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Key determinant factors in oil price markets

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Η παρούσα Διπλωματική Εργασία με τίτλο “Key determinant factors in oil price markets” συντάχθηκε στα πλαίσια της ολοκλήρωσης του Προγράμματος των Μεταπτυχιακών Σπουδών μου στη Ναυτιλία, του Πανεπιστημίου Πειραιώς.

Το αντικείμενο της διπλωματικής αφορά την ανάδειξη των παραγόντων που προσδιορίζουν την τιμή του πετρελαίου, το διεθνές πλαίσιο μέσα στο οποίο αυτοί λειτουργούν συνθετικά και πώς ο τομέας της ναυτιλίας είναι σημαντικός στην ερμηνεία τους.

Ένα μεγάλο ευχαριστώ στον επιβλέποντα αυτής της διπλωματικής εργασίας, κ. Θεόδωρο Πελαγίδα για τη στήριξη, πάντα άμεση καθοδήγηση και υπομονή του, καθώς και σε όλα τα κοντινά μου άτομα για την κατανόηση και σταθερή υποστήριξή τους.



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ΠΕΡΙΛΗΨΗ

Ο καθορισμός της τιμής του πετρελαίου αποτελεί ένα σύνθετο ζήτημα στη ναυτιλιακή αγορά. Είναι μια πολυπαραγοντική διαδικασία, κατά την οποία εμπλέκονται διάφοροι παίκτες και καθοριστικά γεγονότα, όχι απαραίτητα ίδια σε κάθε χρονική στιγμή. Η άμεση σύνδεσή της με τις κινήσεις των ναυτιλιακών αγορών, των ναυτιλιακών κύκλων, το γεωπολιτικό υπόβαθρο, κρίσεις, καθώς και ο τρόπος με τον οποίο λειτουργεί το χρηματοπιστωτικό σύστημα παγκόσμια, αναδεικνύουν την πολυπλοκότητα στη σύνθεση του μεγάλου όγκου πληροφοριών που λαμβάνουμε, προκειμένου να προβλέψουμε τις κινήσεις της τιμής του πετρελαίου.

ABSTRACT

Determining the oil price is a multifaceted issue in the shipping market. It is a process affected by numerous factors, in which various players and impactful events playing their part, not necessarily the same at all times. Its direct relation to the movements of the shipping markets, the trends of the shipping circles, geopolitical backgrounds, international crises, as well as the way the financial system works globally, highlight the complexity of synthesizing the large amount of information received, in order to predict oil price movements.



INTRODUCTION

The oil price has always been a controversial subject, and the last couple of decades, even more.

Since 2000 onwards, the defining factors of the oil price have changed dramatically. Initially, the price changing during the day was more frequent and intense. Now there's more stability, as if there has been established some sort of equilibrium in the market. Price fluctuations are not so frequent anymore, unless something dramatic happens, and oil oversupply is a given.

Within this context, speculation can be important in understanding how the oil price mechanism works, and how it will appear in the future.

The shipping industry, by its nature, is a business environment of big uncertainty and instability, with cyclical and unpredictable periods. As a consequence, the level of risk that has to be taken into consideration, either from corporate entities and /or investors, is significant, in order to invest and decide wisely.

Taking into consideration that shipping could be characterized as a representative example of free trade, supply and demand is the basic economic idea, based on which we can understand and predict the availability and price of a commodity in the market. Same is the situation with oil. However, how much close to reality is the oil price? Does it truly reflect the physical markets? Sometimes, we see that supply is formed according to the needs for oil price increase.

The scope of this dissertation is to mark the changes occurred in the oil price making by the time of its writing, as well as an effort to read the given data differently. A deeper understanding of some main factors of the oil price give us a better idea of what to decide, either short – term or long-term.



Shipping industry in general has the uncertainty in its core: the way it operates and it is structured, shows that getting a good sense of the market, in order to make the best decisions, is of primary importance. Likewise, in order to predict the price of the oil, numerous parameters have to be taken into consideration, by doing an instant market analysis each moment. What was previously a fact, 30 minutes later might not have any importance in the decision making at all.

In our effort to depict the key determinant factors of the oil price, there's an extensive outline of the fundamentals. Firstly, there's a general description of the seaborne trade which is effected through shipping, as well as the situation currently. Then, we provide a presentation of the shipping markets and what happens during the shipping cycles, which can help us understand the way the economy of shipping works.

All of the above subjects basically define the general environment where the oil is being produced, transported and traded. Based on that, the main part of our study follows, where some main factors – categories of the oil price are analysed, such as the participants themselves, the international oil price benchmarks (Brent and WTI), its transportation through the tanker market and freights market, the crises and disruptions, and last, the forecasting.



1. SEABORNE TRADE AND SHIPPING

Shipping, being one of the most ancient transportation systems, has certainly been proved the most efficient one, reigning over the others, with a good margin for profit, due to extreme applications of economies of scale.

Some basic, everlasting truths about shipping are that: 1) it's driven mainly from supply - demand¹, 2) it is vital part of globalization and 3) it thrives in times of political stability and world prosperity. All these truths/ axioms are interlinked and interdependent. Trade and economic development² define shipping (Stopford, 2016, pp. 79-80).

The maritime transportation is very important in the international trade, due to the fact that very large quantities of products of many types can be transported, safely and at low cost (Acik, 2021, pp. 400-401). For example, due to its nature, bulk carrier shipping is aiming for the total cost minimization, while in liner shipping, speed, reliability and high quality in services are mostly important (Stopford, 2016, p. 122). So, the bigger the vessel, the smaller the cost.

The main goal in order to keep afloat in the shipping industry is to minimize costs as much as possible, while at the same time operating the vessel in its optimal form. For some goods the low transport cost is the important factor for the execution of the transport, otherwise it is possible that other products will be selected by the demand factors, which will ultimately bring greater profit. The technological

¹ Supply and demand always set the tone of the market, any given time (Stopford, 2016, p. 190)

² *"Much of the growth recorded over the past decade is largely driven by fast growing emerging developing countries, most notably China. These countries have also been driving the structural shift in trade patterns observed since 2013, whereby volumes unloaded in developing countries exceeded volumes loaded. The shift is a reversal of a historical pattern where developing countries acted as suppliers of large-volume low value raw materials imported by developed countries"* ((UNCTAD), 2020, p. 7)



developments of recent years and the gigantism of ships have brought about a relative reduction in transport costs along with higher quality in the services provided, with the final direct consequence of the creation of new trade/ shipping routes (Βλάχος & Ψύχου, 2011, p. 152).

Due to the fact that shipping operates on a global level, it is inevitable that it is always affected by any circumstances that occur in every aspect of the international trade (Acik, 2021, p. 400). In other words *shipping* could be described as *a derived demand largely determined by developments in the world economy and trade* ((UNCTAD), 2020, p. 6). The international economic environment and development have a significant impact on shaping the course of shipping. Demand for shipping services is "secondary" (producer demand), with the result that maritime trade is highly dependent on global economic activity, with direct and indirect effects. (Βλάχος & Ψύχου, 2011, p. 153).

The main clients of shipping are governments, state companies and organisations, in charge of large scale imports and exports of basic food categories, such as grain, and sources of energy, like oil, as well as large private companies and industries (Βλάχος & Ψύχου, 2011, pp. 149-150). The fact that 60% of the tonnage of the total maritime trade comes from energy and the metal industry³, explains why the shipping sector is affected immensely from the developments in these two industries (Stopford, 2016, p. 97).

According to UNCTAD, since 1990, the various market segments have evolved, and the maritime trade has shown growth, attributed mainly to the bullish trends noticed in the container market, started in the 2000, coinciding with the wave of

³ "Dry cargo continued to account for over two thirds of total maritime trade volumes, while liquid bulk commodities, including crude oil, refined petroleum products, gas and chemicals, accounted for the remaining share. In 2019, growth in all market segments decelerated." ((UNCTAD), 2020, p. 8)



hyperglobalization. Also, another important factor which gave a tremendous boost in the maritime sector was the rapid industrial expansion of China, with the relevant growth of dry bulk commodities trade ((UNCTAD), 2020, p. 8).

The main factors of demand are world economy fluctuations, as well as the changes that occur both in the trade of specific goods and in the distances that must be covered⁴. Effectively, the slowdown in the global economy⁵ usually means a decline in the demand for maritime transport of goods, while an adverse political event may affect negatively the demand⁶, not only that of a specific region, but even that of global scale as a whole (Βλάχος & Ψύχου, 2011, pp. 148-149).

