Extreme Value

Theory (EVT) has been suggested as an alternative framework proficient at identifying rare but substantial price increases. Statistically, EVT-based methods look at how data that goes above a high threshold or is a block maximum behaves. This offers a better idea of what tail risks are really like (Pickands, 1975; Embrechts et al., 1999). Studies conducted by Ren and Giles (2010) and Marimoutou et al. (2009) demonstrate the effectiveness of EVT in energy and commodities markets. Smirlis et al. (2025) and Basdekis et al. (2022) also use GARCH–EVT combinations to look at tanker freight rates. They show that volatility clustering and fat-tailed distributions are the most common features of the market.

The shifting costs of oil make it increasingly harder to figure out how much to provide. Kilian (2009) states that oil price shocks might arise due of difficulties with supply, demand throughout the globe, or demand that is just for oil. These shocks change the demand for tankers, which in turn changes the cost of shipping. However, this doesn't always happen in the same way. Empirical studies yield ambiguous results: Shi et al. (2013) assert that supply shocks exert the greatest influence on the Baltic Dirty Tanker Index, while Gavriilidis et al. (2018) argue that demand shocks improve forecasting accuracy more effectively than supply-induced variations. These disparities highlight how hard it is to figure out how oil markets and tanker freight pricing are related.

Additional study corroborates the viewpoint that tanker freight volatility is temporally changeable and influenced by structural cracks. GARCH-type models show that the risk is higher for larger ships and in the spot market (Glen & Martin, 1998; Kavussanos, 1996; Kavussanos, 2003). Adland and Cullinane (2006) also write about nonlinear mean-reversion, notably at the extremes of the distribution of freight rates. This reinforces the claim that extreme market outcomes should be considered essential features in supply-side models, rather than simply outliers.

The study indicates that the supply of tankers responds to market signals in a manner that is neither consistent nor linear. Fleet expansion, vessel speed, lay-up options, shipyard activity, and scrapping all fluctuate with a lot of lag, which means that the supply curve is inherently inelastic in the short run. These characteristics, together with demand shocks, geopolitical upheavals, and the statistical prevalence of extreme values, render the market a domain necessitating more sophisticated analytical techniques for forecasting and risk management. EVT and volatility-based models are

useful for understanding how supply operates in tanker markets because they let us see big changes.

2.2.2 Demand in the Tanker Shipping Market

The necessity to supply consumption from the main oil production hubs creates a need for the transportation of oil, either as refined products or in its crude (unrefined) form.

2.2.2.1 Demand Derived

In marine economics, the demand for tanker transportation is classified as derived demand, indicating that the transportation of oil has no intrinsic benefit. The only reason it has value is because it lets the good go to markets where its marginal utility is higher than it was at the place of creation. Oil transportation is a component of the larger supply chain and is a factor of production, hence the usual rules of factor demand apply (Glen & Christy, 2010).

Glen and Christy provide four "Marshallian rules" that control how elastic derived demand is:

The first ones are The final product's elasticity: The demand for oil transportation is more elastic when the demand for refined oil products (such petrol, heating oil, and feedstock) is more elastic.

There is also the possibility of substitution. The more interchangeable the factor input is in the manufacturing process, the more elastic its demand is.

The third guideline is to share costs. The more transportation expenses are a part of the ultimate price for the customer, the more elastic the demand for that input is.

Lastly, supply elasticity means that the more elastic the supply of a factor input is, the more elastic the resulting demand is.

If you use these laws to move oil, you can see why tanker services are so price inelastic.

First, as Rule 1 says, the price elasticity of demand for oil goods is usually low, usually between -0.4 and -1 in the near term. So, the demand for tanker services is likewise not very elastic. Second, Rule 2 says that poor substitutability makes elasticity lower.

This is true even if oil pipelines exist in certain areas; most crude oil has to be moved by sea. Third, the cost of transportation is just a minor part of the retail price of refined oil. For instance, in the UK, freight adds around one cent to the price of a liter of fuel, which is about £1.00. This means that even big changes in freight rates don't have much

of an effect on pricing for consumers. In general, economic theory and real-world data show that the demand for oil transportation is rather inelastic when it comes to freight rates, but far more sensitive to changes in the overall economy. Cross-price elasticities may only become substantial in areas where there are other ways to move goods (such big pipelines) or fuel replacements, as in Brazil (Glen & Christy, 2010).

2.2.2.2 Measuring demand

It has been shown that significant amounts of oil are moved from one area to another each year. This is one measure of the generated demand for changes in oil prices. Transportation is a service that cannot be stored; in order to provide it, the oil cargo must be moved between two locations. There are two techniques to assess the demand for oil. First, in terms of the number of oil tons transported in a certain time frame; second, in terms of the number of ton miles requested in a given time frame. Demand for transportation services is a flow demand, and the total demand is produced by multiplying the volume of cargo by the distance traveled in a certain amount of time.¹⁸ Because changes in route layout, such as a major move to short haul trades, would lower tonne mile demand even if oil volume demand remains constant, average trip length serves as a stand-in for route structure. The converse is true when long-distance routes are used (Glen & Christy, 2010).

	1990	1995	2000	2008
World production (Mn tonnes)	3,164	3,269	3,589	3,929
Seaborne trade				
Mn tonnes	1,526	1,808	2,119	2,681
Bn tonne miles	7,821	9,320	10,420	12,440
Average haul (miles)	5,125	5,155	4,917	4,640
Seaborne trade share of production	48%	56%	59%	68%

Table 1: Trends in oil transportation demand 1990-2008 (Source: Glen & Christy, 2010)

2.2.2.3 Tanker demand trends

Table 4 provides some data on the trends in tanker demand from 1990 to 2008, measured in terms of tons of cargo carried and tons of kilometers traveled annually. It is important to remember that at this time, the average haul of crude and goods movements is around 5,000 miles. Although it seems to be fairly continuous, this hasn't always been the case. The haul averaged 4,775 miles in 1967 and 6,651 miles in 1977. It is evident that the Suez Canal closure from 1967 to 1975 separated the need for tons from the demand for tonsiles. Tonnage demand increased by 13.6% year over the 1968–1973 period, while tonne mile demand increased by 21.4% annually on average. From 1978–1983 tonnage demand decreased by 5.6% annually, while tonne mile demand decreased by 9.0% annually.¹⁹ The closing of key routes, like the Suez Canal, and the shifting patterns of oil demand, either toward or away from long haul trades, are the primary causes of the differences between tonne mile demand and tonne demand for tanker markets. The Very Large Crude Carrier (VLCC), a tanker with a capacity of 200,000 tons or more, also rose to prominence in the early 1970s. It was primarily used for long-distance crude oil transportation from the Middle East to Europe and the Far East, but it was also influenced by the expanding commerce from West Africa to the Far East. These ships' size and draft prevented them from transiting the Suez Canal loaded, but the new technology offered enough scale economies to negate the importance of "distance" factors. It is evident from Table 4 that throughout the last decade, the amount of oil carried has increased. The volume of cargoes being transported on the main oil trade routes varies greatly, according to the oil trade movement map released by BP20. The structure of these routes has remained largely constant, but it may alter in response to developments in new oil fields, disruptions in current supplies, and shifts in the patterns of oil consumption. Singapore has emerged as a key hub for oil movements, reflecting the region's vitality during the last ten years, and there are new significant oil flows from West Africa to the Far East (Glen & Christy, 2010).

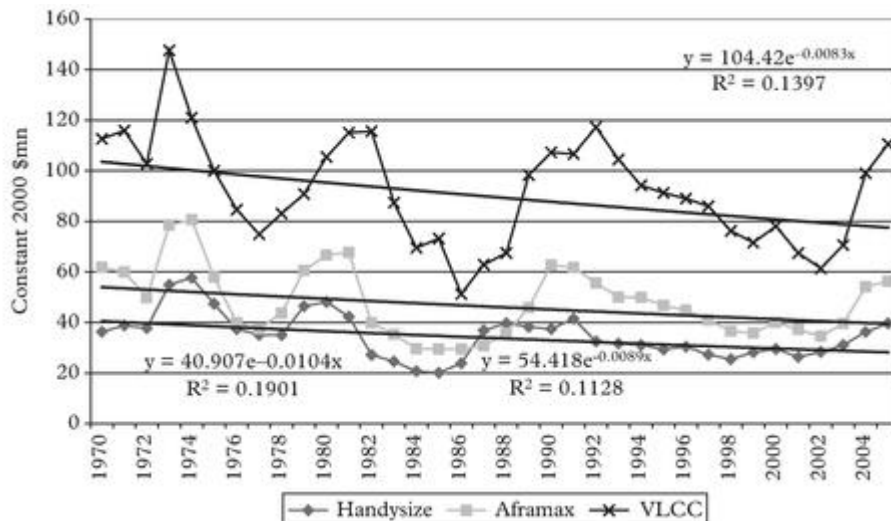


Figure 9: Real tanker prices 1970-2005 (Source: (Glen & Christy, 2010))

2.2.2.4 Cyclical features

The reader may conclude from the evidence so far that demand patterns are mild and long-term. In fact, the maritime markets exhibit distinct cycles of economic activity, and the tanker business is no exception. The most recent tanker boom, which peaked in 2001, was said to be the first in a long time that wasn't brought on by an outside shock like a conflict in the Middle East. Figure 3, which displays the behavior of actual tanker pricing for three size classes from 1970 to 2005, demonstrates the industry's pronounced cyclical character. Boom eras are shown by the positive departure from the trend, whereas "recession" is indicated by the negative divergence. Asset values are a useful indicator of agents' expectations for future profitability and profits. The most recent upturn in the cycle took place in 2003 and ended in 2009. Some analysts stated that the current cycle had vanished in its early stages. They were obviously misinformed (Glen & Christy, 2010).

Examining tanker charter rates—the "hire price" (in dollars per day) for operating a tanker for one's own use without actually owning it—offers an alternate perspective on the market. The historical evolution of one-year rates from 1990 to May 2009 is shown in Figure 4. There are noticeable hiring rate surges in 1997–1998 and 2001, particularly in 2008. It also shows the current "boom" from 2004 to 2008. These times show that the tanker market has moved beyond the effects of the 1970s and 1980s and do not correlate with

outside

events.21

Everyone in the tanker industry knows that their company is cyclical, but no one has been able to come up with a reliable way to predict when the cycle would change from one phase to the next. The cyclical rise in supply and demand, which do not fluctuate at a steady pace, is reflected in the cyclical behavior of rates (Glen & Christy, 2010).

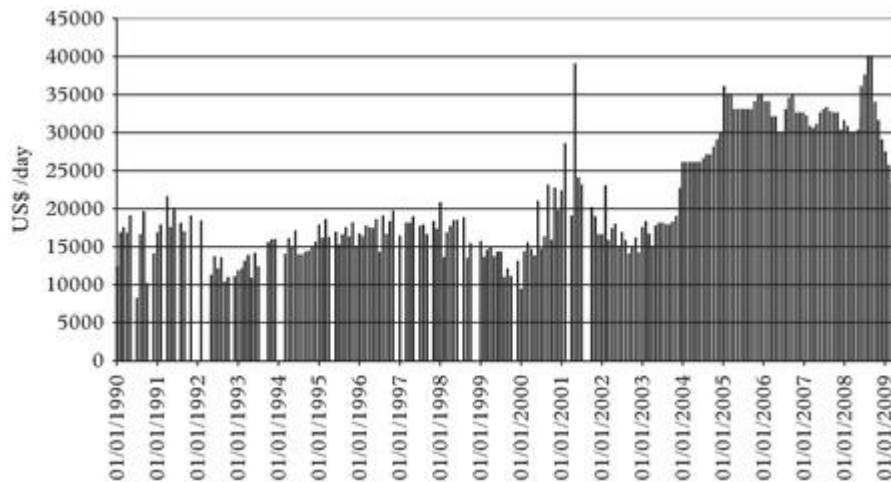


Figure 10 Alframax one-year TC rates 1990–2009 (Source: Glen & Christy, 2010)

2.2.3 Supply dynamics

In 2019, there were 9,025 product tankers in the world, and they could transport 184.8 million dwt (Clarksons Research, 2019). Figure 11 shows that general-purpose (GP) tankers under 10,000 dwt make up the most of the fleet. The MR class, on the other hand, makes up more than 40% of the total tonnage and is still the most flexible because it can reach a wide range of ports (U.S. Energy Information Administration, 2014). In 2019, fleet capacity grew slowly, with total tonnage increasing by 4.7% and the number of vessels increasing by 4.1%. This was mainly due to LR2 and MR deliveries (Torm, 2020).

Even if this growth happened, the real supply became tighter at the end of 2019. The U.S. sanctions on COSCO took away a lot of VLCC capacity, which made several LR2 ships temporarily switch to crude trading (Norden, 2020). Scrubber retrofits added further restrictions, which made it much harder to find clean product tankers for trade. The COVID-19 epidemic made these problems worse by messing up shipyard schedules and delaying staff changes, which made operations less productive. Stopford (2009) says that things like port time, maintenance, ballast legs, and floating storage may have a big effect on the amount of tonnage available each year. These problems

were quite obvious in early 2020.

Figure 12 depicts the fleet's age structure. It reveals that 81% of the capacity is less than 15 years old, with an average age of 11 years (Clarksons Research, 2019). Younger ships need fewer inspections, use less fuel, and work more effectively, which increases total production. But the orderbook is still small. Orders fell from 272 ships in 2018 to 223 in 2019 for delivery in 2020–2022. They fell even more in 2020 because of shocks connected to the pandemic (Bockmann et al., 2020). Because shipyard activities are behind schedule, actual deliveries are projected to be much lower than initial estimates (Catlin, 2020), which will make short-term supply much tighter.

Even though 272 ships are more than 20 years old, there hasn't been any scrapping action. Product tankers usually last 20 to 25 years before they need to be torn down. Because of this, more demolition work is predicted, although when it will happen is still unknown (Sand, 2019; Clarksons Research, 2019). Owners' choices on whether to order or scrap tonnage are heavily based on freight income (Stopford, 2009). High rates in late 2019 and early 2020—due to refinery dislocations, demand for floating storage, and the contango in oil prices—made people want to invest, while COVID-19 uncertainties made businesses apprehensive (Bøge & Marstein, 2020; OPEC, 2020).