The emerging of new areas⁷, or the replacement of other, old areas, from which the supply of bulk goods takes place, directly affects trade. In particular, the discovery

⁴ "Growth in international maritime trade stalled in 2019, reaching its lowest level since the global financial crisis of 2008–2009. Lingering trade tensions and high policy uncertainty undermined growth in global economic output and merchandise trade and by extension, maritime trade. Maritime trade volumes expanded by 0.5 per cent, down from 2.8 per cent in 2018 and reached a total of 11.08 billion tons in 2019. Growth in world gross domestic product slowed to 2.5 per cent, down from 3.1 per cent in 2018 and 1.1 percentage point below the historical average over the 2001–2008 period. In tandem, global merchandise trade contracted by 0.5 per cent, as manufacturing activity came under pressure and the negative impact of trade tensions between the two largest world economies took a toll on investment and trade. Against the backdrop of a weaker 2019, the short-term prospects of maritime transport and trade darkened in early 2020. While initial expectations were that 2020 would bring moderate improvements in the economy and trade, the unprecedented global health and economic crisis triggered by the COVID-19 pandemic severely affected the outlook." ((UNCTAD), 2020, p. 1)

⁵ "Therefore, negative economic and trade trends affected maritime trade growth in 2019. Global economic growth decelerated in 2019 against a backdrop of lingering trade tensions and high policy uncertainty." ((UNCTAD), 2020, p. 6)

⁶ "Global merchandise trade contracted in 2019 as manufacturing activity slowed over the course of the year. Rising tariffs have heightened policy uncertainty, undermined investment and weighed on global trade. In 2019, world merchandise trade volumes declined and fell by 0.5 per cent, its lowest level since the financial crisis a decade earlier (table 1.4). The negative trends were mainly driven by a contraction in imports from developing countries, including China, other emerging Asian economies and developing America (United Nations, 2020a)." ((UNCTAD), 2020, p. 4)

⁷ "In 2019, 41 per cent of the total goods loaded (exported) were sourced from Asia and 62 per cent of total goods unloaded (imported) were received in this same region. The contribution of developing



of new sources of oil, coal, bauxite, where the production price is lower, led to the change of places of supply, which usually creates an increase in the distances to be covered. In this case, too, oil is a prime example. In the 1960s, the exploitation of the oil wells of the Middle East began to develop, as the reserves discovered were among the largest of the time, while due to the surface nature of the deposits, mining was advantageous and the cost very low. The immediate consequence was the shift of many states and suppliers to the oil market that emerged from these areas, and which changed the distances they had to travel (Βλάχος & Ψύχου, 2011, p. 150).

Shipping is predominately about trade – it is not interested in GDP: *"There is a predominance of Asian and intra-Asian trade in globalized production processes and value chain growth. A closer look at this trend indicates that the globalization of manufacturing processes has never been truly global. There is scope for other developing regions within and outside Asia to diversify their economies, expand their maritime transport capacity and participate more effectively in regional and international production processes. The marginal contribution of these economies to global value chains is reflected in their relatively limited contribution to container trade flows and global container port throughput. Maritime transport, combined with supportive trade and industrial policies, can be a catalyst for growth and greater integration in the world economy for a broader range of such developing countries.*

((UNCTAD), 2020, p. 7)

America and Africa to maritime trade flows remained marginal. In comparison, and as previously noted, Asia has benefited from a greater integration into global manufacturing and trading networks, promoting intraregional trade. Capitalizing on the fragmentation of globalized production processes, Asia has become a maritime hub that brings together over 50 per cent of global maritime trade volumes". ((UNCTAD), 2020, p. 9)

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It is evident that, due to many parameters that have to be taken into consideration when involved in shipping business, shipping interests can be extremely mobile.

Combined with the geographical position, as analysed above, the position of the ports emerges also as an important factor which can influence trade and demand: The location of loading and unloading ports is particularly important, in cases where the ship is destined for an area where it will not be possible to easily find its next fix (eg West Africa, where exported cargo is limited and may not meet the requirements of that ship), then it is possible to be forced to stay there for a long time or to charter with very little or minimal profit, with the immediate consequence of losing significant profits. In such cases, shipowners avoid these charters, which allows those who decide to make such a voyage to require a high freight to cover their losses (Βλάχος & Ψύχου, 2011, p. 150)

Uncertainty is one very important factor which affects dramatically the decision making and the overall psychology in all aspects of the international trade. The last few years, starting with the recent trade war, between US and China, and lately with COVID 19 pandemic⁸ still dominating, uncertainty is the main constant, which seems is here to stay longer than expected.

⁸ "The onset of the pandemic in early 2020 and its fallout on world economies, travel, transport and consumption patterns, as well as manufacturing activity and supply chains, are causing a global recession in 2020."((UNCTAD), 2020, p. 6)



2. SHIPPING MARKETS

Shipping is a service provider sector. There are 3 main categories in the shipping market: liner shipping, bulk shipping and specialized shipping. All these sectors offer different types of services, but they are always interconnected and codependent (Stopford, 2016, p. 91)

The shipping market is considered to be an example of the “perfect” free market. Monopolies, in the sense that we know them in other business sectors, don’t exist. However, it is evident and undeniable lately that major players can have a significant impact on the market trends and, ultimately, to have the market work in their favor.

Depending on the market conditions at a specific moment, the players might choose to collaborate implicitly, in order to protect these specific conditions and make a profit or, alternatively, to shake the market in their favor. It’s almost like a cause – reaction situation. In some cases, some rumors or predictions are enough to affect shipowners' investments in newbuildings or secondhand vessels, the prices they are trying to achieve at charter, etc (Βλάχος & Ψύχου, 2011, p. 153)

The direct players are the cargo owners, meaning the producers of raw materials such as oil or metal companies, and the shipowners (shipping companies). However, in the last 20 years, two groups of growing importance have been added to this list: traders who buy and sell commodities, such as oil, which needs to be transported, thus making themselves important players in the charter market, as well as operators who charter ships against a freight contract for arbitrage. Ship managers and brokers are also involved in the day-to-day business process. Each of the parties involved has a slightly different perspective on how shipping is conducted. Owners are primarily price takers. Additionally, in the background, we meet the suppliers, the

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management companies, the shipyard owners, equipment manufacturers and demolition/ scrap owners (Stopford, 2016, pp. 131-132)

The current shipping market is characterized by strong fluctuations, while it is almost never easy to predict its evolution⁹. It has been observed that from time to time, the market shows strong upward or downward trends, depending on different factors happening during a specific occurrence. For example, favorable economic and political circumstances¹⁰ could lead to an increase in demand for maritime transport, and consequently an increase in freight rates, as shipowners have to choose between different cargoes (Βλάχος & Ψύχου, 2011, pp. 146-147).

The decisive risk of the shipping market has to do with the realization of the transportation process at the right moment. In order to accomplish that, it's necessary to decode hidden messages in the information received, do an in depth analysis and a clear presentation of the risks and the current situation, through always an open mind. At the same time, there's always the challenge for the shipping industry to keep in mind of the past, while preparing for the future (Stopford, 2016).

Consequently, the best opportunities are taken by those who can judge when other players in the market are wrong, which means digging under the surface to understand the consequences of current developments (Stopford, 2016, p. 198). Ultimately it is the attitude to risk and the attitude to innovation which define the strong players.

⁹ "While these trends are positive for shipping, recovery remains nevertheless fragile in view of the highly volatile rates yet relatively low levels." (UNCTAD, 2018, p. x)

¹⁰ "Main economic and shipping indicators trended upward, reflecting growth in global investment, manufacturing activity and merchandise trade." (UNCTAD, 2018, p. 3)



3. SHIPPING CYCLES

There are four markets in shipping, which are strongly interlinked: the freights market, where the trade is sea transportation service; the second-hand market, where there's a buy-sell of ships; the newbuilding market and the scrap/ demolition market (Stopford, 2016, p. 250). The trends of these four shipping sectors define the shipping cycle.

A characteristic element of the shipping market is its cyclicality, meaning the rise and fall of prices, at regular intervals, which can neither be determined nor predicted. Many theories have been developed in this regard and several attempts have been made to predict the timely response to crisis situations, without substantial results. The fact that the course of the shipping market is shaped by so many and extremely variable different factors, which are extremely difficult to identify and calculate in each case, inevitably contributes to this. These are both external reasons and reasons that stem from endogenous factors, conditions and situations. External factors can be war, a major economic crisis in a country that imports large quantities of raw materials (eg China, USA), a large increase in the price of some products, such as oil, etc (Βλάχος & Ψύχου, 2011, p. 147).

In reality, economic cycles taking place in the global economy¹¹ are inevitably reflected on the shipping cycles (Stopford, 2016, p. 203). Of course this doesn't mean that shipping cycles will have necessarily the same length of time as recessions and growth periods. The course of a maritime cycle can change in an unpredictable time,

¹¹ "Shipping is a service industry whose demand is closely correlated with international trade levels and patterns. As a consequence shipping is subject to sometimes unpredictable swings in demand requiring the operator to make strategic planning decisions while navigating through the economic cycle of many countries." (Bendall & Stent, 2005, p. 13)



so it is possible that one can only perceive the signs of a change or differentiation in the economy and take some action (Βλάχος & Ψύχου, 2011, p. 148).

As far as it concerns to the internal problems, the main cause is shipping market dynamics per se, ie increased orders for new ships, low disintegration rate and reduced quantity of goods to be transported. In other words, a shipping crisis may start as a result of international productive activity and international maritime trade, but it will quickly take on an "endogenous" character, that is, due solely to maritime parameters (Βλάχος & Ψύχου, 2011, p. 147). Typically, it can be said that the demolition and shipbuilding sectors mainly define the growth rate of the global fleet. This is interdependent with the supply and demand for vessels (Stopford, 2016, p. 217)

Generally, at the beginning of the cycle, there's a rise in freight and charter prices and money begins to flow, allowing shipowners to pay higher prices for secondhand vessels. At the same time, investors are turning to the newbuildings market which now seems to have better value. Their confidence due to the new profits pushes them to order many new ships. After a few years, when these ships enter market, the downward trend begins. Falling cargo prices result in shrinking cash inflows as investors begin to repay the new ships. Financially weak shipowners who are unable to meet their daily obligations are forced to sell ships in the secondhand market. This is where the asset play market begins for the financially strong shipowners (Stopford, 2016, p. 251).

Although each shipping cycle is unique, there are three types, with specific characteristics that define them: short-term, long-term and seasonal. Short – term cycles appear to prevail over the long-term trend. Their duration could be from 3 to 12 years, with strong fluctuations, either upwards or downwards. They appear periodically and their duration is not always the same. Long-term cycles (or long-term trend) may have 60 years duration and they are not easily evident. They are the result

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of long lasting technical, social and political changes (Stopford, 2016, pp. 145-147). Seasonal cycles though are noticed yearly, through their expected fluctuations. For example, the purchase of dry bulk cargo in shipping is usually weak in July and August, when relatively small volumes of cereals are shipped. Similarly, there is a seasonal cycle in the oil trade destined for winter storage in the northern hemisphere (Stopford, 2016, p. 146)

The focus in shipping is primarily on the short-term cycle, due to its unpredictability in its appearance and its duration. More particularly, a short – term cycle is not a cycle per se, more likely a loose sequence of peaks and troughs (Stopford, 2016, p. 191). It comprises of four (4) stages, which don't appear according to a specific norm. The norm is not part of the process (Stopford, 2016, p. 154)

In the first stage, the lowest point of the *trough*, there is a fleet overcapacity and the freights are enough only to cover the operating costs. Also, low freights, combined with stricter credit limits, create a low cashflow, and difficult decisions are postponed for the future. In the second stage (*recovery*), supply and demand move to equilibrium levels, freight prices rise slightly, while laid-up tonnage decreases. The market climate remains uncertain, but confidence is gradually growing. In the third stage we have the peak (*plateau*), when all the available fleet tonnage of the fleet is used, while only the non-marketable ships are decommissioned. Transport prices go up significantly and profitability is back. The peak can last from a few weeks to a few years, always depending on the balance of supply and demand, and the longer it lasts, so does market optimism. The market is booming (*overtrading*), while newbuildings' orders are increasing to the maximum. In the fourth stage, we have the collapse (*collapse*), which occurs when supply exceeds demand, at which time freight rates fall sharply. Newbuildings are entering the market, resulting in oversupply, reduced freights and general movement remains stagnant. At the same time, market sentiment

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is mixed, with participants reluctant to accept that the peak is over (Stopford, 2016, p. 149). As a result, vessels demolition is increased, and hence reduction in supply, rise in the freights and beginning of the cycle again (Stopford, 2016, p. 253)

One of the main reasons why shipping cycles are so unpredictable is because the players involved can influence the conditions of the market. Different groups of investors do not necessarily behave in a rational way, which proves why the market repeatedly seems to overreact to price indications (Stopford, 2016, p. 153) Depending on the phase of the cycle, players behave differently, in order to last longer (Stopford, 2016, p. 191)

More specifically, depending on the trends of the freight market at a specific period, there's an effect on the psychology of the players, firstly to those active in the second hand market, and then those of the newbuildings, which is evident eventually in the company's revenues (Stopford, 2016, pp. 250-251). The expected outcome after some time from this situation is that markets tend to kill themselves with oversupply¹². The high freight market period ¹³ is characterized by the reintegration of decommissioned ships into the active fleet and the increase in orders for new ships, as shipowners believe that they can benefit and make additional profits. This leads to an ever-increasing supply of capacity, which, when it starts to exceed demand, then

¹² "...it is clear that if certain great groups of participants will – for any reason whatsoever – act together, then the great number of participants may not become effective; the decisive exchanges may take place directly between large 'coalitions', few in number, and not between individuals, many in number, acting independently." (Newmann & Morgenstern, 1953, p. 15)

¹³ "After five years of decelerating growth, 2017 saw a small improvement in world fleet expansion. During the year, a total of 42 million gross tons were added to global tonnage, equivalent to a 3.3 per cent growth rate. This performance reflects both a slight upturn in new deliveries and a decline in demolition activity, except in the tanker market, where demolition activity picked up. The expansion in ship supply capacity was surpassed by faster growth in seaborne trade volumes, altering the market balance and supporting improved freight rates and earnings." (UNCTAD, 2018, p. x)



an imbalance occurs and the market is led to a new downturn and recession¹⁴. The duration of the recession period cannot be predicted, as it depends on many factors. It is characterized by reduced capacity demand, stagnation and reduced investment capital, as investors turn their attention to sectors of the economy with higher profits. Market imbalances directly affect the formation of fare prices, which are significantly compressed (Βλάχος & Ψύχου, 2011, p. 147).

Expectations, fears, unreasonable certainties, and the general psychological state and charge are important factors that are likely to lure shipowners (or charterers) into hasty and unplanned decisions. Many times, for example, excessive optimism leads to excessively high number of orders for new ships, which is the cause of long-term oversupply, while, respectively, pessimism can cause a serious short-term drop in freights (Βλάχος & Ψύχου, 2011, p. 167). If investors decide it is time for an upwards trend and don't proceed with scrapping, then the cycle simply lasts longer. The fact that shipowners constantly try to guess the course of the cycle¹⁵ and the popular psychology plays its part often in determining the decision-making process, each cycle has its own distinct character (Stopford, 2016, p. 153).

¹⁴ "In early 2020, the world orderbook had declined with respect to dry bulk carriers, oil carriers, container ships and general cargo ships . Orders for three of these shipping segments have been shrinking since 2017 (except for dry bulk carriers, which increased in 2019)". ((UNCTAD), 2020, p. 42)

¹⁵ "The industry's cash flows are exposed daily to changes in international financial markets, to multicurrency sovereign risk, to pirates, to movement in oil prices, to changes in commodity prices, to other competitors, and above all, the trade cycle." (Bendall & Stent, 2005, p. 13)



4. OIL PRICE DEFINITION: KEY FACTORS

The analysis and understanding of the oil prices movement has always been - and now more than ever – so multifaceted, that someone needs to have a very deep understanding of as many parameters as possible, in order to be able to predict safely and decide wisely for the company needs. Sometimes, the trend in the oil prices might just reflect the overall sentiment that prevails at a specific time, in international level.

Generally, the different combinations of many situations, circumstances and characteristics are responsible for the oil price. Namely, the geographical location¹⁶, the transportation and extraction¹⁷ costs could be perceived as the first and most objective factors of the oil price. Of course, even though different geographical areas or countries could have different pricing policies, they can still influence each other, and hence, the overall global vibe.

Another one of the most important factors is the geopolitical position, whether a country is a producer or not, political and economic reasons¹⁸, whether the oil produced is being handled and processed by local companies or the Majors, the way it's being produced, the cost of the oil production¹⁹.

¹⁶ For example, the WTI, the years-long-standing benchmark for the US market, is strongly tied to geography, through Cushing, Oklahoma, always being the designated delivery point for WTI contracts (Grote, et al., 2017, p. 8)

¹⁷ “*The Drilling and Offshore sectors are probably more correlated with the oil price than with other shipping sectors.*” (Kavussanos, et al., 2005, p. 31)

¹⁸ For example: “*In the developing Americas, economic growth was hindered by adverse domestic and global conditions. In 2019, GDP growth in the region contracted by 0.3 per cent. Subdued growth (0.9 per cent) in Western Asia reflected weaker oil prices and geopolitical tensions in the region, including those arising from the sanctions placed on the Islamic Republic of Iran. Growth in Africa remained relatively steady, increasing by 3.1 per cent.*” ((UNCTAD), 2020, p. 4)

¹⁹ The advantage for low cost oil production is bigger profit margin for the production country.



Production, refining and distribution and marketing are the three main activities that define the structure of the crude oil market. These take place within a global marketplace, where buyers and sellers interact, supported by an international financial market, by utilizing futures and other financial contracts, in order to minimize as much as possible the impact of price volatility in their operations (Levine, et al., 2014, pp. 8-9).

Crude oil prices differentiate according to their quality/ type, as well as to their transportation cost (Melek & Ojeda, 2017, p. 53). The way that the oil being transported plays a big role to this picture: is it by pipeline, trucks, ships, or their combination? The different types of transportation is part of the price.

The most common factor defining the oil price, as any other commodity, would be supply and demand: *“The traditional textbook approach to oil price determination is based around the assumption that oil is an exhaustible resource, such the world will eventually run out of oil. In these textbook models, oil commands a premium, over and above its immediate economic value, reflecting the perceived scarcity of oil and the presumption that this scarcity will intensify overtime”* (Dale & Fattouh, 2018, p. 8).

On the other hand, it's been observed that oil price is formed predominately from factors that are not necessarily related to that (Mabro, 2001). The oil price is being generated and defined in the commodity markets, which are basically the common transaction place for the financial markets and the actual, physical markets. The fact that the oil industry relies on the financial (“paper”) markets so much, has taken away the possibility for finding out what is this the actual price of the oil “now”²⁰ (Grote, et al., 2017, p. 6).

²⁰ *“Brent oil is initially sold in very large amounts, on the order of tanker loads or approximately 600,000+ barrels, limiting the number of actors who have the financial resources to participate (Fielden 2015b). Moreover, these tanker sales are generally conducted far in advance of delivery and provide relatively little help in determining price. For that, the industry relies upon futures – bundled in much smaller lots,*



There's a relationship among spot and future crude prices, oil inventories and tanker rates, which define significantly operational management and budget planning decisions. More particularly, bunkering is one of the highest costs in terms of ships operations: *"On the other hand, fuel cost is the major cost driver in the shipping industry. It is therefore critical for a shipping company to manage its bunker purchasing and consumption properly. In practice, fuel prices are highly volatile which could bring considerable risks. Bunker risk management is then commonly applied by shipping companies in order to control the risk brought by the high volatility of the fuel cost... Fuel hedging is also one of the popular risk control approaches in the shipping industry. As a contractual tool, it allows the shipping company to reduce its exposure to fuel risk by establishing a fixed or capped cost for its future fuel consumption (Gu, et al., 2016, p. 2)"*.