BIMCO (2023) predicts that both the crude and product tanker markets will remain strong in the future. This is because demand for tonne-miles is growing since Russian oil flows are being redirected and global consumption of refined products is recovering, as illustrated in Figures 13 and 14. Limited order books and regulatory demands, especially CII and EU ETS, are likely to keep fleet speed low and make it hard to get the right amount of supplies. Crude tankers have higher unpredictability because of geopolitical risk, while product tankers benefit from faster cargo growth and additional refinery capacity in nations that export oil. Under these circumstances, both markets are expected to have one of their longest periods of high profits since the 2008 financial crisis.

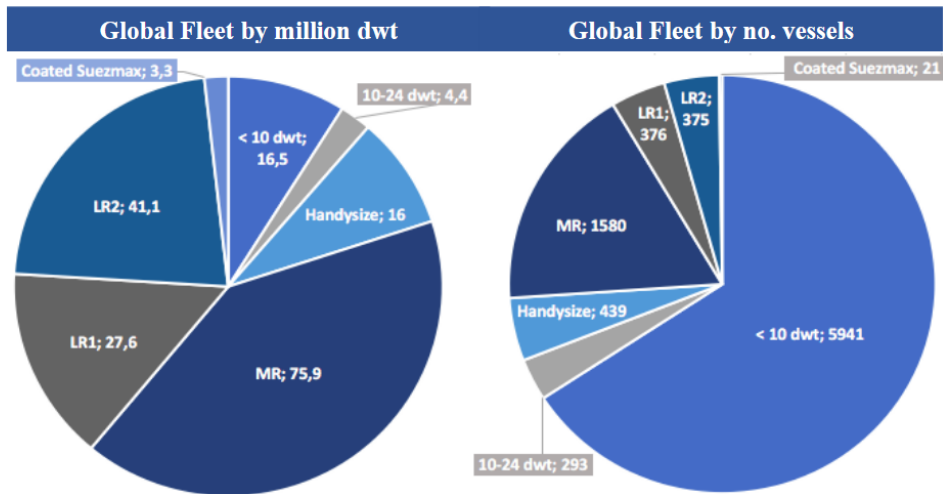


Figure 11: Overview of global merchant fleet (Source: Clarksons Research, 2019)

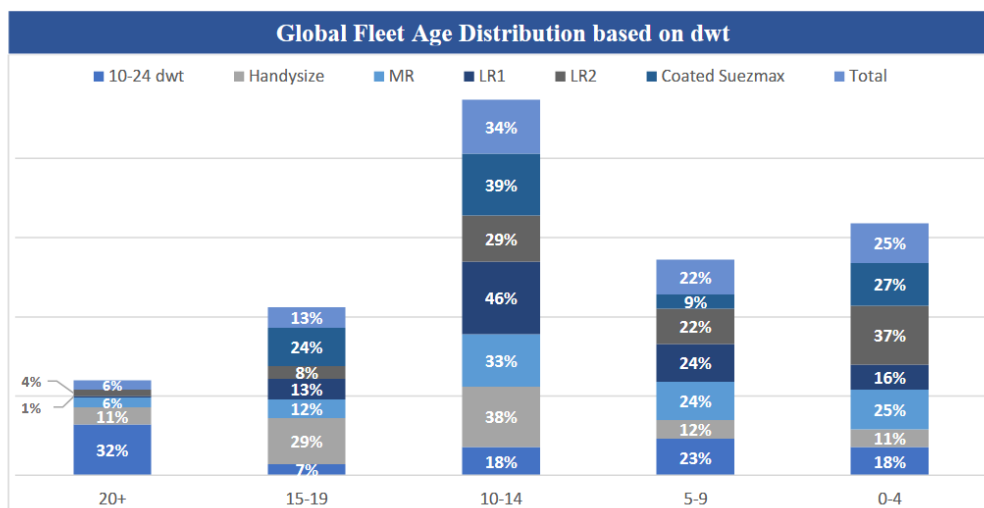


Figure 12: Age by class in the product tanker market (Source: Clarkson Research, 2019)

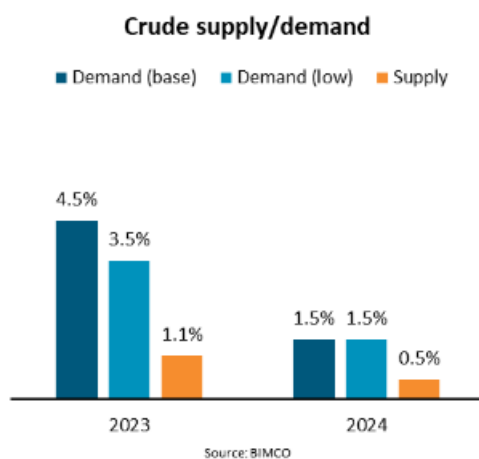


Figure 13 Crude supply/demand (Source: BIMCO, 2023)

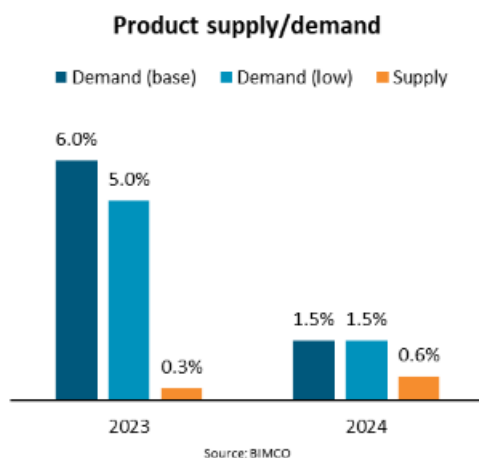


Figure 14 Product supply/ demand (Source: BIMCO, 2023)

2.2.4 Basic Economic Principles: Market Equilibrium in the Tanker Shipping Market

Market equilibrium in the tanker charter industry is an important economic concept that describes the balance between supply and demand. In basic words, equilibrium happens when shipowners supply the same amount of shipping services that charterers want at a certain freight cost. This equilibrium is not set in stone; it varies all the time due to changes in global trade patterns, oil use, geopolitical events, and rules and regulations. In this regard, it is necessary that deep knowledge of the market equilibrium exists so as to predict changes in freight rates, investment cycles, and general market stability.

Freight rates, which are the most important price indication in the tanker market, depend on how much supply and demand there is. Freight costs usually go up as demand goes up, such when oil commerce increases, the global economy grows, or geopolitical tensions rise. When rates are greater, shipowners are more inclined to employ all of their ships. They achieve this by sailing quicker, reducing down on time spent not working, and bringing ships that were previously out of service back into operation. When freight rates are high for a long period, there are usually a lot of newbuilding orders. But it takes years to construct tankers, so the supply often doesn't keep up with the demand. This makes prices go up even more. On the other side, as demand goes down, freight prices go down. This might happen when the economy is bad, when oil use goes down, or when countries that export oil

cut down on production. Shipowners generally put off new orders during these times, and they could even retire older or less efficient ships sooner than they had planned. Many operators utilize slow steaming or lay-up strategies to get the market back to normal and cut down on too much capacity. These actions help avoid things from altering too drastically, but it may take a long time to adjust supply, which means that demand and available tonnage may not line up for a long period. Things outside of the market may have a huge effect on its equilibrium. Changes in the way oil is produced and refined throughout the world, geopolitical crises, and changes in rules might all affect trade flows. Sanctions or trade disputes may force shipping routes that are already in place to shift. This might cause supply and demand to be out of sync in certain areas for a short time. For instance, violence in significant oil-producing regions might block local exports and slow down freight commerce in such areas. At the same time, it might make tankers more popular in other regions as new supply routes open up. Shipowners have had to update their ships or get rid of older ones because of environmental laws like the IMO (2023) sulfur limit. This has impacted the size of their fleets.

Changes that happen because of the season alter the equilibrium. During the winter, people need more heating oil, which means more tankers are needed. In the summer, people drive more, which means more refined goods like gasoline are needed, which affects how much product tankers are used. These changes in demand throughout the year cause freight prices to go up and down in the short term as the market adjusts.

Ton-mile demand is another essential element. It looks at both the amount of goods moved and the distance it goes. Changes in the sources of oil supply, such more crude oil being sent from the Americas instead of the Middle East, may make average trip lengths longer, even if the overall amount of oil shipped stays the same. This enhances the demand for tankers without affecting the amount of cargo, which momentarily throws off the balance and hikes freight prices.

2.2.5 Economic theories for and against state intervention in international shipping and maritime transport

The justification for government interference in the economy, and hence in the shipping industry, was attempted to be explained by a number of economic theories and economists. The extent of this intervention, however, must be taken into account because some economists, such as Friedrich August Hayek (1899–1992), were very liberal and favored the free-market mechanism, while others, such as John Maynard Keynes (1883–1946), took a more conservative stance on government intervention. Here, there is an effort made to analyze the primary economic theories that influence the shipping industry and shape fiscal and economic government policies related to shipping and marine transportation. If a fully competitive market is particularly mentioned, we may infer that the supply and demand sectors are automatically equal and that the company's economic profit is typical (Figure 1).

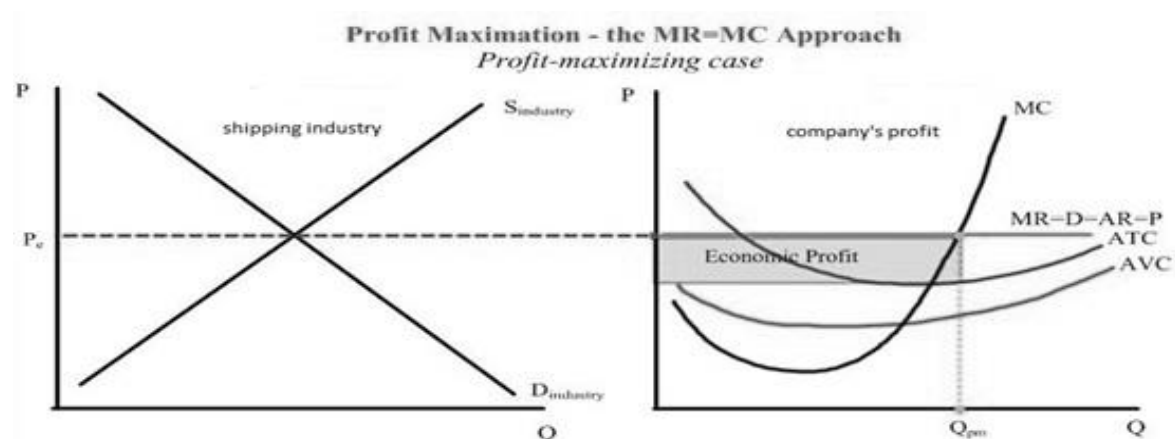


Figure 15 Demand and Supply Equilibrium and Shipping Company's Profit (Source: Mavrokefalos, 2015)

However, when discussing other market types, such as oligopolies and monopolies, the enterprises operating in these markets do not maximize profits in accordance with the maximizing of societal well-being (Figure). For example, ports are seen as monopolistic powers (i.e., the ship will arrive anyway) and provide market investment possibilities that force governments to allow for more private sector involvement and less public sector participation (Haralambides 1998).

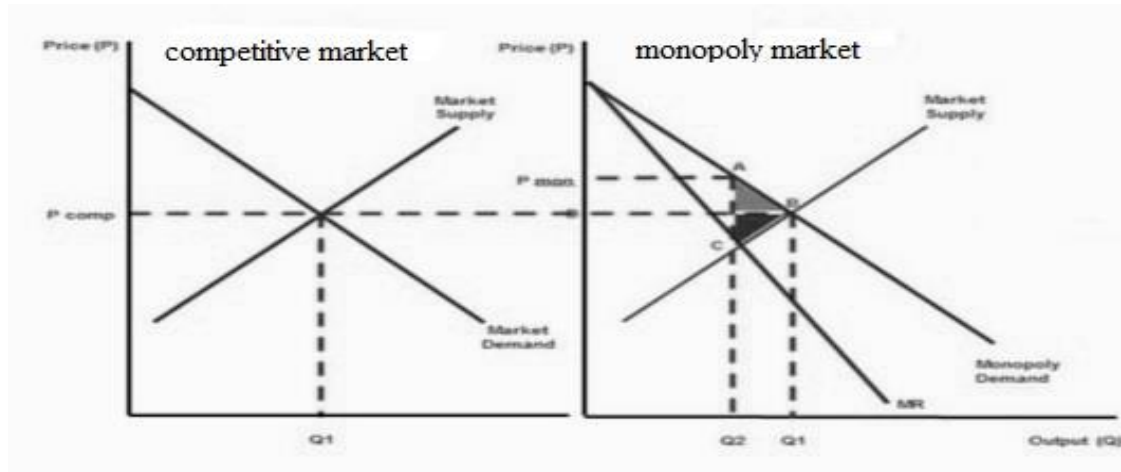


Figure 16. Demand and Supply in Perfect Competitive and Monopoly Market, Shipping Company's Profit and Economic Losses for the society (Source: Mavrokefalos, 2015).

The triangle ABC depicts the complete collapse of civilization or, alternatively, the breakdown of the market. This loss results from the monopoly corporations' (shipping companies') failure to account for the adverse externalities they create for their surroundings. Health, the economy, the ecology, and local economies are all severely impacted by these externalities, and the state must step in by enacting the necessary laws and policies to stop and eradicate those detrimental impacts on the environment. In 1936, J. M. Keynes made the case that governments needed to actively engage in economic policy. He believed that governments ought to step in throughout economic cycles, either by enacting monetary policies that increase public expenditure or by imposing stringent taxes and cutting down on government expenses. In other words, it is necessary for governments to get involved in the market aiming at ensuring that any efforts made by businesses to increase profits involve societal well-being as well. According to the IMO and UN agreements, nations are often required to take action after accidents, whether or not they are deadly, in order to stop future occurrences.