WTI and Brent are the oil benchmarks, which refer to futures prices and are not necessarily the reflection of the physical oil supply. They are composed by multiple positions taken by traders where mainly non - oil factors dominate such as bonds, equities, foreign exchange and other commodities) (Mabro, 2001).

generally 1,000 barrels, increasing the number of market participants – for price signals. Central to this process is the manner in which North Sea oil moves from the production fields to tankers and refineries. If the buyers have their own refinery, e.g., large integrated oil companies, they can simply take possession of the crude oil at one of four different terminals – Hound Point and Sullom Voe in Scotland, Teesside in England and Sture in Norway – but as this is an internal transaction, no pricing information is gained. Much more useful from the market perspective are buyers of Brent oil (generally trading companies) who resell these parcels in either the paper market, approximately a month or more away from delivery, or the "dated" or "wet" market when a three day delivery window within 25 days has been set (Fielden 2015b). These relatively well-functioning systems – particularly in the dated markets – provide key pricing signals on Brent crude that in turn are used globally to price over sixty percent of global oil (Kurt 2015)." (Grote, et al., 2017, p. 10)



It's certainly a matter of perspective when looking into and analyzing the oil price and how it's defined. For example, the countries that have their own oil²¹, such as Saudi Arabia or USA, define massively the price²².

We see also many "games" from the big oil players – producing countries, for dominating the market. For example, when the US introduced the long expected self-produced shale oil, things got shaken up in the industry. Each time such a shift takes place, the equilibrium changes up, more or less. New opportunities may arise or the opposite, depending on the players' position²³.

This change in the US happened with the aim for the country to be more self – reliant. When the US introduced the shale oil for domestic use, mainly this caused a worry to the other producing countries, since they would lose a very big market, a very big client.

There's extensive research in regards to the shocks, artificial or not, taking place in the oil market. (Chiaie, et al., 2017, p. 2) Also, there's an interrelation with the economic policies followed by the countries whether by choice or because they have to. Actual knowledge and information of the oil stocks is gathered mainly from the US, but only when they choose to do so, with their public announcements (Mabro, 2001).

²¹ Oil producer countries

²² "The prices for gasoline, distillate, and jet fuel in the U.S. have been and will continue to be driven primarily by international supply and demand factors and their impact on world crude oil prices. These factors include consumption growth in Asia Pacific markets, supply disruptions in oil producing countries, the levels of spare crude production capacity, and production targets set by OPEC." (Levine, et al., 2014, p. 35)

²³ "Reduced shipments from exporters of the Organization of Petroleum Exporting Countries were offset by increased trade flows originating from the Atlantic basin and moving eastward towards Asia. This new trend has reshaped crude oil trade patterns, which became less concentrated on usual suppliers from Western Asia. Supported by the growing global refining capacity – especially in Asia – and the appeal of gas as a cleaner energy source, refined petroleum products and gas increased by a combined 3.9 per cent in 2017." (UNCTAD, 2018, p. x)



There are different kinds of oil price shocks: the impact of demand shocks, OPEC supply shocks, non-OPEC supply shocks, and speculative shock based on futures trading on crude oil prices (Maniam, et al., 2017, p. 208). However, the question as to why when intended production cuts are happening and still the price is going up, since we know for certain now that there's much oil still available²⁴. So why though then the prices keep on rising? It's like it's happening automatically, no matter what the actual physical situation is, *"the behavior of oil prices in recent years has attracted considerable attention and debate about whether this behavior is caused by fundamental supply and demand variables or by excess speculation and possibly manipulation."* (Ederington, et al., 2021, p. 3)

For example, there's a change in the oil reserves paradigm: we have passed from the *age of (perceived) scarcity* to the *age of abundance*, which has led, inevitably, to a more competitive market environment. Due to that change, oil producing countries are not only trying to have their oil consumed, but also to diversify their economic policy so that it does not rely primarily to this production (Dale & Fattouh, 2018, p. 1).

It can be said that even though the oil price is affected by non tangible factors, such as the futures market or made-up shortages, in its core, it still remains a result of supply and demand, as all the actions involved in the shipping sector.

Although there's the general sense that speculators and finance people, who are the most recently added players in the oil market, influence the prices and the trends decisively, yet there's no actual data evidence to support that. As already described, it's mostly a sense, rather than a fact.

²⁴ *"...the price of oil as being determined by shocks to the amount of oil coming out of the ground ('flow supply of oil') and the amount of oil being consumed ('flow demand for oil') with little attention to the role of inventories."* (Kilian & Murphy, 2014, p. 454)



The future of globalization may even be playing a very strong role in shaping each time the oil price currently: *The globalization process based on low labour cost differentials and on an extensive outsourcing of production that stimulated trade may have reached its limits, with factors other than developments in the world economy and population likely to shape the maritime trade patterns of the future transport. These include the global decarbonization agenda, which has implications for the two largest commodities transported at sea: crude oil and coal. Another driver would be the growing demand for smaller and low-value packages of physical goods that are increasingly bundled with services and require faster transit time.* ((UNCTAD), 2020, p. 23).

In regards to the decarbonization efforts specifically, it's important always to take into consideration the applicable regulations, such as IMO 2020, which may define effectively the oil prices for quite long periods: *"Fuel oil demand will increase by nearly 0.3 mb/d in 2021 (4.5%) as it is expected to benefits from a rebound in bunker fuel demand and higher industrial activity. Most of the growth will be for the new, very low sulphur fuel oil introduced by International Maritime Organisation regulations."*((IEA), 2021, p. 16)

4.1 THE GAME – THE PLAYERS

The global oil market involves thousands of players who transport the oil from its production place, to the refineries and ultimately sold to the final consumers (Levine, et al., 2014, p. 9). Strategic decisions in the political arena, in worldwide level play their part in defining the trade transactions and how they will materialize in the future²⁵.

²⁵ *"The first is a change in global oil supply. Thanks to shale, America has become the world's biggest crude oil producer, reducing the power of the Organisation of Petroleum Exporting Countries to control*



Although it's a totally free market, the players are very specific, and the big ones define the game. At the same time, the interdependence of the participants in this *shipping game* is not a factor to be put aside; on the contrary, it plays a vital role on the decision making. Mainly, there are two main distinct, but interconnected, categories of the market, which include a different set of factors and interests: the financial category of the markets, where the players are the hedge funds and other financial institutions²⁶, and the physical category, with the oil producing countries, oil companies and traders (Grote, et al., 2017, p. 7)

The prices reflect the interactions of buyers and sellers, with their own view of crude oil and petroleum products demand and supply. These interactions take place in physical and futures markets, responding to both current and future changes²⁷ in demand and supply conditions (Levine, et al., 2014, p. 6). Also, the publicized intentions of the production countries define market behaviors... and ultimately considered facts, even though they might never be materialized. In the meantime though, their impact has affected inevitably the actions taken by shippers and traders.

the market. The second is a change in demand. Concerns about climate change make demand much harder to predict, as energy efficiency increases and electric cars become more popular. Oil prices will become more volatile, making it harder for countries to achieve steady economic growth." (The Economist, 2018)

²⁶ "A change in market investment philosophy near the end of 2005 resulted in oil futures being treated as a general investment option rather than a specialty investment belonging mainly to hedgers and speculators." (Ederington, et al., 2021, p. 3)

²⁷ Several times within a specific time period, the oil market price is defined by the current or expected availability: Oversupply is the "situation in which current and expected increased in global oil production run ahead of the current and expected increase in global demand, associated with the unwillingness of oil producers to defer excess production driven by the fact that shutting-in operating capacity is costly, as well as the heightened uncertainty about the sensitivity of the underlying supply-demand conditions to a higher price" (Fattouh & Economou, 2018, p. 6). Undersupply is the "situation in which current and expected global oil production unable to meet current and expected increases in global demand, associated with the inability of oil producers to maintain and expand production due to long-lead times and long gestation periods from the point at which Final Investment Decision (FID) is made and the start of first-production" (Fattouh & Economou, 2018, p. 6)



Several world economies rely on petroleum industry, both as main source of energy and economic dependence. The largest oil sources are in Saudi Arabia, Russia, USA, China, Canada and Iran (Levine, et al., 2014, p. 26).

OPEC (Organization of Petroleum Exporting Countries)²⁸ was created on the premise of uniting the largest oil producer countries in order to control oil price, through production rate (Maniam, et al., 2017, p. 207) and eventually larger profits. Through announcements about current oil production, it takes up the role of an oil market manager (Mensi, et al., 2013)

With the introduction of US shale oil, the competition has risen significantly and OPEC's market share has been declined. Although much discussion and opposition have taken place, crude oil production in the United States has been increasing rapidly, using mainly two ways: horizontal drilling²⁹ and multistage hydraulic fracturing. The access to oil and natural gas resources from shale rock formations³⁰ is now technically possible and not so expensive to produce. With this way, the US has been able to cover domestic petroleum product demand and have substantially reduced dependence upon crude oil imports from overseas (Levine, et al., 2014, p. 4).

China is the biggest energy consumer, which means also big dependency on other producer countries (Gholz, et al., 2017, p. 42). Also, due to its great importance in the worldwide trade, is a benchmark by itself. Being the predominant manufacturer,

²⁸ "OPEC is an intergovernmental organization whose stated objective is to "coordinate and unify the petroleum policies of member countries." OPEC acts as a cartel by setting production quotas. It was created in 1960 and it's current members are Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE, and Venezuela." (Levine, et al., 2014, p. 37)

²⁹ "Horizontal drilling or directional drilling is a drilling methodology in which wellbores are turned horizontally at a certain depth. It is normally used to extract energy from a specific geologic stratum, such as a layer of shale rock." (Levine, et al., 2014, p. 37)

³⁰ "The largest shale and tight oil production is from the Eagle Ford (Texas), Bakken (Montana and North Dakota) and Permian (West Texas) shale formations." (Levine, et al., 2014)



exporter and consumer country, it is naturally a very good indicator³¹ of many sectors in the shipping market, as well as the oil market: *"Nonetheless, China is likely to remain a key player, given its strong supply-chain network and infrastructure and knowledge base, as well as its massive labour force, which has no match.* ((UNCTAD), 2020, p. 23).

US used to be a large oil importer, but this has changed considerably the last years³², with the largest production areas to be mainly Texas, the Gulf of Mexico, North Dakota, California, and Alaska (Levine, et al., 2014, p. 26). Actually it has become a net exporter of refined products for the first time in 60 years (Levine, et al., 2014, p. 35). This change has created a new equilibrium among the producer countries.

4.2 BRENT AND WTI BENCHMARKS

The current global-pricing system for crude oil is a consequence of the 1973 oil shock, which reduced dramatically OPEC's influence on the global oil prices. As more and more non OPEC countries and producers (including the private companies long active in the North Sea's oil fields) increased their production and presence in the market, the need for pricing transparency and objective standards became imperative.

³¹ *"Since more than 80 per cent of world merchandise trade by volume is carried by sea, the impact of the pandemic on maritime transport can have far-reaching implications. The impact is magnified by the role played by China in maritime trade, as prosperity within the shipping sector has long been strongly tied to that country. In 2003, amid the outbreak of severe acute respiratory syndrome, China made up 5 per cent of global GDP. Today this figure stands at 16 per cent. In 2019, China accounted for over 20 per cent of world imports by sea, up from less than 10 per cent in 2003. While its share of total exports has remained stable at 5 per cent of the world total since 2003, its share in global container exports has increased. In this context, its maritime trade has ripple effects on all shipping market segments, and supply-chain disruptions involving China naturally send shockwaves across shipping and ports worldwide"* ((UNCTAD), 2020, p. 19).

³² *"Since the onset of the shale revolution in the United States, developments in the country's energy sector have played a significant role in shaping global tanker trade. This was apparent throughout 2019, with a decline in United States crude oil imports and a rise in its long-haul exports."*((UNCTAD), 2020, p. 9)



As a result, during the 1980s we have the development of spot³³ and futures markets, both in Europe and the US, with their respective benchmarks for oil prices³⁴, Brent crude and West Texas Intermediate (WTI) (Marten & Jimenez, 2015, p. 2).

The large volume of production, which ensures physical liquidity for the purposes of trading, the representative quality standard and North Sea's geographical position close to both a large oil-consumption region and the main refining centers of Europe and the US, as well as a diverse ownership of production, are some of the main characteristics that established Brent as a global benchmark for oil prices. Additionally, Brent benchmark is being monitored by the UK government, offering a stable and supportive tax regulation and a relatively low political risk (Marten & Jimenez, 2015, p. 2).

WTI had been the leading global benchmark, and for quite some time the prices quoted for WTI and Brent were almost the same³⁵. Since 2011 though, the WTI disconnected from reflecting the prices on international level and depicted mostly the

³³ "Spot markets are markets in which commodities such as crude oil and petroleum products are bought and sold for immediate or very near-term delivery, usually within a period of 30 days or fewer. The transaction does not imply a continuing arrangement between the buyer and the seller. A spot market is more likely to develop at a location with numerous pipeline interconnections, thus allowing for a large number of buyers and sellers. Cushing Oklahoma is one important spot market for crude oil – specifically the WTI benchmark." (Levine, et al., 2014, p. 37)

³⁴ "Two of the most important benchmarks are West Texas Intermediate (U.S. mid-continent crude traded at Cushing Oklahoma) and Brent (North Sea and North Atlantic crude traded at Sullom Voe terminal in Scotland)." (Levine, et al., 2014, p. 36)

³⁵ "...with WTI having a relatively small price premium (about \$50 on average) from 2000 through 2010..." (Marten & Jimenez, 2015, p. 2)



US oil situation^{36 37}. Due to that and because the price difference compared to Brent, WTI gradually was perceived as a less objective indicator for the global oil prices.

Although the North Sea oil production has been gradually plunging since the mid 1980s, there have been some concerns as to how Brent crude could still remain to be a good indicator³⁸ of the oil prices on a global level. Nevertheless, these concerns haven't been materialized and Brent is still the most powerful benchmark, to be taken into consideration when trading.

Due to the fact that the futures contracts are mainly non-materialized, and that they take place in organized exchanges, the futures market is essentially a financial market³⁹. The WTI, which is traded on the New York Mercantile Exchange (NYMEX) or

³⁶ "...reflecting the effects of the US shale boom and subsequent logistics – driven glut of US supply, coupled with the U.S. government's ongoing ban on crude exports. In 2011 and 2012, WTI was priced at an average discount of more than \$17 per barrel, compared with Brent crude; by mid – November of 2015, that discount had fallen to \$4 per barrel." (Marten & Jimenez, 2015, p. 3)

³⁷ "Since late 2010 WTI prices have fallen from parity with Brent to a persistent discount in the \$10 to \$25 per barrel range. Likewise, prices for light, sweet crude oil produced from the Bakken shale in North Dakota have declined relative to Brent as a result of takeaway pipeline capacity constraints. Indeed, Bakken crude has sometimes traded at lower prices than WTI. Very recently the prices for Louisiana Light Sweet (LLS) (a crude oil produced along the U.S. Gulf Coast) have also fallen below Brent prices, indicating that the Gulf Coast has become over-supplied with light crude oil relative to refinery demand." (Levine, et al., 2014, p. 14)

³⁸ "Production from the original Brent oil field started to decline in the mid – 1980s, plunging from roughly 400,000 barrels per day in 1986 to about 75,000 barrels in 1990. This led to pricing distortions, with far reaching effects. To prevent the problem from recurring, oil from other regional fields has been added to the benchmark over time, starting with crude from the Ninian field in 1995 and followed later by oil from the Forties, Osenberg and Ekofisk fields. Even with this expanded lineup, however, the production of Brent crude has continued to decline, falling from 420,000 barrels per day in 2009 to 260,000 barrels per day in 2014." (Marten & Jimenez, 2015, p. 3)

³⁹ "A futures contract is a binding, legal agreement between a buyer and a seller for delivery of a particular quantity of a commodity at a specified time, place, and price. These contracts are traded on regulated exchanges and are settled daily based on their current value in the marketplace. Many oil contracts traded on the New York Mercantile Exchange (NYMEX) and other exchanges end without actual physical delivery of the commodity. Futures contracts most often are liquidated or cancelled out by purchasing a covering position prior to the delivery date and are generally used as a financial risk management and investment tool rather than for supply purposes." (Levine, et al., 2014, p. 37)



the Brent, traded on the Inter-Continental Exchange (ICE) (Grote, et al., 2017, p. 6), are the principal crudes which constitute the “markers” or “benchmarks” for the futures contracts. Ultimately, the interactions of thousands of independent traders, both of commercial and financial institutions in these organised exchanges, play a crucial role in the price of the oil (Levine, et al., 2014, p. 32).

Although “spot” and “futures” markets exist for quite some time in the commodities’ markets, in regards to oil, they are relatively new. They are extremely important right now, since all the participants (buyers and sellers, including refiners, traders, producers, and transporters, throughout the chain of supply) of the global oil industry are being informed, make decisions and shape current and future supply and demand conditions (Levine, et al., 2014, p. 31).

The sale or purchase of a commodity, such as crude oil or its refined products, for near- term delivery, take place in the spot market. Spot contracts normally involve delivery of crude over the coming month. Spot market, contrary to futures market, is considered to be the “physical” market⁴⁰, since the buying and selling of physical volumes take place.

The contracts in a futures market basically lock a future oil sale or purchase transaction⁴¹, with all the necessary details specified for the delivery: the volume, type or grade of crude oil, the price, the future time in which the crude is bought or sold, and the particular location to which it is to be delivered. Nevertheless, the actual delivery rarely materializes, since the traders “close out” their positions, meaning they

⁴⁰ *“Spot” purchases refer to situations in which the commodity physically changes hands at a refinery gate or other major pricing hub for delivery on a pipeline or via barge or cargo.* (Ederington, et al., 2021, p. 3)

⁴¹ *“So, for example, the closing price of a futures contract for delivery in June must equal the spot price for oil in June. If the prices differed, a trader would buy in the market in which the price is lower and immediately sell it into the market where the price is higher and earn a profit.”* (Levine, et al., 2014, p. 33)



cancel out a contract prior to the time it would require for the oil to be actually delivered.

4.3 TRANSPORTATION OF OIL AND FREIGHTS MARKET

The oil producing industry is one of the biggest client of shipping, and certainly 20th century has been certainly the era of oil, as it was established as the main source of energy in worldwide level. (Βλάχος & Ψύχου, 2011, p. 113). Hence, the transportation of oil is a very important component relating to its price (Joutz & Poulakidas, 2009, p. 216).