However, Hayek believes that more market efficiency results from less government intervention. He maintained that the economy functions more efficiently when people are free to choose. In his 1960 book "The Constitution of Liberty," Hayek expressed his views on the proper function of government. This is a comprehensive analysis of the right function of government based on the principles of freedom. He argued that progressive taxation undermines equivalency before the law, which was his major point

of contention. Hayek contrasted conservatism to classical liberalism in his book "Why I Am Not a Conservative." Last but not least, Coase's (1910–2013) theory offers the shipping industry highly helpful instructions for governments and marine organizations to avoid adverse consequences on mankind.

2.2.6 Public Goods and Externalities

In marine transportation, "quality" is linked to both safety and the environment. One may argue that, as ideas, they include every aspect of public goods. According to economic theory, this indicates that they are both non-exclusive—for example, no one can profit only from a cleaner ocean—and non-competitive—for example, no one can be prevented from enjoying a clean ocean due to the actions of others. According to Tyler Cowen (2008), it is too expensive to deny non-payers access to a good, because people cannot enjoy a good without increasing the cost of its production and denying others the opportunity to do so. However, since they won't be able to price them as the business sector suggests, market participants are hesitant to comply with safety regulations. At this stage, they violate quality by creating externalities, in which an action taken by one individual reduces the welfare of another agent. People who are not in commercial relationships with the ship owner, such as fishermen, locals, and businesspeople, may suffer financial or recreational losses if the ship unlawfully disposes of garbage into the ocean. This raises the issue of whether and how much government engagement is necessary to ensure environmental and public safety. Pigou offers the following response to this query: "the government may find it necessary to exercise some means of authoritative control when the interrelations of the various private persons affected are highly complex" (Pigou 1920). Coase acknowledges the importance of supervision in defining and enforcing property rights for natural resources and reducing transaction costs, but he rejects government involvement in the form of standard-setting or taxation to address the externality.

Economic theories attempted to provide justifications for government involvement in the shipping industry. Coase argues in his 1960 paper "The Problem of Social Cost" that pollution from waste produced in an economic system poses a threat to the environment. He concentrated on the property rights of pollution, highlighting the detrimental externalities of some businesses' operations, including as oil spills,

contaminated oceans, ineffective sewage systems, and the like, as well as externalities coupled with the lives of seafarers. His analysis of the transportation of goods by water looks at both societal costs and negative externalities. As long as property rights are well defined and transaction costs are fair, Coase emphasizes that stakeholders should trade with one another to optimize the result. As a result, the state may step in and award property rights to determine who is allowed to pollute and to what degree. The negative externalities produced by the so-called free-riders in economics, who are indifferent to societal costs, will be lessened as a result of these rules. These participants will anticipate that someone else will take on the duty of enforcing and safeguarding them unless the state steps in. The lighthouse paradigm (Mill 1998) effectively illustrates this concept, since ship owners refuse to pay for the upkeep or building of lighthouses. Their actions are in opposition to Gray's 1865 perspective on the provided "self-interest and emulation of the trader," who operates in a free competitive market (Goss R.O.), and they do not assume responsibility. Coase maintained that in addition to lowering the societal cost of the detrimental activities of the maritime sector, maximizing social benefit must be a top objective. The market was unable to adequately address these externalities and the role of the "invisible hand," as Adam Smith (1723–1790) refers to it in "The Wealth of Nations: An Inquiry into the Nature and Causes of the Wealth of Nations: First published in 1776."

Given the reasoning above, governments would be better off implementing preventative measures to enhance safety and save the environment than responding after the fact. The International Maritime Organization has offered the following answers in this regard, along with certain Acts that adhere to public international law.

2.2.7 The IMO, its structure and the chronicle of the creation and amendment of its Conventions

The shipping sector is subject to a complex web of rules and procedures since it is an international business. The IMO oversees all facets of international shipping and the 53 treaty instruments that are now in effect, including SOLAS and MARPOL, the two main conventions on maritime pollution and safety that are backed by rules and regulations and apply to commercial ships for the duration of their lives. In order to implement rules and recommendations pertaining to maritime safety, navigational

efficiency, the prevention or reduction of marine pollution from ships, and other legal problems, the IMO, which represents the public sector, must encourage cooperation between states. Convention adoption and implementation are the focus of its six primary bodies. The primary decision-making bodies are the Assembly and the Council. In any committee, any Member State may bring up the need for new conventions or changes. Following a consensus, the plan is sent to the Council and, if required, the Assembly for approval. After the proposal has been approved by the two major organizations, the relevant committee starts looking into the issue more thoroughly. Eventually, a draft Convention is created, and if it is approved by the Assembly, it is adopted. After that, Member States come to the Assembly to discuss the Draft Convention, which is typically available for signing for a year. The Convention becomes enforceable whenever all necessary requirements are fulfilled. In addition to the IMO, the European Maritime Safety Agency (EMSA) is in charge of overseeing the application of EU laws pertaining to ship construction, pollution control, etc. (EMSA website). Last but not least, the three intergovernmental funds that make up the IOPC Funds, an institution separate from the IMO, are dedicated to compensating member states who are parties to the 1992 Civil Liability Convention (CLC '92) and have experienced oil disasters but were not reimbursed under the Convention. In the guise of conventions, a wide range of measurements have been adopted since 1959. Conventions are the most significant of these metrics, and three of them are especially pertinent to navigation. The first of them is the 1974 International Convention for the Safety of Life at Sea (SOLAS), which is often considered to be the most significant international agreement. Setting minimal requirements for safe ship design, equipment, and operation is its primary goal (IMO website).

The Convention on the International Regulations for Preventing Collisions at Sea, or COLREG, was established in 1972. It includes standards for vessel operations in small channels and with limited sight, as well as rules for ships experiencing maneuverability issues. It also contains provisions for ship procedures under traffic separation systems.

The 1978 International Convention on the Standards of Seafarers' Certification, Training, and Watchkeeping (STCW). It establishes requirements for seagoing commercial ship captains, crews, and watch staff. It became effective in 1984 and underwent major revisions in 1995 (IMO website).

The main international convention that prevents ships from contaminating the maritime environment by operational or unintentional means and from disposing of other hazardous materials is MARPOL 73/78, often known as the "International Convention for the Prevention of Pollution from Ships 1973/78." In actuality, around one-fifth of the cargo on board the Exxon Valdez, which was carrying crude oil, leaked in March 1989. The Oil Pollution Act of 1990 (OPA 90), which required all tankers calling at U.S. ports to have double hulls, was adopted in response to public demands after the worst oil leak in US history. The United States also petitioned the IMO to demand twin hulls for MARPOL (IMO website). Furthermore, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) lays out the fundamental rights and responsibilities of states with regard to vessels flying their flag, establishes a comprehensive set of rules governing the world's seas and oceans, and serves as the foundation for the regulation of ships and the provision of maritime transport services. Members of the Member States are among the participants. Ultimately, the flag state or the port state that complies with the Convention's provisions applies the regulatory structure. Lastly, governments need to provide infrastructure that makes it safer to navigate and operate boats. The construction of lighthouses to ensure navigation safety, the expansion of current commercial ports and the construction of new, modern, and effective ones to prevent maneuvering problems, the provision of amenities like breakwaters, and channel dredging for safer navigation are all examples of this type of infrastructure. In order to maintain or deepen navigation channels and guarantee the safe passage of boats, dredging is used. The Panama Canal extension project is the most common example. By 2016, this project hopes to increase the canal's capacity. Dredging is essential to the nation's economic success as well as the social and global well-being of the globe since large ships transport the majority of the items brought into the nation.

2.3 Understanding Charter Markets

In contrast to the general financial literature, the relationship between decision-making and forecasting evaluation in a scenario where economic profit is a suitable indicator of forecast accuracy has not yet been explored in shipping economics, and predictability is still a challenge in maritime economics. Regression variables for optimizing chartering techniques are not included in any decision support system. Selecting the appropriate policy is essential for ship operators' welfare in order to guarantee a steady

flow of revenue. The study creates a model for figuring out the best chartering practices for bulk commodity ocean transportation services. The liner market and the bulk market are the two main segments of the ocean transportation industry. The former carries manufactured goods in containers and is the market for standard transportation services. While the liner industry is oligopolistic and similar to the airline sector, the bulk market is almost entirely competitive. Regarding ship utilization, ship operators have three options: Pts charter the ship in the spot market (for a single voyage); Pts charter the ship in the term charter market (for multiple voyages); or Pts lay up the vessel (which involves putting it out of commission for a fair amount of time in order to wait for better market conditions; however, laying up entails some maintenance costs as well as "in" and "out" fees, but variable costs are minimal) (Pourkermani, 2023).

The time charter equivalent (TCE) spot freight rate is referred to as the "spot freight rate" in this context. The TCE was created to compare spot and time charter prices since hire rates for boats on spot charters aren't always specified as daily rates. In empirical marine finance, the decision-making process and the predictability of the freight rate market have been significant problems. The efficient market hypothesis is predicated on the fundamental premise of rational expectations, which holds that if one could consistently predict market developments with success, limitless economic profits would be generated. Accordingly, if a market is informationally efficient, it is impossible to beat the market because all information is already factored into the freight price. Consequently, the economic profit produced by the projections will be used to analyze the market's predictability in this study.

Predicting freight price returns is used to simulate recursive strategy choices, assuming that the ship operator who is confident in the prediction moves between the spot and term charter markets. The ship owner will choose the spot market if the outlook favors it; if not, the operator will prefer the term charter market. The final wealth obtained by selecting either of the options is compared to the final wealth determined by the forecast; this is done while taking into account the fact that the real-world forecast is based on economic profit in order to determine whether returns are predictable and can, therefore, be used to generate economic profit. It has long been assumed that macroeconomic factors and commodity prices drive the shipping market in the long run, but this has not been examined econometrically and may be largely incorrect. The majority of the short-term shipping market is influenced

by factors other than the observable macroeconomic fundamentals. The two most basic presumptions that underlie macro theories are the efficiency of the market and the rationality of macroeconomic actors. To put it another way, agents make decisions by integrating all of their present information and preferences into logical predictions about the future (Pourkermani, 2023).

2.3.1 Time Charter

Time chartering is one of the most prevalent methods to hire a tanker ship. A time charter contract allows the charterer hire the ship from the owner for a certain length of time, which may be anything from a few months to several years. During this period, the charterer is in command of the ship's business usage, which includes picking the route and the cargo. The shipowner is still in control of the ship's technical operations, such hiring and firing crew members, keeping the ship in good shape, and acquiring insurance (Stopford, 2009; Pourkermani, 2023).

The time charter rate is the amount that the charterer pays every day or every month. The price is dependent on the current situation of the market, the availability of the ship, and the predicted demand for tanker services (Glen & Christy, 2010). One big benefit for charterers is that they may find out how much their transportation will cost ahead of time. Fixed-rate contracts protect enterprises from the spot freight market's ups and downs, which makes it simpler to plan logistics (BIMCO, 2023). These sorts of contracts provide shipowners a steady source of money that isn't affected by short-term fluctuations in the market (Pourkermani, 2023).

The charterer pays for the fuel (bunkers), port taxes, and travel charges when they rent a time charter. The owner pays for these things in voyage charters. This implies that the charterer might lose money if fuel costs go up, which could have a large influence on the total cost of transportation. huge oil companies and huge commodities traders still like this cost structure because they want to be in charge of their businesses and don't want to be overly exposed to market volatility (Stopford, 2009; Glen & Christy, 2010). The duration of a time charter influences the level of risk and autonomy for each party. Short-term or "trip time" charters, which only cover one or a few journeys, are more flexible but also leave both parties more sensitive to market movements. Long-term

contracts, on the other hand, keep prices consistent over time, but they also include built-in risks. For example, shipowners might lose money if market rates go up, while charterers could end up paying more than market rates if the market goes down (Pourkermani, 2023).

Key phrases in time charter agreements spell out what each side has to do and what they have the right to do. The "off-hire" clause, for instance, indicates when the ship is not accessible due of problems or delays caused by the owner, and the charterer does not have to pay hire during such periods. This condition saves charterers from having to pay for costs when the ship can't be used (Bøge & Marstein, 2020). The price of time charters depends a lot on how the market is doing. Prices go climb when demand for tankers goes up because of increasing oil flow, geopolitical events, or seasonal reasons. This makes charters more expensive. On the other hand, shipowners may have trouble finding long-term work for their ships at good rates during downturns (BIMCO, 2023).

So, time charter rates indicate how the world economy and trade vary over time (Stopford, 2009). In brief, time chartering is a simple approach to negotiate deals in the tanker market that allows both parties a decent balance of stability and control over operations. This method provides shipowners a constant stream of cash and charterers greater peace of mind concerning logistics. However, it also puts both parties at risk of fuel price volatility, market instability, and contract obligations. So, everyone in the company who wants to get the most out of their fleet, keep costs down, and do well in the cyclical tanker market has to know all there is to know about how time charters work (Pourkermani, 2023; Stopford, 2009).

2.3.2 Bareboat Charter

A bareboat charter, sometimes known as a demise charter, is a contract in which the person who rents the boat has full ownership and operational duties for it for a certain length of time, generally many years (Stopford, 2009; Glen & Christy, 2010). The shipowner is still in responsible of managing the crew, maintaining the ship in excellent repair, and monitoring operations whether the ship is on a cruise or a time charter. The charterer, on the other hand, is responsible for all of these things in a bareboat charter.

In this deal, the shipowner just provides the ship. The charterer has to pay for everything that has to do with the ship, such maintenance, personnel, insurance, and fuel (Pourkermani, 2023).

Bareboat charters are generally utilized for financing and fleet organization in the tanker shipping business, not for short-term commercial use (Bøge & Marstein, 2020). Shipping firms and huge oil companies sometimes utilize bareboat arrangements to acquire ship space without having to purchase the whole ship. The charterer may utilize the ship as it's their own for their own travel needs and pay the owner a set charter fee (Stopford, 2009). This arrangement is good for shipowners because it gives them a steady stream of income without having to deal with the day-to-day costs and responsibility of running the ship. One of the best things about bareboat charters is that they provide both parties long-term financial freedom (Glen & Christy, 2010). Charterers, particularly big oil and transportation corporations, may add to their fleets without making a big upfront investment by signing leasing agreements that keep their cash flow while giving them complete control over operations (BIMCO, 2023). Shipowners who want regular, low-risk revenue typically prefer to lease their ships under bareboat conditions. This means they retain ownership of the ships but give up all operating obligations (Stopford, 2009; Bøge & Marstein, 2020).