Tankers transport crude oil, refined⁴² petroleum products, gas and chemicals. The main types of tanker vessels are crude tankers and product tankers. Crude is the unrefined oil, transported from extraction locations to refineries. Product tankers transport refined oil products, such as gasoline, kerosene, distillates⁴³ and lubricants to consuming markets.

There are also different tanker sizes, which also categorize them to different markets. Medium and larger vessels are used for long distance routes and carry unrefined oil, while small ones carry predominately oil products. Handy or Product (25.000 – 39.000 dwt), Medium - Range tankers (40.000 – 54.999 dwt) Panamax (55.000 - 84.999 dwt), Aframax (84.000 – 124.999 dwt), Suezmax (125.000 - 199.999 dwt), Very Large Crude Carrier VLCC (200.000 – 319.999 dwt), Ultra Large Crude

⁴² "Refining, the process by which crude oil is turned into products, such as gasoline." (Levine, et al., 2014, p. 8)

⁴³ "Distillate or distillate fuel oil is a general classification for the petroleum fractions produced in conventional distillation (i.e., before thermal or catalytic cracking). It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation." (Levine, et al., 2014, p. 36)



Carriers ULCC (320.000 dwt and above) ((UNCTAD), 2020, p. x). Generally, the average age of larger tankers is around 9 years, while for the smaller ones would reach up to 20 years. (Stopford, 2016, pp. 110-112)

The crude oil market is considered to be the largest market of wet cargo, since crude oil is the commodity with the largest volume transported by the sea (Βλάχος & Ψύχου, 2011, p. 159). The *physical infrastructure* of the crude oil market entails *a vast array of capital, including drilling rigs, pipelines, ports, tankers, barges, trucks, crude oil storage facilities, refineries, product terminals—right down to retail storage tanks and gasoline pumps. The physical infrastructure links an international network of thousands of producers, refiners, marketers, brokers, traders, and consumers buying and selling physical volumes of crude oil and petroleum products throughout this chain of production* (Levine, et al., 2014, pp. 8-9)

Freight is the amount received by the shipowner from the charterer, for the disposal of his ship for the transportation of one or more cargoes (Βλάχος & Ψύχου, 2011, p. 21). When there's an increased demand for tanker vessels, freight rate will go up.

As far as it concerns the oil companies, they can choose to diversify their strategy, by deciding to buy its own tanker fleet to cover half of its crude oil transportation needs, while the remaining 50% of its needs to be met by chartered vessels from independent shipowners (Stopford, 2016, p. 103). It's usual for the oil producers/ handlers to manage their own fleet, in order to have, full overview of the operation, as well as minimize their cost. This was very usual in the past, but lately it's been noticed that large oil companies prefer to charter vessels long-term, instead of operating their own.



The tanker supply is influenced by the prices of oil in the international market, in periods of particular demand⁴⁴ for oil transportation services there is a significant increase in the quantities transported, with the aim of creating stocks⁴⁵ (and future large profits) (Βλάχος & Ψύχου, 2011, p. 170). In that respect, tankers can also be used as floating storages of oil, especially when the market is low⁴⁶.

The influence of the political conditions has a special weight in the cases of transportation of huge volumes of crude oil. In this case, both offshore and onshore oil routes are defined and adjusted according to political conditions, business and transnational relations between producers, means of transport and oil importers (Βλάχος & Ψύχου, 2011, p. 155). The freight market destabilization is actually a frequent outcome of the unstable political situation in producer countries with weak governments and dictatorial regimes, such as Iran, Iraq, Saudi Arabia, Kuwait (Βλάχος & Ψύχου, 2011, p. 156).

⁴⁴ “Mexican imports, a key driver of global trade growth in recent years, dropped in 2019 as domestic supply increased. Growth in imports to Latin America and rising exports from China provided support to product tanker demand”. ((UNCTAD), 2020, p. 9)

⁴⁵ “Tanker rates surged in March and April 2020, reflecting growing demand for floating storage. The oil market was in a state of super contango where front-month prices were much lower than prices in future months, making storing oil for future sales profitable. Traders chartered tankers to store low-cost crude oil, thereby reducing the availability of vessels for transport and supporting tanker rates. Freight rates declined sharply in May 2020, with about a third of total vessels locked in floating storage returning to active trade and inflating oil supply.” ((UNCTAD), 2020, p. 12)

⁴⁶ “In March and April 2020, tanker rates rose sharply, as demand for these vessels increased, despite global demand for crude oil and petroleum products falling dramatically due to the pandemic. This is explained by the hiring of many vessels as floating storage, following the lack of agreement within the Organization of the Petroleum Exporting Countries and its wider group regarding further production cuts that had led to a temporary increase in output from Saudi Arabia at a time when there was no such need on the consumption side. The oil market was in a state of super contango where front-month prices were much lower than they would be in future months, making the storage of oil for future sales profitable. Traders rushed to charter large tankers for floating storage so they could sell the oil at higher prices later, thus reducing the availability of vessels in the market and triggering a sharp rise in tanker rates.” ((UNCTAD), 2020, p. 52)



Regarding the impact of political and economic decisions, crude and product tankers flows were significantly affected by the US shale oil boom, as well as by changes in the refining capacity of different regions (GIBSON Shipbrokers, 2018, p. 1). Additional to that, new markets are created or modified, and the reshuffling of the world's economies standing in the international business spectrum can be impactful on the way the oil is being traded⁴⁷.

Last, it can't be ignored that, as with every other economic activity, unexpected events of large scale, inevitably affect the transportation of all commodities, and hence oil, and the markets fluctuate intensively, while trying to adjust to the new circumstances⁴⁸.

4.4 CRISES/ SHOCKS/ DISRUPTIONS

One of the most defining factors of the oil prices, and maybe the most recognizable one, is any kind of international or domestic crisis. We have seen many times during the decades big global events, that either came as shocks, or have a lengthy presence and duration, have an immediate impact on the oil prices. Even the uncertainty that we're currently experiencing, it can be perceived as a type of shock in the market (Acik, 2021, p. 400).

All these circumstances and events over the years are depicted and analysed in depth in the UNCTAD reports.

⁴⁷ "Emerging markets are driving energy demand back above 2019 levels". ((IEA), 2021, p. 2)

⁴⁸ "Lockdowns induced by the pandemic, geopolitical events and oil price fluctuations had an impact on developments in the oil tanker freight market, maintaining freight rates high during the first quarter of 2020. During this period, the freight rates market experienced highly volatile trends, despite a weak market balance due to an oversupplied fleet market and low demand". ((UNCTAD), 2020, p. 52)



During the period 2000-2008, the price of crude oil increased worldwide due to global economic growth and supply was not enough⁴⁹. The rapid demand growth of China and India, continuous conflicts in Middle East and Africa and the worldwide recession of 2008, where some of the main events that affected the prices fundamentally (Levine, et al., 2014).

In 2008, the economic crisis resulted in major decline of oil consumption, which was also reinforced by the growing OPEC consumption. Consequently, the oil price collapsed in the second half of 2008. The oil demand remained weak in 2009, but prices rose significantly from that year onwards, due to a number of geopolitical factors: 1) OPEC made substantial production cuts, 2) during 2010-2012, the economy starts to recover, so does the oil demand, with the largest oil growth demand to take place in the Asia Pacific markets, 3) there have also been supply disruptions (*supply risk*), due to political instability in North Africa and the Middle East and the sanctions imposed against Iran⁵⁰, 4) and last, as a result of these events, in 2012-2013, there was also a decline in the levels of worldwide spare oil production capacity (Levine, et al., 2014, p. 30).

During 2011 – 2014, Brent price is over \$100/ bbl, US oil production is increased heavily from 5.5 million barrels/ to about 8.9 millions. As a result, oil price fell dramatically due to oversupply (Kleinberg, et al., 2018, p. 70).

2019 was a year with many major events that affected dramatically the global trade: China, United States and Brexit: "*Owing to the slowdown in the world economy and trade, growth in international maritime trade stalled in 2019 and reached its lowest*

⁴⁹ "This basic belief has had an important influence on oil markets since the 1970s and before. Oil producing countries rationed their own supplies safe in the belief that if they didn't produce a barrel of oil today they could produce it tomorrow, potentially at a higher price. Oil companies spent huge sums of money exploring and securing oil resources that were expected to become increasingly harder and more expensive to find" (Dale & Fattouh, 2018, p. 3).

⁵⁰ (Βλάχος & Ψύχου, 2011, p. 160)



level since the financial crisis of 2008–2009. After rising moderately (2.8 per cent) in 2018, volumes expanded at a marginal 0.5 per cent in 2019. A number of factors weighed on the performance of maritime trade. These included trade policy tensions; adverse economic conditions and social unrest in some countries; sanctions; supply-side disruptions, such as the Vale dam collapse in Brazil and Cyclone Veronica in Australia; and low oil demand growth." ((UNCTAD), 2020, p. 6)

These have shaken the world, causing instability, uncertainty and low activity, which also continued during 2020⁵¹, together with the COVID 19 pandemic: "Ordering contracts were down 53 per cent year over year in July 2020 (Clarksons Research, 2020c). In addition, many companies decided to delay scrubber installation because of the impact of the pandemic on financial cash flow (Clarksons Research, 2020d; *Manifold Times*, 2020). This is also linked to fuel price dynamics since January 2020, namely the narrowing of the price differential between high and low sulphur fuel, which increased the time to recover the investment cost of installing scrubbers (IHS Markit, 2020; *Seatrade Maritime News*, 2020a). ((UNCTAD), 2020, pp. 45-46)"

As a subcategory of these crises, any disruption or abnormality / differentiation in the flow of the oil production in any of the producing countries specifically, could

⁵¹ "In December 2019, China and the United States agreed on the first phase of a trade agreement to help de-escalate the tensions between the two economies. On 15 January 2020, both countries signed the agreement on the understanding that China would increase its merchandise imports from the United States by \$200 billion (United Nations, 2020a). In return, the United States would cut by half its 15 per cent tariffs on \$120 billion of imports from China. In Europe, reduced uncertainty over Brexit was a welcome development, although the European Union and the United Kingdom still needed to define a new trading relationship before January 2021 (United Nations, 2020a). In June 2020, the United Kingdom outlined new customs and border arrangements for 2021 and indicated its commitment to introducing a three-phase plan of import changes, building new border facilities for carrying out required checks and providing targeted support to ports to build new infrastructure (Lloyd's Loading List, 2020a). Further, the European Union is expected to impose full customs controls and checks on goods from the United Kingdom starting 1 January 2021 (United Nations, 2020a)." ((UNCTAD), 2020, p. 6)



cause a major effect to the oil prices, and consequently to the way the fuel is being traded⁵².