Many bareboat rentals come with purchase options, which let the charterer buy the boat at the conclusion of the lease for a certain fee. These "bareboat hire-purchase agreements" are widespread in ship finance since they let charterers eventually acquire the ship while letting shipowners slowly get their money back (Glen & Christy, 2010).

Even while bareboat charters have certain benefits, they are quite risky for both parties. Charterers who have complete operational authority are responsible for maintenance, compliance, and being exposed to market volatility (Pourkermani, 2023). A big drop in freight rates might make it hard to cover operational expenditures, which lowers profits. Shipowners run the risk that the ship won't be well cared for during the charter time, which might lead to damage or expensive repairs when the ship is returned (Stopford, 2009).

Regulatory compliance is another important part of bareboat charters. Charterers must make sure that ships follow all safety, environmental, and operational criteria, such as those set by international maritime agreements, flag state legislation, and classification

societies (BIMCO, 2023). If you don't satisfy these requirements, you might face significant fines, limits on your business, or harm to your reputation.

In brief, bareboat charters let shipowners generate money without having to perform any work on the ship. The charterer has full control over the ship. Most of the time, this structure is employed to make money and add to the fleet. It allows the charterer financial independence and the potential to acquire the boat, but it also gives them a lot of operational and financial responsibility and puts the owner at risk (Stopford, 2009; Glen & Christy, 2010; Pourkermani, 2023). People who work in shipping, investors, and people who work in the oil business who want to enhance fleet management and deal with the complexities of the tanker charter market need to know a lot about bareboat charter agreements (Bøge & Marstein, 2020).

2.3.3. Tanker Charter Market

Bareboat charters provide shipowners a constant stream of money without having to deal with the everyday expenditures and problems of running a ship (Stopford, 2009; Glen & Christy, 2010). This kind of leasing gives charterers long-term financial freedom (Bøge & Marstein, 2020). Big transportation and energy firms may grow their fleets without making a big investment up front. This lets them keep their money flowing while still being in charge of everything (BIMCO, 2023). Shipowners, on the other hand, preserve ownership but give up all operating tasks. This keeps returns constant while limiting exposure to market risk (Pourkermani, 2023; Stopford, 2009).

A lot of the time, bareboat contracts provide a purchase option that lets the charterer buy the boat at the conclusion of the lease for a certain sum (Glen & Christy, 2010). Ship financing often uses hire-purchase plans since they let owners slowly get their money back and charterers eventually buy the ship (Bøge & Marstein, 2020).

But the deal comes with hazards. The charterer is fully responsible for maintenance, crew management, and compliance, and the market's ups and downs have a direct effect on them (Stopford, 2009; Pourkermani, 2023). When freight rates go down, it might be hard to keep expenses down. Shipowners run the risk of getting their ship back in bad shape since it wasn't taken care of properly, which raises repair costs (Glen & Christy, 2010).

Another important part is following the rules very closely. Charterers must make sure that the ship meets all of the safety, environmental, and operational criteria stipulated by international agreements, the flag state, and classification bodies (BIMCO, 2023). Not following the rules might result in fines, limits on operations, or damage to your reputation (Stopford, 2009; Bøge & Marstein, 2020).

3. Analysis of Tanker Charter Markets

3.1 Historical Trends in Tanker Charter Markets

Changes in the world economy, politics, and maritime technology have always impacted the tanker chartering market. It is needed that there exist knowledge of the way supply, demand, freight rates, and market structure have evolved throughout time in order to comprehend the way the market operates nowadays (Stopford, 2009; Glen & Christy, 2010).

After World War II, North America, Western Europe, and East Asia (1945–1973) became tremendously industrialized very rapidly. This made people utilize a lot more energy. This caused the tanker fleet to increase and the introduction of VLCCs and ULCCs, which leveraged economies of scale to make shipping more affordable (Stopford, 2009; UNCTAD, 2012). Clarksons Research (2024) have found that freight rates remained high at this period due to the vast amount of exports that have been noted from the Middle East as well as from the fact that the market seems to have been balanced.

The oil shocks from the 1970s resulted in the this tendency to stop from becoming worse. The oil embargo that took place in 1973 by OPEC led the oil prices to increase although the demand was down (IEA, 2024) while a lot of orders have been put into place during the previous boom period. The Iranian Revolution and the Iran-Iraq War that followed led to another change in the scenery and made the situation more instable. Because of this, Western nations made investments into energy efficiency and there has been a cease in use of oil, which reduced the amount of crude oil that was transported by sea (Stopford, 2009; Glen & Christy, 2010).

In the 1990s and early 2000s, the market started becoming stable again. The rapid increase observed pertaining the Chinese and Indian markets and the ever increasing

dominance of globalization resulted in a subsequent increase in oil trade (UNCTAD, 2018; OECD, 2025). Big oil spills like the Exxon Valdez and Erika catastrophes led to stricter restrictions for safety and the environment, notably the MARPOL rule that ships must have double hulls (IMO, 2023; BIMCO, 2023).

The tanker market went through a "super-cycle" from 2003 to 2008 because China's economy was growing and oil usage was expanding, which pushed freight costs to record highs (Clarksons Research, 2024). The boom came to an end all of a sudden in 2008 when the global financial crisis struck. Demand went down a bit, but the huge number of new ships coming in from old contracts made the supply too high and the freight rates fell a lot (Stopford, 2009; UNCTAD, 2012). New standards for managing ballast water and emissions make it more costly to meet the rules at the same time (IMO, 2023).

There have been a number of shocks from outside the tanker industry in the previous 10 years. Trade patterns have altered a lot because of geopolitical tensions in the Middle East and Eastern Europe, the danger of piracy, and traffic jams at critical maritime chokepoints (BIMCO, 2024; IEA, 2025).

The world is moving toward decarbonization, which has sped up the development of cleaner and more efficient marine technology (OECD, 2025; DNV, 2024). The COVID-19 epidemic made things even less stable. In 2020, oil demand fell, which lowered freight levels until markets slowly started to recover (UNCTAD, 2024).

The Russian invasion of Ukraine and Western restrictions on Russian oil have changed the way oil is traded throughout the world since 2022. Flows of crude oil have increased in the Asian market and especially from China and India that had as a result, the journeys to be longer and the demand to be increased per tonne-mile at a large extent. The longer the routes, the more tankers were used or needed to be used and this led to higher freight rates especially in the cases of Aframax and Suezmax sectors (Gordon, 2025; IEA, 2025).

3.2 Current Market Dynamics

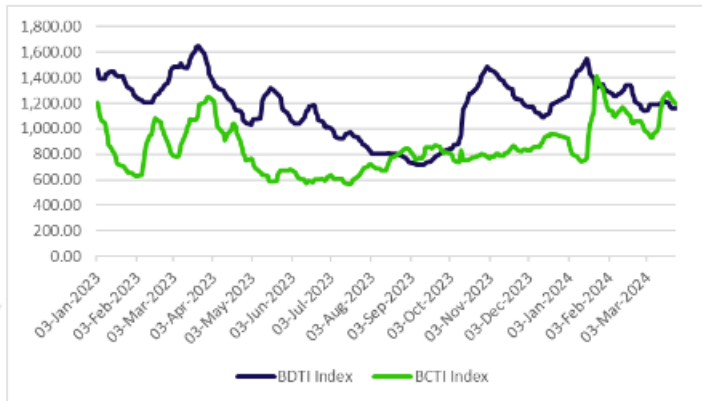
A combination of political issues, shifting trade patterns, new restrictions, and changes in how fleets are formed all have an effect on modern tanker markets. The Red Sea issue and new restrictions on Russian oil and refined goods were two of the biggest

news stories in early 2024. Both of these things produced a huge shift in the way ships moved across the world.

Attacks on commercial ships in the Red Sea forced big shipping companies cease going through the region. This made voyages around the Cape of Good Hope take longer. This shift in route increased tonne-mile demand, notably for product tankers that delivered gasoline and diesel to Europe after Russia ceased providing them. Even though there wasn't always enough goods, this kept freight costs high. The situation became worse since the crisis struck at the same time as the global refinery maintenance season. This made the supply of refined goods tighter and caused longer delivery delays, higher freight expenses, and more price changes. OPEC also said that world oil usage will go up, mostly because China's economy was growing stronger. But supply of liquids outside of OPEC remained low, so the globe had to depend more on long-haul product and crude shipments.

In February 2024, the market moved in a manner that highlighted how geopolitical uncertainty and pressures that only affect particular sectors worked together. Freight charges went up a lot after a small decline, especially for clean tankers. This was because gasoline prices rose increased because of problems in the Middle East and fears that U.S. sanctions on Venezuela might restrict supplies. Stolt-Nielsen's growing stake in Odfjell SE was another evidence of consolidation. This demonstrated that the corporation was shifting its strategy in the petrochemical and tanker sectors (National and Kapodistrian University of Athens, 2024).

Rerouting in the Red Sea continued to generate a disparity between spot fixings and clean tanker rates. This showed that the market was mixed and operations were not always predictable. European merchants are choosing to make longer treks across Africa to purchase commodities more and more regularly. This indicates that issues in one place may have an effect on freight markets all around the globe. The scenario highlighted how geopolitical shocks and logistical problems may impact tanker freight pricing, as well as how regional and global supply chains depend on each other.



Graph 1: Baltic Dirty Tanker and Clean Tanker Index

Figure 17 Baltic Dirty Tanker and Clean Tanker Index (Source: (National and Kapodistrian University of Athens, 2024)

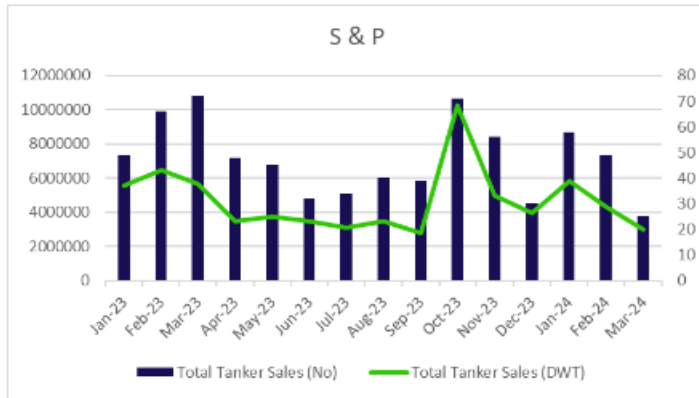
In March 2024, the market started showing its confidence levels. According to BIMCO the demand for petroleum and product tankers which has increased in conjunction with the effect that the geopolitical rerouting had made projections pertaining freight rates seem good. There was still a lot of interest in new ship constructions and more particularly orders were placed for tankers, Aframax, VLCCs, LR2 chemical tankers, and methanol-ready ships. Major shipowners including COSCO, Union Maritime, Maran, and Seatankers were active something that showed that their level of confidence was increased due to the long-term demand for tanker capacity in combination with the much needed shift to cleaner propulsion technology. There were low levels concerning impacts however there has been noted an increase in the orderbook at an international level.



Graph 2: Orderbook for Tankers

Figure 18 Orderbook for Tankers (Source: (National and Kapodistrian University of Athens, 2024)

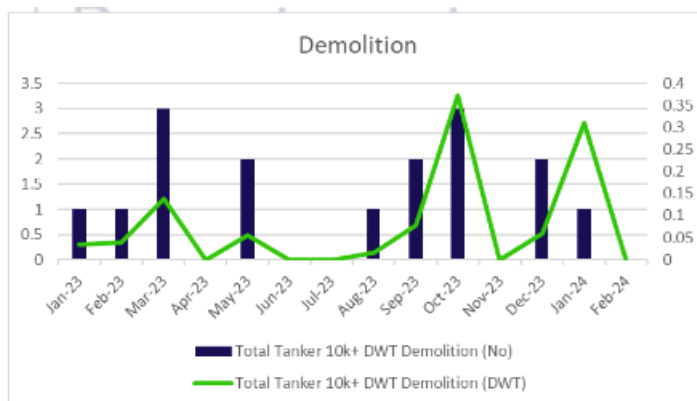
The S&P market also seemed to be characterized by high demand as there have been observed high investments in ecologically friendly ship designs like VLCCs with scrubbers and tankers that can carry LNG. Greek owners were quite active, buying contemporary ships and doing both new and used ship trades. Even if there were times when tanker S&P was quieter, overall activity showed that investors still had faith in the future of the freight business (National and Kapodistrian University of Athens, 2024).



Graph 3: Sales & Purchase market

Figure 19 Sales & Purchase market

On the other hand, the ship-recycling industry was stagnant for much of early 2024. Limited availability of end-of-life tonnage, stable second-hand pricing, and uncertainty about regulations, especially about how the Basel and Hong Kong Conventions would work together, all led to less activity. Bangladesh and Pakistan, two South Asian countries, had trouble getting loans. India and Turkey, on the other hand, said there wasn't much demand for junk boats. Strong freight markets for both dry bulk and tankers made demolition even less likely, which slowed down fleet renewal cycles and made supply-side rigidity even stronger.



Graph 4: Demolition market

Figure 20: Demolition market (Source: (National and Kapodistrian University of Athens, 2024)

3.3 Key Drivers Influencing Charter Markets

3.3.1 Economic factors: global oil demand, bunker fuel prices, and freight rates.

To know how freight rates vary and how the overall industry is performing, you need to look at the economic factors that impact the tanker charter market. International economic activity, changes in energy demand, crude oil and bunker prices, and the general liquidity of global markets all have a direct impact on charter markets. These things interact together in a sophisticated manner to create an environment that businesses must constantly adjust in order to make money.

3.3.1.1 The international demand for oil and energy transformation

Oil demand is the most significant parameter affecting tanker activity. This is because much of the liquid cargo traffic is the transfer of crude oil and refined products. Recent data from the International Energy Agency (IEA, 2025) shows that overall oil consumption will be consistent at about 100 million barrels per day until at least 2030. This is true even if the contribution of renewable energy sources in the energy mix is slowly growing. The expected stability does not mean that things will stay the same; it means that the world economy is going through a transition phase during which oil is still the main fuel for industry, transportation, and power production (World Bank, 2025).

Regional differences in demand are very important for determining marine flows. Advanced economies in Europe and North America are more actively embracing decarbonization strategies. However, oil consumption is still growing quickly in rising markets in Asia. China, India, and Southeast Asian nations currently make up more than 60% of the world's demand increase (UNCTAD, 2024). This is making more people want to carry crude oil and finished goods. There is a lot of industrial expansion in these regions, more people are relocating to cities, and highways and air transport are increasing swiftly. All of these factors are helping oil endure longer as a key source

of energy. But the conversion to cleaner energy sources is more of a change in demand than a decline in demand. Developed nations make less use of oil as part of abiding by the Paris Agreement which has set net zero emissions until 2050. At the same time, they are making it more important to find other fuels, such as liquefied natural gas (LNG) and ammonia (DNV, 2024).

This change does not mean less effort for shipping; instead, it means that commerce flows will change and ships will have to take different routes. A good illustration is how markets will change after 2022 in terms of geo-economics. European sanctions on Russia have made it very hard for Russia to sell its crude oil, therefore Moscow is looking for new customers in Asia. This change has made shipping routes longer, from 2,000 nautical miles (Russia to Europe) to 8,000 to 10,000 nautical miles (Russia to India/China). This has also raised "ton-mile demand," which is the amount of effort needed to move one ton of goods per nautical mile (Gordon, 2025). The Baltic and International Maritime Council (BIMCO, 2024) says that this change has boosted the use of the whole fleet by 8–10%, which has kept freight rates at historically high levels even while the total amount of commerce has not changed. Also, political instability and changes in oil prices have a direct impact on charter scheduling. According to S&P Global Commodity Insights (2025), the price of crude oil rose beyond \$90 per barrel in 2024. This made transportation more expensive and made shipowners more profitable by making spot freight prices more volatile. The market's long-term visibility is hurt, nevertheless, by uncertainties about how long the energy transition will take and how stable the governments of producing nations will be (for example, in the Middle East and North Africa). In general, the demand for oil throughout the world is what connects energy policy, shipping supply, and investment choices. The energy transition is expected to slowly reduce the use of fossil fuels. However, the transition period over the next few decades may be especially good for tankers. This is because changes in trade flows and longer transport distances will keep demand for seaborne oil and product transport high.

3.3.1.2 Fuel prices and operational costs

Fuel costs are still one of the most important and unpredictable things that affect the profitability of tanker operations. Clarksons Research (2024) says that bunker prices may make up as much as 60% of a ship's overall operating costs. This means that changes in freight rates are strongly tied to changes in energy markets. Because of this, shipowners and charterers are always trying to find a balance between their fuel costs and their income.

The IMO 2020 rule changed the structure of the industry by lowering the worldwide sulfur limit in marine fuels from 3.5% to 0.5%. At first, this change in the regulation created a mess-up in the markets and increased the prices for ships without exhaust-gas scrubbers. It has been supported in DNV (2024) that older tonnage use faced challenges pertaining use more than younger tonnage in the first two years after the regulation was imposed. The difference in price between very-low-sulfur fuel oil (VLSFO) and high-sulfur fuel oil (HSFO) was 35–40%, which explains the reason of this. Even if there has been a slow reaction observed in the market, the gas costs that have risen led to profitability issues, especially in 2020 and 2021 that prices have been observed to be low.

Geopolitics still has an impact on the price of gasoline and bunkers. Prices go climb and fall swiftly because of war in certain areas, sanctions against Russia and Iran, and fluctuations in OPEC+ supply (S&P Global Commodity Insights, 2025). When the price of crude oil is overly high, shipowners must deal with greater operating costs and a decrease in shipping demand.

"Slow steaming," or speeding up processes, may save 10% to 20% of fuel without hurting productivity. The EU and IMO's stricter environmental rules have led to a big increase in investments in LNG, methanol, and biofuels (OECD, 2025). But hefty starting expenses and a lack of recharging infrastructure make it hard for many people to use it.

Operators may expect to make money on their investments and protect themselves from bunker costs by using fuel swaps, futures, and options (Baltic Exchange, 2025). Spot and time chartering balance risk. Time charters provide you steady income, while spot

exposure pays well when the market goes up. Gordon (2025) found that owners who employed both tactics profited 12–15% more each year in fuel markets that changed a lot.

Businesses are starting to care more and more about how much they spend on the environment. Shipping will be part of the EU ETS in 2024. The EEXI and CII indicators from the IMO will likewise improve performance criteria. These days, following the rules is a legal and financial issue. Modern hull coatings, variable-pitch propellers, and improved energy management systems are examples of energy-efficient technologies that might cut costs and make it easier to get loans (DNV, 2024). At present, the management of fuel costs not only does it mean to make things work more effectively and at a high performance. It means that alterations should take place taking into consideration the weather, politics, and technological change. In a global economy which is driven by a swift in the way energy is handled, companies that can find a balance between limitation set in budgeting and the flexibility to adapt to new technologies will perform more efficiently.

3.3.1.3 Formation and Volatility of Fare prices

A combination of fundamental supply and demand, macroeconomic conditions, geopolitical shocks, and the way the global fleet is constructed all impact freight rates in the tanker business. The tanker shipping sector has a lot of ups and downs, and it reacts strongly to changes in the economy, politics, and how individuals invest, which is not the case with other forms of transportation. Gordon (2025) says that the two most important things that determine freight profitability are the quantity of oil moved by sea and the amount of tanker tonnage that is available. When there is more demand than the fleet can manage, shipowners have greater power to bargain, and freight prices go higher. Prices fall down and investment slows down when there is too much supply or trade slows down. The principle of effective supply is what most people need to know about how rates vary. The number of ships that are "effectively" available vary depends on the speed of the ships, how long it takes for a ship to turn around in port, traffic, weather-related delays, and fuel efficiency. This is true even if the fleet size keeps the same. Slow steaming, which is encouraged by both market forces and environmental standards, takes up less room and may make transportation more expensive.

The Baltic Exchange indices are the most common technique to keep track of freight levels. The Baltic Clean Tanker Index (BCTI) keeps track of the rates for tankers carrying refined products, while the Baltic Dirty Tanker Index (BDTI) keeps track of the earnings for ships carrying crude oil. Because China and India need a lot of oil, long-haul oil flows to Asia remained robust, which kept the BDTI over 1,100 points in early 2025. The BCTI changed by 700 to 800 points because Europeans consumed less gasoline in the winter and more in the summer, and because the way refined goods were obtained changed (Baltic Exchange, 2025).

Operational problems are usually what cause short-term volatility. Delays in key canals, strikes, bad weather, and port congestion make ships less available and temporarily raise freight prices (UNCTAD, 2025). Policies like EEXI and CII that restrict speed and hasten up the retirement of older, less efficient ships make these consequences even worse. At the same time, shipbuilding capacity has switched toward LNG carriers, which has made it harder to construct new tankers (OECD, 2025). Deliveries of new tankers in 2024–2025 were among the lowest in the last decade (DNV, 2024), which made the supply tighter and kept freight prices high.

Macroeconomic factors still have the same effect. During times of economic growth, the need for oil and the activity of industries throughout the world drive up freight rates. On the other hand, during times of recession or when oil prices drop substantially, the necessity for seaborne transportation drops rapidly. The global financial crisis of 2008 and the COVID-19 epidemic caused average VLCC profits to drop by more than 70%. This was because trade volumes were low and there was too much fleet capacity (Stopford, 2009).

These changes become worse throughout investment cycles. High freight rates lead to newbuilding orders, which increases the supply of ships in the future and puts downward pressure on prices when the ships are delivered. The time it takes to buy and distribute items causes tanker markets to move through cycles. This indicates that decisions concerning investments made today will have an effect on the market for years to come (Gordon, 2021). The rise of Forward Freight Agreements (FFAs) has made freight markets even more different. FFAs assist shipowners and charterers avoid risk, but trading on speculation may make short-term volatility worse. Traders and the attitude of the market usually

respond to geopolitical news before changes arise in physical flows. This indicates that changes in the financial market (BIMCO, 2024) are connected to changes in freight prices.

A variety of elements effect freight rates in the tanker sector. These include fleet supply, trading patterns, macroeconomic cycles, changes in regulations, and how the financial markets react. In this time of increased uncertainty, shipowners' long-term success rests on how well they can read market signals, put in place good risk management plans, and change their investment choices when rules and politics change.

3.3.1.4 Capital structure and investment cycles

The shipping industry is among the most capital-intensive sectors globally, and tanker investment decisions are highly sensitive to financial conditions. The acquisition and long-term maintenance of a tanker require substantial capital outlays, while the long economic life of vessels exposes owners to fluctuations in interest rates, liquidity conditions, bank lending policies, and expectations regarding future freight market performance (Stopford, 2020). Following the monetary tightening cycle of 2023, global loan rates increased significantly, slowing investment activity. In Clarksons Research (2024) it has been found that the average cost of financing a VLCC have risen by 25–30% compared to 2021 levels.

Investments in shipping show a strong cyclical pattern that reinforces itself. High freight rates and high profits encourage newbuilding orders, but the two- to three-year wait between ordering and delivery often leads to too much tonnage and falling freight rates. On the other hand, as freight prices go down, ordering activity goes down as well, which ultimately leads to a lack of supply and higher rates again. People usually name this pattern the "Shipping Market Cycle," and it usually lasts 7 to 10 years, while the length of time it lasts depends on changes in the economy and technology (Stopford, 2020).

These changes are more obvious in the years after 2020. The COVID-19 shock made people less interested in tankers and less likely to invest. After that, the rise in energy use and the change in trade patterns caused by Russia's invasion of Ukraine in 2022 pushed freight prices higher, which led to a "investment rally" in 2023–2024. However,

by 2025, this pace had slowed down because of increasing global interest rates and uncertainties about future fuel technologies (OECD, 2025).

The way ships are financed has also changed a lot. Nordea, DVB, and HSH Nordbank are some of the traditional European maritime banks that have cut down on their exposure, making room for other ways to get money. Private equity funds, sale-and-leaseback deals, and green bonds are becoming more and more important. According to Allied Shipbroking (2024), 28% of tanker investment money came from sources other than banks. This shows that finance arrangements are becoming more complicated and varied. Investors are putting more and more weight on ESG compliance and the long-term sustainability of assets. This is particularly true because of the uncertainties about the future of fuels like hydrogen, methanol, ammonia, and LNG. This unpredictability makes it hard to plan for the long run. For example, purchasing traditional tankers may provide you a short-term business advantage, but these assets may become obsolete too soon. On the other hand, waiting to invest may mean missing out on good market circumstances. In response, corporations are using more flexible structures, such joint ventures and long-term charters, to keep cash flow steady no matter what the market does.

Environmental financing factors also affect how people invest. The World Bank and the European Investment Bank (EIB) are two examples of organizations that give priority to low-emission assets. This makes it harder for ships that don't meet strict environmental performance criteria to get finance. This tendency has an indirect effect on the charter market by making it harder for owners to use older or conventionally fueled tankers.

3.3.2 Political and regulatory factors: geopolitics, environmental regulations, and international trade policies.

In the tanker market, where oil and its substitutes are transported, there is directly linkage to production and consumption, the importance of political and regulatory factors is even greater and there is an impact created which affects the profitability (in the short run) and as a result leads to greater sustainability of companies in the industry (in the long run) (Stopford, 2020).

3.3.2.1 Geopolitical Developments and energy security

Changes in geopolitics have a huge effect on the flow of maritime trade and, as a consequence, on tanker freight rates. A variety of things affect the transportation of oil and refined goods, such as the stability of places where energy is produced and utilized and the seamless operation of international trade routes. When politics are uncertain, transferring energy becomes a strategic security issue that affects both chartering decisions and shipping prices (Stopford, 2020).

Russia's invasion of Ukraine in 2022 had an effect on the global oil market and, by extension, the tanker charter sector. The European Union and the United States implemented restrictions on Russian oil and oil products, which changed the flow of commerce. European countries have been getting things from new areas including Saudi Arabia, the United Arab Emirates, Nigeria, and the United States. More and more of Russia's commodities are going to China and India (IEA, 2024). As trade swings east, the average distance between Russia and Europe has expanded from around 2,000 nautical miles to more than 9,000 nautical miles between Russia and Asia. This has made the demand for ton-miles increase at a large extent and eventually increased freight costs even more as well. This holds for large tankers like VLCCs and Suezmaxes whose operations are more optimal on long-haul routes (Gordon, 2025).

This new energy geography has also led to the creation of new "dependency" spots that bear a strategic importance. The Indian Ocean and the Pacific constitute the fundamental marine routes for the transportation of oil. This makes the Straits of Hormuz, Bab el-Mandab, and the Suez Canal even more significant, which are already quite important. Over one-fifth of the world's oil trade goes through the Strait of Hormuz, which makes it extremely easy for military war and geopolitical turmoil to happen. Any kind of disruption, like attacks on tankers or blockades, raises the political-risk premium straight quickly. Shipping prices have gone up, which shows this (UNCTAD, 2025).

The Middle East is not the only location where instability has spread. In 2024 and 2025, attacks on commercial ships in the Suez Canal and the Red Sea were happening. This made many operators travel around the Cape of Good Hope, which added 12 to 14 days to their trips and cost up to 25% more. The decline in effective fleet supply that followed helped preserve freight rates at record highs (BIMCO, 2024). Because the Panama

Canal was dry, draft constraints rendered the market smaller and made it tougher to transmit energy between the Atlantic and Pacific basins (OECD, 2025). There is also turmoil because of political unrest in nations that are producing oil like Nigeria, Venezuela, and Libya. The price and availability of freight may be impacted by a variety of factors such as strikes, public riots, and unexpected delays in production (World Bank, 2025). When shipments from West Africa halted in 2023, Aframax tariffs rose up by 8% (Gordon, 2025). Shipowners are using more and more varied charter portfolios to avoid things from getting too out of hand. When rates go up, spot market exposure might lead to short-term profits. Long-term time charters, on the other hand, give steady income and protection against abrupt shocks. BIMCO (2024) says that businesses who adopted both methods in 2024 and 2025 had the greatest risk-return performance.