Supply disruptions are a main instrument of the global oil markets, with immediate impact on the oil prices, due to the uncertainty that is created about their length duration on one hand, and how quickly the production will recover, on the other (Levine, et al., 2014, pp. 30-31).

For example, the OPEC countries are constantly using these shocks as a commercial technique to define the oil prices decisively. They are so frequent, that they are almost expected from the market players, from time to time. These shocks are effected through artificial cuttings in the production flow. On the other hand, we have cuttings of the production flow, when unexpected situations occur, such as, a significant pipeline has broken in a major oil producing country. The interesting thing is that even though sometimes these accidents aren't so grave or don't have a long duration in the disruption, they still have an immediate effect on the oil price, even short term. Although at first glance is not obvious as to why there should be an impact at all, still it's a condition of the market that gives the traders the possibility to justify the price increase, even if it last for a few hours or a day, and hence increase their profit.

⁵² *Since the onset of the shale revolution in the United States, developments in the country's energy sector have played a significant role in shaping global tanker trade. This was apparent throughout 2019, with a decline in United States crude oil imports and a rise in its long-haul exports. ... "Crude oil trade decreased by 1.1. per cent in 2019. Downside factors include the cuts in supply by members of the Organization of the Petroleum Exporting Countries aimed at supporting oil prices, as well as disruptions affecting exports from the Islamic Republic of Iran and the Bolivarian Republic of Venezuela. The impact on exports from Western Asia resulting from the attacks on Saudi oil infrastructure was limited. Pressure on the demand side include lower global oil demand, a sharp reduction in United States imports and a decline in global refinery activity. However, expansion in exports from Brazil and the United States have supported long-haul journeys from the Atlantic to Asia". ((UNCTAD), 2020, pp. 8-9)*



Overall, through this historic review of the last 20 years, all kinds of crises, shocks and disruptions are evident, as well as the way they work. Sometimes they are interrelated, and some others they are anticipated, and so any damage can be absorbed.

4.4.1 The new era: decarbonisation - The ULSFO effect

With the growing pressures to decarbonize the transportation sector as much as possible, alternative sources of energy are threatening oil⁵³ and all the markets around it (Dale & Fattouh, 2018, p. 2).

Generally, *a ship's emissions depend on numerous factors, including vessel size, engine type, fuel used and speed.* A larger ship will naturally emit more carbon dioxide per mile, but due to economies of scale, it will emit less carbon dioxide per ton-mile. Liquefied natural gas and cruise ships are on average far larger than offshore or service vessels, such as tugs, and will thus emit more carbon dioxide per ship than the smaller vessels ((UNCTAD), 2020, p. 75).

Regarding container ships, the smallest ones of up to 999 TEUs, emit about twice as much carbon dioxide per container carried as the largest container ships. However, the important thing to take into consideration about container vessels is that, due to the nature of the services they provide, they have to transit at higher speeds than dry bulk carriers, and consequently, providing that all other things being equal, emitting more carbon dioxide per ton mile than the latter ((UNCTAD), 2020, p. 93).

⁵³ *"Revenues from oil and natural gas have plunged in recent years, as prices have fallen. A new report from the International Energy Agency (IEA) puts the challenge in stark relief. In six large petrostates the IEA examined—Iraq, Nigeria, Russia, Saudi Arabia, the United Arab Emirates and Venezuela—net income from oil and natural gas in 2016 was less than one-third of its level in 2012. Such a huge drop-off is painful. In Russia, oil and gas receipts account for about 40% of the government's revenue. In Iraq they account for 90%." (The Economist, 2018)*



The shift towards larger vessels of all types (bulk carriers, containers, tankers) over the past decade, combined with increased efficiency gains and the scrapping of less efficient vessels, shows that carbon-dioxide emissions growth has trailed behind the increase in fleet dead weight. Over the same period, carbon-dioxide emissions from tankers and bulk carriers increased by 19% and 17%, respectively, well below the 38 % and 51% growth in respective fleet capacity ((UNCTAD), 2020, p. 93)

Even though we have larger average vessel sizes, the carbon-dioxide emissions per vessel have declined slightly over the past decade. While further gains can reasonably be expected over the next decade, as modern eco-designs continue to replace older, less efficient designs, and with some further increases in average vessel size likely, these will not be enough to meaningfully reduce overall carbon-dioxide emissions in line with the 2050 targets of IMO. In order to achieve these targets, radical engine and fuel technology changes will be required ((UNCTAD), 2020, p. 95). *Due to the enormous amount of marine fuel consumed by the world fleet, the maritime sector is one of the biggest sources of CO2 emissions among all transportation industries. International shipping emits approximately 2.2% of the world's anthropogenic CO2 emissions.* (Gu, et al., 2016, p. 2)

The emissions in shipping were primarily handled mainly the last decade with the implementation of the ECA regulation. Certain port areas imposed to the incoming and staying vessels to switch from burning high sulphur fuel oil (HFO) to marine gasoil (MGO), which is much more expensive, and hence affects the decisions to be taken in regards to the sailing route and speed (Gu, et al., 2016, pp. 4-5).



IMO decision for the carbon reduction of shipping by 2020 was a game changer. Shipping companies had to adhere to this upcoming regulation⁵⁴, and so there were three main options they could choose from, to be applied to their vessels:

⁵⁴ *Maritime decarbonization and the reduction of greenhouse gas emissions from ships have become a priority area for policymakers and industry to be achieved, among others, through the adoption of energy-efficient technologies, the optimization of ship operations and use of low- and zero-carbon fuels, as well as regulation. A number of measures are being adopted in these areas by Governments, often in collaboration with industry, both nationally and internationally. The IMO Marine Environment Protection Committee has for some time been addressing greenhouse gas emissions from ships engaged in international voyages. The measures to improve the energy efficiency of international shipping were adopted under a new chapter of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL), annex VI. In force since 1 January 2013, these measures apply to ships of 400 gross tons and above that are engaged in international voyage. They make two key requirements mandatory: The energy efficiency design index for new ships and the ship energy efficiency management plan for new and existing ships. The energy efficiency design index for new ships has become increasingly strict over time. In May 2019, the Marine Environment Protection Committee approved, for adoption at its next session (initially scheduled for April 2020, but postponed due to the COVID-19 pandemic), draft amendments to MARPOL annex VI.*

These aimed to significantly strengthen the phase 3 requirements of the index, bringing forward their entry into force date to 2022, from 2025, for several ship types, including container ships, gas carriers, general cargo ships and liquefied natural gas carriers.

The ship energy efficiency management plan for new and existing ships establishes a mechanism for improving the energy efficiency of ships, including by 36 For solutions that involve the use of electronic documents, scanned, faxed or emailed images and potential scenarios in the delivery of documents during the COVID-19 crisis, see International Chamber of Commerce, 2020b. monitoring their energy efficiency performance, new practices and technologies. For instance, it is now mandatory for ships to collect and report ship fuel oil consumption data. Since 1 January 2019, flag States collect consumption data for each type of fuel oil used by ships of 5,000 gross tons and above, which are then transferred to the IMO ship fuel oil consumption database. Reports analysing and summarizing the data collected shall periodically inform the Marine Environment Protection Committee. Information from the reports also benefits analysis on emissions by flag or vessel type as presented in chapter 3.E of the Review.

Already in April 2018, the Marine Environment Protection Committee had adopted the Initial Strategy on reduction of greenhouse gas emissions from ships (IMO, 2018a, annex 1; UNCTAD, 2019a), which envisages a reduction of the total annual greenhouse gas emissions from international shipping by at least 50 per cent by 2050 as compared with 2008, while, at the same time, pursuing efforts towards phasing them out entirely. Candidate short-term measures, to be further developed and agreed upon by member States between 2018 and 2023, include technical and operational energy efficiency measures for both new and existing ships, such as speed optimization and reduction, the development of robust life cycle greenhouse gas and carbon intensity guidelines for all types of fuels to prepare for the use of alternative low-carbon and zero-carbon fuels, port activities and incentives for first movers. Innovative



emissions-reduction mechanisms, possibly including market-based measures, to incentivize greenhouse gas emission reduction – a controversial issue for a number of years – were included among candidate midterm measures. These are to be agreed and decided upon between 2023 and 2030, along with possible long-term measures to be undertaken beyond 2030 that would ultimately lead to zero-carbon or fossil-free fuels to enable the potential decarbonization of the shipping sector in the second half of the century (for more information, see UNCTAD, 2018).