Geopolitical risk is on the rise, which is terrible for investments. When circumstances are rough, businesses hold off on new building orders or cut down on their capital commitments to be ready for future downturns. Geopolitical changes have an impact on the cycles of marine investment and freight (OECD, 2025). Geopolitical volatility and energy security have become the most crucial and least predictable things that impact the tanker sector. Wars, sanctions, and regional crises throughout the world modify trade patterns, how far things have to go, and when to invest. In a world where things are becoming more unstable, shipping companies will only be able to continue in business as long as they can adapt by diversifying, forming strategic relationships, and using flexible chartering methods.

3.3.2.2 Environmental regulations and regulatory framework

In the last several years, environmental rules have been the biggest force behind changes to the way global shipping works. The industry is responsible for around 3% of all CO₂ emissions throughout the globe and is currently at the center of international climate policy (IMO, 2023). The IMO 2020 sulphur limit, which cut the amount of sulphur allowed in marine fuels from 3.5% to 0.5%, started a new age of energy compliance and technical change (Gordon, 2025).

The International Maritime Organization has set two new performance requirements since 2023. The Energy Efficiency Existing Ship Index (EEXI) looks at how well a ship's design works, and the Carbon Intensity Indicator (CII) looks at how much CO₂

is released during each transport operation. If the rules are broken, a business runs the danger of being denied access to certain ports (DNV, 2024).

The EU is setting the norm by incorporating maritime transportation in its ETS. By 2024, ship operators operating in EU waters must obtain and give up emission licenses. The European Commission (2025) says that these permits will cover 40% of emissions at first and 100% by 2027. The European Commission says that this would hurt small and medium-sized firms by raising their costs of doing business by 10% to 15% (OECD, 2025).

The specific regulations encourage employment of cleaner technology and more openness running the danger of "carbon leakage". This happens when companies transfer their operations to ports outside the EU aiming at saving money so that compliance is in place. Primary data has shown an increase in the use of Turkish and non-ETS terminals in North Africa (UNCTAD, 2025).

Decisions on compliance are becoming more and more expensive. To make a VLCC compliant with EEXI, \$3–5 million is required. It may cost more than \$120 million to build ships that run on LNG or methanol (DNV, 2024). Wealthy companies favor new buildings because they consume less fuel and are more likely to stay in compliance over time. Investment planning is hard, however, since LNG, methanol, ammonia, and hydrogen fuel are all still up in the air. The most feasible solution is not found creating problems with safety and infrastructure (IEA, 2024).

Low newbuilding activity makes it hard to grow the fleet and raise freight prices. Other parameters that exert influence involve a turn towards a better physical environment. Sustainability has become a significant prerequisite for deals to be handled with global creditors like the World Bank and the EIB. The Poseidon Principles state that the carbon footprint of a ship is what determines how much money it can get. Owners of clean technologies enjoy lower credit rates than owners of polluting fleets (Poseidon Principles, 2025).

Even if it costs a lot, environmentalism has led to new ideas in every industry. With the help of carbon capture research, biofuel testing, and hybrid propulsion, shipping is becoming more high-tech and energy-efficient. The OECD (2025) says that marine decarbonization can only work if environmental aims and economic feasibility are in line with each other. Regulation is becoming an important part of international shipping that is transforming it. Businesses who embrace clean technology and green financing

early will have an advantage as the world progresses toward a future with less emissions.

3.3.2.3 International Trade policies and regulations

International trade policy is now one of the most important things that affects the global freight sector, along with geopolitical and environmental considerations. States and international organizations make decisions on tariffs, taxes, energy requirements, and trade agreements that have a direct impact on seaborne trade and the need for tankers. Because it is so closely linked to the global energy economy, the tanker business is especially at risk of changes in trade regimes (Stopford, 2020). Economic nationalism and protectionist policies are on the rise again, and they have already changed the flow of shipping throughout the world. The trade war between the US and China that started in 2018 set off a chain reaction in energy markets, changing the way money moves and how people invest in oil transport (World Bank, 2025). The uncertainty that followed slowed down the development of projects and briefly lowered freight revenues, notably on lines between Asia and the Americas.

After COVID 19, there has been an exhibition of protective behavior. For example, several governments proceeded with posing limitations on energy exports or invested on local producers to ensure countries' energy stability. However, the result was to reduce international commerce. UNCTAD (2024) says that measures that made countries more self-sufficient and limits on exports led to a 3.1% drop in the amount of energy cargoes moved across the globe in 2023. This made tanker demand momentarily weaker.

At the same time, trade agreements between countries in the same area are changing the way goods are sent throughout the world. Frameworks like the Regional Comprehensive Economic Partnership (RCEP), the ASEAN Free Trade Area (AFTA), and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) have moved trade activity to the Indo-Pacific and away from the Atlantic and Mediterranean corridors (OECD, 2025). These longer routes enhance the demand for ton-miles, which helps huge oil transporters make more money. For instance, the growth of connections between Asian ports and industrial centers in Africa and the Middle East has led to the use of VLCC and Suezmax ships (UNCTAD, 2024). But regionalization may also produce short-term imbalances as fleets adapt to new

patterns. When vessels are shifted to Asian markets, their availability elsewhere is decreased, which impacts the price of freight. Gordon (2025) claims that between 2024 and 2025, the oil tanker's voyage time is 12% longer. This is because of commerce going east.

The goals of commerce and the environment are coming together. The forthcoming EU Green Deal and Global Maritime Fuel Standard must contain rules for ship operations and reporting emissions. These rules push companies to buy ships that don't pollute much and make it harder to invest in older ships that do (European Commission, 2025). This is because rich countries may have an easier time paying for "green" fleets than poor countries, which don't have as much money or technology (OECD, 2021). To bridge this gap, the IMO gives money to poor countries to modernize their fleets (IMO, 2023). Trade barriers will ultimately make the marine industry less competitive. Environmental compliance, regional integration, and protectionism all work together to generate a convoluted system of standards that encourage flexibility and creativity. The OECD (2025) says that long-term finance, better freight mobility, and better energy efficiency enable businesses compete in more political and economic marketplaces. Political and regulatory issues are having a more and bigger effect on how competitive tankers are. Political unrest, laws for the environment, and trade barriers may be both good and bad. Bigger international shipping companies with a variety of ships and solid finances may be able to handle changes in the market, while smaller companies may find it hard to secure funding and enter new markets. In today's world, it's important to be able to adapt. You need to be adaptable, purchase technology that are better for the environment, and obey the rules to achieve this. Being able to deal with change is very important for success in a strong sector.

4. Economic Analysis and Market Forecasting

4.1 Analysis of Key Economic Indicators

To understand the tanker charter business, you need to know a lot about the economics. In this part, we look at the economic and market factors that impact shipping performance in a quantitative manner, as well as the economic models that help us figure out how well the tanker charter market is doing.

4.1.1 Macroeconomic Variables and Their Impact on the Tanker Charter Market

International commerce usually rises 1.3 to 1.5 times faster than GDP (UNCTAD, 2024). According to Alizadeh and Nomikos (2009), a 1% change in global GDP means a 2.5–3% shift in oil prices. This is because as the economy grows, it needs more energy and raw materials, which means it needs more shipping. The global economy was greatly impacted by a series of crises from 2020 to 2025, including the pandemic, inflation, monetary tightening, and geopolitical tensions. Growth slowed from 6% in 2021 to around 2.7% in 2025 (OECD, 2025). However, the demand for marine oil transport has remained rather stable, mostly because trade patterns have changed and "ton-mile demand" has gone up. According to Song & Chen (2025), the elasticity of shipping to GDP differs based on the kind of cargo; for liquid cargo, the dependency is higher since the product is energy-based.

The price of oil is very important for shipping since it impacts both the demand for transportation by sea and the expenses of running ships. Kilian (2009) and Shi et al (2013) have demonstrated that when oil prices go up, they have two effects: 1. They raise freight rates when the rise is due to higher global demand ("demand-driven oil shocks"), and 2. They lower freight rates when the rise is due to higher supply ("supply-driven oil shocks").

In the tanker market, the situation is even more complicated since high oil prices raise fuel expenses, which cuts into profit margins, but at the same time, they enhance transport activity when commerce is moving about (Kavussanos et al., 2010). OPEC+ moves to change oil output have led VLCC and Suezmax freight rates to change quickly several times (IEA, 2025).

Two macroeconomic variables that significantly affect the financial aspect of maritime transportation are inflation and interest rates. It is more expensive to borrow money, get credit, and finance or refinance a new construction when interest rates are high. As a result, expanding a fleet is more difficult, and freight costs usually increase (Kavussanos et al., 2010). Conversely, excessive money may result in market corrections and excess capacity when central banks implement loose monetary policies

(Stopford, 2009). There has been observed an essential increase in interest rates in the US and Europe from 2022 to 2025. As a result, a number of maritime companies started searching for alternative sources of funding like private equity, leasing, and green bonds. Christofi et al. (1999) say that growing capital costs generally lead to "compressed investment cycles." This means that only operators with strong finances can grow their fleets and take advantage of strong freight markets without taking on too much debt.

Changes in the exchange rate can affect the demand for freight. The US dollar is the most important currency in global shipping, therefore its strength or weakness has a direct effect on how much oil importers can buy. A higher dollar makes it more expensive for developing countries to buy goods from other countries, which lowers demand in the near term. A weaker dollar, on the other hand, makes it easier for more goods to come from Asia and Africa (Msomi & Muzindutsi, 2025). The RCEP and CPTPP are examples of regional trade frameworks that have strengthened economic linkages inside Asia. They have also moved the center of maritime gravity from the Atlantic to the Indo-Pacific (UNCTAD, 2024). The longer trade distances that come from this promote long-term demand for tankers.

The total amount of international commerce is still one of the best ways to tell how busy shipping is. Song & Chen, (2025) found a substantial positive relationship, with a value of more than 0.8, between the amount of global seaborne commerce and the cost of tanker freight. According to UNCTAD (2024), overall marine commerce reached 12.4 billion tons, with liquid bulk making up around 30% of this amount. Despite repeated downturns, commerce by sea continues to support global economic development.

These macroeconomic elements all have affects on each other that are quite strong. During times of growth, demand for freight and investment both go up. During times of economic crisis, both of these things go down sharply. However, as Haralambides (2017) points out, shipping is quite cyclical: when the economy slows down, it typically picks up quickly again since there is a natural lag between changes in the economy and changes in the fleet supply.

4.1.2 Microeconomic variables and their impact on tanker market

Kavussanos and Alizadeh (2002) have supported that the tanker industry is an oligopolistic market with substantial cyclicality, where enterprises make choices based on what they think will happen in the future and not just what is happening right now. The primary microeconomic factors that determine how the market works are: operational costs, return on capital, the supply-demand connection of capacity, the fleet renewal rate, and the charter structure (spot vs. time charter markets). The expenses of running a tanker include fuel, upkeep, insurance, personnel, and administration. The installation of IMO 2020 and the introduction of the EEXI and CII efficiency indicators after 2020 have made compliance costs much higher. Because of this, being able to control costs well has become a very important way to go ahead of the competition. New technologies like eco-design boats, dual-fuel propulsion, and hull-optimization systems may cut variable operating costs by as much as 15%, but they need a lot of money up front. So, bigger enterprises profit from economies of scale, which makes the market even more concentrated (Drobetz et al., 2012). Clarksons Research (2024) exhibit that the average operating costs for VLCCs went risen by 12% from 2022 to 2024, reaching around USD 9,800 per day. Higher energy and insurance expenses, as well as normal inflation, caused the hike. These things have a direct impact on the break-even point, which is expected to be \$33,000 per day for a contemporary VLCC in 2025 (BIMCO, 2024).

Stopford (2009) and Kavussanos (2011) say that the shipping market goes through four stages over and over again: recovery, boom, recession, and crisis. Because it takes a long time to build new ships, capacity changes don't keep up with changes in demand, which makes freight prices "overshoot." This time lag is still one of the most important things that makes marine markets cyclical.

Drobetz et al (2012) demonstrate that the average delay between an increase in demand and the arrival of new ships is around 30 months. This explains why freight markets are cyclical. Market expectations also affect how shipping businesses act. Alizadeh and Nomikos (2011) discovered that businesses often invest in new facilities when freight rates are high, which leads to an excess of capacity in the years that follow and a decrease in the market. This is known as endogenous oversupply.

The overall number of tankers, the number of orders, and the pace at which existing ships are scrapped all affect the supply of tankers. Gordon (2025) supports that the active tanker fleet will be 640 million DWT, while the orderbook will only be 6.5% of the fleet. This is the lowest level since 1996. This little supply keeps freight costs high (Allied Shipbroking, 2024). Oil seaborne quantities and ton-mile demand connected to the reconfiguration of trade flows are what drive demand (UNCTAD, 2024). As more crude oil flows from Russia to Asia, the average shipping distance has gone up by 22%, which has raised freight charges (IEA, 2025). The Baltic Dirty Tanker Index (BDTI) and the Baltic Clean Tanker Index (BCTI) show how the supply and demand are balanced. These are important market health indicators. The BDTI is always around 1,100 in 2025, while the BCTI is around 780. This means that the performance will continue to be robust (Baltic Exchange, 2025). The age and make-up of the fleet have a direct effect on how freight rates change. Ships that are more than 15 years old are not very energy-efficient, and they are generally decommissioned because of rules (EEXI/CII). According to Allied Shipbroking (2024), 27% of the world's oil tanker fleet is more than 20 years old something that prompts construction of new ships.

Most of the time, ships are built in Asia and South Korea. Because steel costs and borrowing rates are going higher, new ship deliveries are predicted to reduce by 18% in 2024 (OECD, 2025). Over the same time period, the number of scrapped ships rose by 35%, largely because they didn't meet higher environmental criteria (DNV, 2024).

Limited shipyard capacity and rising demand for LNG carriers are causing a structural scarcity of capacity in the tanker market, which is keeping freight prices high. Drobetz et al. (2018) call this a "structural supply constraint." The short-term rate of freight rates is determined by the balance between the spot and time charter markets. Prices in the spot market are based on current supply and demand, whereas prices in the time charter market are based on what people think will happen in the future (Christofi et al, 1999). Shipowners with a lot of money generally pick spot markets because they want larger profits. Shipowners who are more cautious choose multi-year charters because they want a steady income.

Forward freight agreements (FFAs) have given businesses new ways to protect themselves against risk. Kavussanos et al (2010) demonstrated that FFAs reduce revenue volatility by 20–30%, however their efficacy is contingent upon market volatility.

There are a number of various microeconomic and business factors that have an impact on the tanker sector. Businesses are under a lot of stress because costs are going up, technological demands are changing, and availability is restricted. This also makes modern, energy-efficient ships worth more. In a market where strategic decisions may have long-lasting effects on sustainability, supply and demand cycles, delays in investments, and changes in freight rates are all key factors. Prices, supply, and freight rates are continually changing, but risk management, capital flexibility, and new ideas are always vitally crucial for success (Haralambides, 2017).

4.1.3. Factors impacting tanker charter rates and market performance.

There are a lot of different economic, technical, and institutional factors that affect freight prices in the tanker market. Because the business is naturally unstable, it's important to know what affects prices in order to comprehend market cycles and make smart investment choices (Kavussanos & Alizadeh, 2002; Stopford, 2009). There are two basic types of factors that affect freight rates: fundamental and derived. Fundamental drivers are based on the supply and demand for transportation services, whereas derived variables come from changes in the market, firm strategy, and outside shocks (Haralambides, 2017). The amount of oil exchanged is still the most important factor among all the others. The need for shipping comes from how much energy is generated and used across the world (Alizadeh & Nomikos, 2011). Changes in industrial production, trade routes, and the shift to cleaner energy affect both the amount and distance of cargo carried, which is termed ton-mile demand. After the war of Russia against Ukraine in 2022 the mean transport rose up to 18%, which implied the use of bigger vessels and changes in supply and demand (Clarksons Research, 2024; UNCTAD, 2024).

Shipbuilding takes time, so when the market changes, supply doesn't change right once, which causes price cycles (Drobetz et al., 2018). Clarksons (2024) says that the tanker orderbook is just 6–7% of the fleet, which is the lowest level in 20 years. Due to new environmental rules (EEXI/CII), ship retirement is being delayed, and supply is

becoming increasingly limited. Short-term imbalances may happen when there is congestion at ports, severe weather, or delays on the Suez and Panama routes (Baltic Exchange, 2025).

The cost of doing business is a very important part. Due to the efficiency and IMO 2020 rules, typical costs went up by 10–15%. This has the most effect on older tonnage (DNV, 2024). Poulsen et al. (2022) assert that low-energy vessels exhibit diminished variable costs and enhanced total cost of ownership (TCE) returns. There is a significantly wider disparity between eco-ships and regular ships. Shipping costs a lot of money, thus it is affected by interest rates and how easy it is to get credit. New orders drop by 4–5% when financing costs go up by 1%, according to Drobetz et al. (2012). Interest rates went risen because of inflation, which made people less likely to invest between 2023 and 2025. This lowered future supply and kept freight levels stable (OECD, 2025). Green finance frameworks like the Poseidon Principles (2025) affect a firm's ability to borrow money and its ability to compete. These frameworks tie loan conditions to how well the company does in terms of the environment (Kavussanos & Tsouknidis, 2021).

The most unexpected part of operating a company is fuel prices. The cost of fuel, insurance, and fleet availability are still affected by hostilities in Ukraine, the Red Sea, and the Strait of Hormuz, as well as drought-related problems in the Panama Canal. This makes rates change more quickly (Allied Shipbroking, 2024; IEA, 2025). Risk premiums might go up by 10% to 20%, thus charterers want long-term contracts to keep things stable (BIMCO, 2024). There are several big-picture, institutional, and psychological factors that affect tanker freight prices. Costs go up when gas prices are high, fleets are small, and the economy is not sure what will happen. Prices go down when the economy is bad or when it is harder to get loans. Shipowners and investors need to know about these connections in order to manage strategic risk and predict how the market will move and what it will do (Drobetz et al., 2012).

4.2 Market Forecasting

4.2.1 The concept and importance of forecasting in the tanker shipping markets

One of the hardest and most significant parts of a maritime transport plan is predicting how the shipping sector will develop. In the tanker business, it's important to be able to

predict freight rates since earnings, investments, and risks are continually changing (Stopford, 2009).

One part of forecasting is predicting freight volume. It means looking at how OPEC's production, the world's demand for oil, the economy, world events, and new technology are all linked. Shipping firms may adjust how they deploy their fleets, when they invest, and how they charter ships if they see changes in the market coming (Kavussanos & Alizadeh, 2002). Park et al. (2023) talk about strategic forecasting for planning capital and investments, as well as proactive forecasting to lower uncertainty during crises.

Because tanker markets are so unpredictable, short-term changes may happen for a number of reasons, including natural disasters, wars, technical problems, or rapid changes in trading routes. Models need to account for non-linear interactions and adapt to changing conditions in order to offer accurate projections (Schramm & Munim, 2021). As a consequence, the use of linear or exponential models is being replaced by machine learning approaches and complex econometric methods like GARCH, VAR, and ARIMA. Predictions are more useful since shipping is cyclical. The periods between newbuilding deliveries and vessel scrapping produce cycles of boom and bust because there are always too many or too few ships (Drobetz et al., 2012). When the cycle shift is precisely forecast, businesses may be able to obtain a competitive edge by building, replacing, or eliminating fleets.

To make good predictions, you need to think about things like how frequently the fleet is utilized, how busy the ports are, fuel expenses, and chartering. Short-term predictions are useful for travel and cash flow, whereas long-term predictions are useful for loans and investments (Clarksons Research, 2024; UNCTAD, 2024). Kavussanos and Tsouknidis (2021) say that scenario analysis makes predictions more helpful by reducing uncertainty. provide strategic guidance instead of promises. The combination of quantitative models and expert opinion enhances foresight by integrating measurable indicators with unmodelable factors like as legislative changes and geopolitical upheavals (OECD, 2025).

It is more of a learning process than a science to predict the tanker market. It employs institutions, technology, and economics to manage the ups and downs of shipping that are certain to happen. Strategic knowledge is used to deal with uncertainty instead than trying to predict the future.

4.2.2 Predictive Models and Analytical Approaches

To understand how the tanker business works and predict its future, economists, statisticians, and computer scientists utilize econometric, statistical, and computational models. Forecasting is difficult because of severe volatility, knowledge asymmetry, and outside factors like energy and geopolitical crises. Because of this, researchers and analysts employ a variety of methods, from complicated machine and computational learning systems that can handle nonlinearity, interactions, and structural changes to stochastic time series models (Yang, 2022). The shipping industry was the first to employ time series models to make predictions. The ARIMA and VAR frameworks are used to look at how freight rates change over time and how they are related to economic issues (Kavussanos & Alizadeh, 2002; Stopford, 2009). ARIMA models are helpful for short-term forecasting because they indicate that variations in freight rates follow patterns that can be measured. In summary, they work effectively when the market is stable, but not when there are huge changes, like new laws or oil crises. With VAR models, you may see the Baltic Exchange indexes, global GDP, freight rates, and gas prices all at once. Song and Chen (2025) and Park et al. (2023) assert that well defined VAR systems might elucidate 60% of short-term market volatility.

GARCH (Generalized Autoregressive Conditional Heteroskedasticity) is a newer kind of stochastic modeling that studies how volatility varies over time. In the shipping sector, GARCH models are used to anticipate short-term risk and volatility since freight prices usually vary following turbulence (Yang, 2022). In addition to standard statistical techniques, there are other econometric methodologies that connect freight rates to things like oil prices, energy consumption, interest rates, and fleet capacity. Kavussanos et al. (2010) and Drobetz et al. (2012) use multivariate regressions to demonstrate these relationships. This helps in making choices about investments in fleets and making projections about the economy.

Moiseev (2021) employed Exponential Smoothing during the COVID-19 pandemic to show that adaptable short-term models can still be trusted when they are given new data. Lyridis (2017) says that FORESIM (Forecast Simulation) employs probability analysis and simulation to make forecasts that change over time. FORESIM gives decision-makers a variety of potential outcomes to help them balance risk and pick the

best course of action when they aren't sure what will happen next. Because computers are becoming better so quickly, maritime forecasting employs AI and machine learning. Support Vector Machines (SVMs), Random Forests, and Neural Networks (ANNs) may show complicated, nonlinear connections between market elements (Babakan, 2020).

At MIT, Babakan (2020) built a machine-learning model for the market for crude oil tankers. It used information on fuel, supply, demand, and politics throughout the world. AI-based models predicted three-month freight rate trends with more than 75% accuracy, which means they may be helpful for making judgments. Yang (2022) spoke on how hybrid systems that combine machine learning with econometric regression make things more stable in situations when things are not always clear, especially when geopolitical variables like trade restrictions, war, and sanctions are taken into account. Forecasting involves looking at various market conditions by employing scenario-based modeling. Monte Carlo simulation creates a number of possible outcomes by employing probability distributions for things like freight rates, oil production, bunker costs, and transport demand (OECD, 2025). In marine economics, these models are significant because they let people figure out how much risk they are taking when things are unpredictable or happen outside of their control. If the price of bunker fuel went up by 10% or the demand for transportation went down by 5%, sales might decline by 20% to 25%. This is bad for banks, investors, and charterers.

4.2.3 Uncertainties and Variables Affecting Forecasts

The volatility of the market is high crude oil and products markets. Environmental, political, technological, and economic factors affect these levels (Kavussanos & Tsouknidis, 2021; OECD, 2025). Due to inherent uncertainty, projections may be entirely influenced by external events, even in the short term.

Shipping is driven by the global economy and energy requirements. But they also make things the most unclear. The growth rates of big economies like the US and China (IEA, 2025; UNCTAD, 2024) have an effect on oil transportation and commerce flows by sea.

Changing energy sources more and more in the name of lowering carbon emissions is making these uncertainties worse. In the long run, the energy revolution will make us

less dependent on oil, but in the short term, regional policy makes trade flows less predictable. Due to structural and outside disruptions, shipping estimates are continually changing. Estimates based on price stability may be thrown off if OPEC+ cuts output or European oil consumption falls (Clarksons Research, 2024). Standard macroeconomic models sometimes fail to account for the structural uncertainty arising from regional wars, policy shifts, and health emergencies. Park et al. (2023) say that these difficulties have "contagion effects," which means that the entire maritime transportation sector has to deal with them. It's astonishing that geopolitical instability is still affecting market forecasts. Attacks on tankers in the Red Sea (2024–2025), tensions in the Strait of Hormuz, and Russia's invasion of Ukraine (2022) have all changed trade routes and travel times, which affects the cost of shipping. Global oil trade is hindered by EU and US sanctions. Russian export limits opened up new long-haul routes to Asia. This temporarily increased the demand for ton-miles, but it also went against earlier estimates (UNCTAD, 2024). When laws and institutions change, it becomes harder to make predictions. Shipping is a component of the EU's ETS starting in 2024. This, together with IMO's EEXI and CII requirements, will likely raise operating costs and make fewer ships available by postponing or retiring older or less efficient ships (European Commission, 2025; DNV, 2024). Because these modifications have non-linear effects on the market, it is difficult to replicate. Even while big-data analytics make projections better, the quick rollout of dual-fuel ships, alternative propulsion technologies, and digital chartering platforms changes capacity and cost structures at an unforeseen rate (Tay & Konovessis, 2023). Environmental instability is affecting estimations more and more. Shipping is susceptible to "environmental shocks" that prediction models must account for owing to harsh weather, route alterations induced by climate change, and new emission rules (OECD, 2025). Analysts are progressively using carbon pricing, compliance costs, and green finance incentives to elucidate the impact of environmental policy on market dynamics over time (Kavussanos & Tsouknidis, 2021). There might also be mistakes in forecasting. Banks, charterers, and shipping companies may make judgments based on their gut emotions or how other people act. People have big expectations while the economy is doing well, but they are afraid to take chances when it is not, which makes the economy worse. Christofi et al. (1999) show that time-varying risk models may follow how investors feel, which shows that shocks from

outside sources and how people respond to them can make things unpredictable.

4.2.4 Integrated Scenario-Based Forecasting Outlook

Due to the constantly change tanker markets and the plethora of extrinsic parameters that impact freight rates, with the aim at a forecasting perspective both short-term market drivers and longer-term structural dynamics should be taken into consideration. The combination of limited supply, changing oil trade patterns, stricter rules, and geopolitical instability means that traditional linear projections don't work anymore. Instead, scenario-based forecasting is necessary to understand possible market paths (IEA, 2025; Clarksons Research, 2024). Instead of trying to guess exactly how rates will change, modern forecasting is more about making educated guesses that assist decision-makers be ready for different situations and take steps to avoid risk. In a base-case scenario, which shows the most probable continuation of existing patterns, global oil consumption is predicted to level off with little increase, while trade flows are still affected by changes made after sanctions were lifted. The shift of Russian crude oil to Asian purchasers keeps ton-mile demand high, especially for VLCC and Suezmax ships. At the same time, refinery disruptions keep LR and MR product tankers in high demand (UNCTAD, 2024; IEA, 2025). The supply of ships is expected to stay low since the number of tankers on order is at an all-time low and shipyards are still busy constructing new LNG and container ships. The EU ETS, EEXI, and CII make it more costly to operate older ships and hasten up their retirement (DNV, 2024). In this sort of weather, freight rates will probably be higher than they usually are for a long time. The BDTI and BCTI indices illustrate that this is a seasonal shift. This baseline suggests that the market is robust because of structural tightness and geopolitical fragmentation.

If oil demand rises more than anticipated and geopolitical issues escalate, trade routes will lengthen and tonne-miles will increase, which is beneficial. If ships are scrapped quicker (because of CII downgrades) and newbuilding activity is delayed, the supply situation would become tighter, which would keep spot and time-charter rates high for a long time. In this situation, the value of tanker assets might go up a lot, especially for dual-fuel or high-efficiency ships that operate with decarbonization finance frameworks (Poseidon Principles, 2025). Rates would move up and down a lot, but

generally up, with spikes occurring all the time due of congestion, uncertainty about sanctions, or shortages of goods in particular places. On the other side, if the world economy slows down, there will be less oil usage and trade routes will be shorter as tensions between countries ease. Newbuilding deliveries may go up around 2027–2028, and harsher carbon-pricing schemes may boost operating costs while also increasing fleet capacity. In this case, the prices of VLCC, Suezmax, and product tankers may fall down. The BDTI and BCTI would not change as much, but they would still go down overall. In this situation, the market is influenced by the risk of oversupply, poor tonne-mile growth, and higher compliance costs (OECD, 2025).

It is important to remember that forecasting in the tanker market is not always a precise science. When we use econometric models, machine learning systems, expert judgment, and scenario matrices together, we can get a better idea of what might happen. This is especially true in markets where there is structural uncertainty, regulatory changes, and geopolitical shocks (Babakan, 2020; Yang et al., 2022). Scenario-based forecasting helps shipowners, charterers, banks, and investors plan ahead, knowing that the purpose of forecasting is not to be right but to be able to make decisions (Stopford, 2009).

5. Conclusions and Recommendations –

5.1 Summary of Main Findings

The tanker charter market is affected by a lot of different things, including cyclical changes, structural instability, and a diverse mix of economic, geopolitical, and regulatory concerns. Changes in global GDP, energy consumption, and currency rates still have a large influence on freight rates and the requirement for transportation at the macroeconomic level (UNCTAD, 2024; OECD, 2025). The world economy had a number of challenges between 2020 and 2025, including the pandemic, increasing prices, and stricter monetary policy. But there was still a surprisingly large demand for transporting oil by water. This resiliency is a result of shifts in trading patterns,

particularly the movement of Russian crude oil from Europe to Asia. This increased the need for ton-miles, even though world oil use was very steady (IEA, 2025; Gordon, 2025).

The industry is still operating with just a little amount of fleet growth on the supply side. The orderbook is at an all-time low, with just 6–7% of the present fleet. Because of this and the fact that more and more older, non-compliant boats are being destroyed under the EEXI/CII framework, the structure is tight and freight levels are high (DNV, 2024; Clarksons Research, 2024). These supply challenges have become worse since shipyards don't have enough space and LNG ships are given priority. This slows down the delivery of tankers and keeps prices high (OECD, 2025). The most significant elements that move the market are rules and the environment. The EEXI, CII, and IMO 2020 have made it far more expensive for firms to follow the rules and made the performance difference between eco-efficient and older tonnage even greater (IMO, 2023; DNV, 2024). From 2024 on, the EU ETS will also be utilized for shipping. This would connect operational performance to direct carbon costs, which will speed up the shift to greener fleets and change how finance works under frameworks like the Poseidon Principles (2025). Because of this, environmental rules are now a big part of both making money and deciding where to put money. Changes in geopolitics, such the war in Ukraine, tensions in the Red Sea, and instability in vital producing regions, have made it more probable that routes would be closed, traffic jams will happen more often, and risk premiums will go up. These things have all made spot markets unstable (BIMCO, 2024; UNCTAD, 2024). These geopolitical shocks made the difference between the spot and time-charter markets considerably greater. FFAs and derivatives gained significance as instruments for risk hedging (Kavussanos et al., 2010). The industry is shifting from traditional econometric models (ARIMA, VAR, GARCH) to hybrid machine-learning frameworks capable of identifying nonlinear interactions, structural breakdowns, and patterns of high-frequency volatility (Yang et al., 2022; Babakan, 2020). This trend suggests that individuals are starting to understand that traditional linear methods can't fully explain why regulatory shocks, energy-transition dynamics, and geopolitical upheavals are becoming more important. The findings often point to a structural shift in the market: — There isn't enough supply, which keeps freight earnings high (Clarksons Research, 2024).

— Trade flows are becoming longer and more affected by geopolitics, which means we need more ton-miles (IEA, 2025).

— Environmental standards are redefining what it means to be competitive, how to make money, and how to keep a fleet up to date (DNV, 2024; Poseidon Principles, 2025).

— Forecasting is increasingly dependent on data-driven, scenario-based approaches rather than deterministic projections (OECD, 2025).

The tanker business is shifting from a basic, cyclical, asset-driven market to a more complex system that is impacted by political instability, new technology, and the demand for sustainability.

5.2 Implications for Stakeholders (Shipowners, Charterers, Investors)

The findings of this study have important strategic implications for all the main groups of people that are active in the tanker shipping sector. The changing market circumstances, which include tighter supply chains, changes in global trade flows, and stronger norms and environmental constraints, mean that everyone has to make decisions that are more flexible, based on data, and good for the environment.

Because of stiffer laws and fewer ships available to replace existing fleets, shipowners need to make major adjustments to their long-term business and investment strategies. The EEXI and CII standards and the EU ETS's extension to maritime transport have a direct effect on how ships are deployed, how much fuel they use, and how much money they make (IMO, 2023; DNV, 2024). Older ships have to spend more money to stay in compliance, and they may require additional retrofits or slower speeds to be competitive. These developments are good for owners who acquire ships that consume less fuel or can use both kinds of fuel, especially if green-linked finance frameworks like the Poseidon Principles become the dominant method to distribute capital (Poseidon Principles, 2025).

At the market level, supply restrictions and shifting trade patterns provide owners an opportunity to get attractive time-charter rates, particularly in the LR and MR categories, where demand is steady because of changes in the way refined products are sold (IEA, 2025; Clarksons Research, 2024). The switch to longer ton-miles, especially as Russian oil is being sent to other places, makes it even more probable that modern

ships will earn money. But there is still a lot of volatility, which implies that owners have to rely more on derivatives and FFAs to manage risk (Kavussanos et al., 2010). Shipowners generally have two problems: they need to make sure that the pathways for fleet renewal and decarbonization are the same, and they also need to cope with increasing operational and geopolitical risk.

Charterers are working in a market where changes in freight costs and regulations are having a growing and bigger influence on how they plan their charters. Charterers need to incorporate assessments of carbon-related costs in their charter party agreements as environmental rules become stricter. This is particularly important when they are operating in regions that are part of the EU ETS (OECD, 2025). This makes it even more necessary to communicate information on how well ships are performing with emissions and to utilize greener tonnage.

Changes in geopolitics, such as instability in the Black Sea, Middle East, and Red Sea, make it harder to plan routes and delivery times. This makes charterers utilize more flexible contract structures, a larger selection of vendors, and better voyage risk analytics (BIMCO, 2024; UNCTAD, 2024). As product flows shift, especially in CPP markets, charterers need to look at regional arbitrage options again and make sure their schedules fit with trends in longer-haul transport. In this case, charterers that utilize real-time market data, emissions monitoring systems, and prepare for a few different scenarios are more likely to obtain capacity and keep freight exposure steady. The structural changes in the tanker sector imply that investors have greater risk and more potential to earn money. Persistent supply limits, together with long ton-mile demand and a limited orderbook, make asset-based investments seem appealing, particularly in energy-efficient ships (Clarksons Research, 2024). At the same time, more and more financial markets are applying ESG norms. This is making investments move toward fleets that satisfy decarbonization targets (Poseidon Principles, 2025; DNV, 2024).

Geopolitical shocks and macroeconomic uncertainties make spot prices go up and down. This makes FFAs, derivatives, and diversified shipping portfolios increasingly relevant. Investors may use data-driven forecasting and machine learning to better figure out when to purchase and sell and how much risk to accept. These approaches are becoming more and more popular since they operate better in scenarios that aren't

linear (Babakan, 2020; Yang et al., 2022). Investors need to find a middle ground between old cycle-based opportunities and new rules that arise from following environmental laws and improvements in technology. The tanker sector is being affected more and more by regulators via things like carbon pricing, environmental laws, and operating rules. The IMO's decarbonization program and the EU ETS are two examples of global and regional activities that make it clear why we need to update our technology and move to low-carbon fleets (IMO, 2023; OECD, 2025). These restrictions make the link between how well a corporation does for the environment and how well it does for business stronger. This impacts how businesses compete in the industry.

To maintain the market stable while it evolves swiftly, the government has to make sure that schedules are predictable, everyone has the same reporting obligations, and carbon accounting is straightforward to grasp. Also, when autonomous and data-driven technologies are utilized in maritime operations, regulators are particularly crucial for making sure that safety, cybersecurity, and data-sharing standards are in place that help new ideas grow without compromising the integrity of operations (DNV, 2024).

5.3 Strategic Recommendations for Market Participants

These tips are aimed to assist shipowners, charterers, and investors make robust and adaptable market strategies.

(a) Strategic Advice for Shipowners. Shipowners' most significant strategic aim should be to make sure that their decisions on fleet management and capital investment are in accordance with the global decarbonization agenda. The findings reveal that the European Union (via EEXI, CII, and ETS processes) and the International Maritime Organization (IMO) are swiftly altering the economics of ships and what charterers want (European Commission, 2025; Kavussanos & Tsouknidis, 2021). Shipowners should utilize a tiered approach that combines both short-term operational improvements and long-term technological enhancements to stay ahead of the competition.

(c) Ideas for Charterers' Plans

The analysis shows that the tanker market would be less stable from 2022 to 2025, which will make operations more dangerous. This implies that organizations who need steady logistical flows won't be able to use normal short-term chartering strategies as effectively.

The optimum strategy is to have a balanced chartering portfolio with both short-term spot exposure and medium- and long-term time charters. The corporation should decide how many of each kind of contract to sign based on how much risk it is prepared to accept, how much money it has, and what it believes the market will do. Long-term time charters are a fantastic choice when there is a lot of geopolitical uncertainty or a lack of supplies. On the other hand, limited spot exposure helps businesses take advantage of temporary rate hikes when the market becomes tighter (BIMCO, 2024). Charterers need to transition to carbon-conscious chartering in addition to the EU ETS and global emission monitoring. Choosing ships that use less energy and include carbon clauses in contracts may make it less likely that the firm will face legal action or harm to its reputation. Some of the top charterers now use "green freight indices" and digital freight transparency platforms to see how well a ship is performing before they sign a contract. This proactive transformation not only makes sure that the firm respects the standards, but it also provides it a competitive edge since consumers and regulators are asking for greater climate responsibility across the supply chain (European Commission, 2025).

Another main objective should be to make chartering activities digital. Charterers may be able to save money and plan their flights better by using big data analytics and AI-driven forecasting tools to estimate rate trends, traffic patterns, and changes in bunker prices.

(c) Strategic Advice for Investors

Changes to the structure and cycles in the tanker charter industry might be good for investors. The findings demonstrate that traditional asset-based strategies need to be replaced with more adaptable, risk-hedged frameworks that use new financial instruments and sustainability standards. A good investment portfolio should contain more than just a ship. It should also include freight indices, green shipping funds, and marine derivatives. Forward Freight

Agreements (FFAs) and exchange-traded instruments linked to the Baltic Clean Tanker Index (BCTI) and the Baltic Dirty Tanker Index (BDTI) (Baltic Exchange, 2025) might help you keep an eye on changes in freight prices without having to own a ship. According to modern portfolio theory, you should diversify your risk and projected returns among assets with varied levels of volatility. This strategy follows that idea. Environmental, Social, and Governance (ESG) problems must now be taken into account. Banks and other financial organizations are using the Poseidon Principles and Sea Cargo Charter frameworks more and more to examine how effectively they interact with the environment. In a market that is moving toward low-carbon operations, investors that put carbon intensity and innovative ideas for sustainability performance first may receive long-term value (OECD, 2025). It is far safer to invest in shipping firms that follow the regulations and disclose their emissions clearly than to support old fleets that don't follow the standards. Finally, an investment strategy should concentrate on new ideas that are based on data and technology. In unpredictable markets, companies who produce AI-based forecasting tools, low-emission propulsion technologies, or blockchain-enabled chartering platforms are more likely to generate money. Investors may use equity participation, venture capital, and green-finance mechanisms to take advantage of the two changes—digital and environmental—that are altering maritime transport.

(d) Strategic Insights Across Different Fields

Everyone involved agrees on the aim of intelligence-driven resilience. To do well in today's tanker market, you need to be able to look at data, predict trends, and change your financial and operational structures to fit with changing legislation and environmental circumstances. Shipowners should see decarbonization as a long-term investment rather than a requirement from the government. Investors need to think about both short-term financial returns and long-term strategic goals. Charterers, on the other hand, need to make sure that sustainability is a part of their risk and logistical management plans.

The study shows that shipowners, charterers, financiers, and regulators need to work together more to agree on sustainable standards, share more information, and coordinate their reactions to global disruptions. Linked data systems and digital reporting platforms that allow people to work together may make it easier to find information and make forecasting models more accurate, which would lower risk throughout the full value chain.

The tanker charter industry is going through changes in how it is set up. Companies that embrace financial innovation, environmental responsibility, and digitization will lead the next phase of maritime progress. As the business moves toward increased regulation and information sharing, competitors that just care about pricing will slowly disappear.

5.4 Suggestions for Future Research

Subsequent research may expand upon the findings of this study by exploring several additional dimensions of the tanker industry that were not included in the present investigation. First, we need to do more research on how environmental rules like EEXI, CII, and the EU ETS affect the freight market, especially as carbon pricing systems become better and differences in vessel performance become clearer. Second, there has to be more study on how to utilize machine learning and artificial intelligence to estimate freight rates. This is particularly true when it comes to how to include high-frequency data on pollution, weather, and geopolitics into prediction models. Moreover, the long-term effects of economic realignments after geopolitical upheavals, exemplified by the rerouting of Russian crude oil exports and increased security risks at vital chokepoints, remain little comprehended. Subsequent studies can examine the financialization of the tanker sector via the rising use of FFAs and derivatives, assessing their influence on volatility and owner-charterer relationships. Finally, research that combines shipping decarbonization, port infrastructure planning, and the usage of alternative fuels would help us understand how the sector is moving toward a future with less carbon.

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