In October 2018, the Marine Environment Protection Committee approved a programme of follow-up actions of the Initial Strategy on reduction of greenhouse gas emissions from ships up to 2023. It is planned that a revised strategy on reduction of greenhouse gas emissions from ships will be adopted in 2023.

The Marine Environment Protection Committee Working Group on Reduction of Greenhouse Gas Emissions from Ships met for its sixth intersessional meeting in November 2019 and made progress on several issues, leading towards achieving the levels of ambition set out in the Initial Strategy (see IMO, 2019a).

These include the following:

- Development of a draft resolution on national action plans to address greenhouse gas emissions from international shipping. The development and update of relevant national action plans was envisaged as a candidate short-term measure in the Initial Strategy. The resolution suggests that national action plans could include, without being limited to, the following actions: improving domestic institutional and legislative arrangements for the effective implementation of existing IMO instruments; developing activities to further enhance the energy efficiency of ships; initiating research and advancing the uptake of alternative low-carbon and zero carbon fuels; accelerating port-emission reduction activities, consistent with resolution MEPC.323(74); fostering capacity-building, awareness-raising and regional cooperation; and facilitating the development of infrastructure for green shipping. Potential legal, policy and institutional arrangements to be put in place by Member States should be elaborated in accordance with national circumstances and priorities and relevant experiences shared with IMO.*
- Consideration of various concrete proposals for mandatory short-term measures to further reduce greenhouse gas emissions from existing ships. Proposals of a technical nature included, for example, an energy efficiency existing ship index, which would require ships to make technical modifications, for example, mandatory engine power limitation, to improve their energy efficiency. Proposals for an operational approach included focusing on carbon-intensity-reduction targets using appropriate carbon-intensity indicators, including by means of strengthening the ship energy efficiency management plan based on regular energy audits of the ship. This approach could include measures to limit or optimize speeds for voyages. There was general agreement that a mandatory goal-based approach for both the technical and operational approaches would provide the needed flexibility and incentive for innovation.*
- Assessment of impacts of the proposals on States, with particular attention to be paid to the needs of developing countries, especially the least developed countries and small island developing States.*
- Consideration of the use of alternative fuels, in particular with regard to measures in the medium and long term. This is also important to encourage the uptake of low- and zero-carbon fuels in the shipping sector. The establishment of a dedicated workstream for the development of life cycle greenhouse gas or carbon-intensity guidelines (for example, from well to wake or tank to propeller) for all relevant types of alternative fuels was suggested. This could include, for example, biofuels, (renewable) electro- or synthetic fuels such as hydrogen or ammonia. The issue of methane slip, including enhanced*



understanding of the problem, how methane slip could be measured, monitored and controlled and which measures could be considered by IMO to address the matter, was discussed in relation to the uptake of methane-based fuels such as liquefied natural gas (IMO, 2019a).

Other recent IMO collaborative work to address greenhouse gas emissions from ships engaged in international voyage include the following:

- *Fourth IMO greenhouse gas study. This study, published in August 2020, includes an inventory of current global emissions of greenhouse gases and relevant substances emitted between 2012 and 2018, from ships of 100 gross tons and above engaged in international voyages, as well as their carbon intensity, and projects scenarios for future international shipping emissions from 2018–2050. It builds on the third IMO greenhouse gas study, issued in 2014. The fourth study, mentioned above, indicates that the share of shipping emissions in global anthropogenic emissions increased from 2.76 per cent in 2012 to 2.89 per cent in 2018. Using a new voyage-based allocation of international shipping, the study indicates that carbon-dioxide emissions increased from 701 million tons in 2012 to 740 million tons in 2018 – a 5.6 per cent increase – but at a lower growth rate than that of total shipping emissions. Using the vessel-based allocation of international shipping taken from the third IMO greenhouse gas study, carbon-dioxide emissions grew from 848 million tons in 2012 to 919 million tonnes in 2018 – an 8.4 per cent increase. The study also notes that ship emissions are projected to rise from about 90 per cent of 2008 emissions in 2018 to 90–130 per cent of 2008 emissions by 2050. Thus, much work lies ahead to meet the IMO strategy goal of cutting greenhouse gas emissions from international shipping by at least 50 per cent from 2008 levels by 2050. Also, to phase out greenhouse gas emissions*

from the sector as soon as possible, regulations that encourage innovation and the widespread adoption of the cleanest, most advanced technologies are needed (International Council on Clean Transportation, 2020). Consideration and approval of the fourth IMO greenhouse gas study 2020 by the Marine Environment Protection Committee is still pending (IMO, 2020b).

- *Multi-donor trust fund for reduction of greenhouse gas emissions from ships. This fund was established to provide a dedicated source of financial support to sustain IMO technical cooperation and capacity-building activities to support the implementation of the Initial Strategy.*

- *Collaboration with UNCTAD on an expert review of the impact assessments submitted to the Intersessional Working Group on Reduction of Greenhouse Gas Emissions from Ships. The collaborative efforts aim to produce a review of the comprehensiveness of the impact assessments of the concrete proposals to improve the energy efficiency of existing ships submitted to the Working Group, taking into account the procedure for assessing impacts on States of candidate measures set out in MEPC.1/Circ.885 and the available data.*

During the United Nations Climate Action Summit, held in New York in September 2019, many business leaders and local government representatives announced concrete actions to address climate change (United Nations, 2019). For example, the industry-led initiative "Getting to Zero Coalition", supported by UNCTAD, committed to the deployment of viable zero-emissions vessels by 2030 to further the achievement of the goals of the IMO Initial Strategy (United Nations, 2019).

With regard to the European Union and the European Economic Area, an important legal requirement is worth noting. Since 1 January 2018, large ships of over 5,000 gross tons that load or unload cargo or passengers at ports in the European Economic Area have been required to monitor and report their related carbon-dioxide emissions and other relevant information, in conformity with Regulation 2015/757, as



1. *Switch from high sulphur fuel oils (HSFO) to low sulphur fuel oils (LSFO).*
 2. *Install exhaust gas cleaning systems (EGSC or scrubbers) and use heavy fuel oil (HFO).*
 3. *Change the use of fuel altogether, such as liquefied natural gas (LNG) or other fuels.*
- (Han & Wang, 2021, p. 1)

All these options were extremely expensive, and had to happen within a very short timeframe, from the time this decision was announced, otherwise the consequences would be grave. The IMO 2020 regulation, which was announced officially only a few years before its mandatory application, and all the players and sectors in the shipping market were preparing and discussing endlessly, in order to arrange their activities with the most profitable way possible, is an indicative example of how the anticipated and actual application of a new guideline can define massively the oil price⁵⁵.

In shipping, shipping companies are trying to anticipate as many costs/expenses as possible. The IMO regulation⁵⁶ was a radical change and an extremely

amended by Delegated Regulation 2016/2071 (see https://ec.europa.eu/clima/policies/transport/shipping_en).

As a result, since 2019, ships calling at ports in the European Economic Area must report under both the European Union regulation and the IMO data collection system. Every year, the European Commission publishes a report to keep the public abreast of trends in carbon-dioxide emissions and provides energy efficiency information concerning the monitored fleet (European Commission, 2020a; European Commission, 2020b)." ((UNCTAD), 2020, pp. 125-127)

⁵⁵ *"Other tanker trade experienced difficulty in 2019, contracting by nearly 1 per cent. Major setback included slower global economic growth and extended refinery maintenance periods, with many refiners adjusting production in preparation for the coming into force on 1 January 2020 of the IMO 2020 regulation on a sulphur cap for marine fuels".* ((UNCTAD), 2020, p. 9)

⁵⁶ *"An IMO regulation limiting the sulphur content in ship fuel oil to 0.50 per cent, down from 3.50 per cent, entered into force on 1 January 2020 (UNCTAD, 2019a). In designated emission control areas, the limit remained even lower, at 0.10 per cent.⁴² To support consistent implementation and compliance and provide a means for effective enforcement by States, particularly port State control, IMO in October 2018 adopted an additional MARPOL amendment, which entered into force on 1 March 2020. The amendment prohibits not just the use, but also the carriage of non-compliant fuel oil for combustion purposes for*



high cost, specially for the smaller players. Of course this decision, the reason that it was so important, was the fact that it reshuffled the dynamics of almost every sector in shipping, from shipbuilding market, scrap, refineries, trading to chartering.

Each shipowning company had to decide which way they would choose in order to comply with the IMO 2020 regulation: would they install scrubbers? Would they use the newly introduced Low Sulphur fuel oil (LSFO)? Would they use both? And what is the cost of each of these options? How would this affect the overall performance of the vessel?

The issues and the parameters that had to be taken into consideration, in order to comply properly with the guideline, as well as ensure the business continuity seamlessly were numerous.

Also, it was very important to be prepared on time, since there was a directive in advance, and the shipping companies wouldn't like to lose their clients (specially the big ones). It's certainly a matter of reputation in the professional world, and ultimately a matter of keeping your clients, and ensuring your share and profits in the market. The large traders are looking very closely and thoroughly the shipping companies they will be dealing with, they will charter their vessels out. The vessels would have to cover all the required characteristics, imposed by the established organizations, in order to be the preferred choice from the shippers.

The core of the IMO 2020 regulation was the oil: the deadline for being fully prepared to comply was the end of 2019. From January 1st 2020, all the vessels would have to be compliant, otherwise very costly fines would be imposed, taking into

propulsion or operation on board a ship, unless the ship is fitted with an approved equivalent method, such as a scrubber or exhaust gas cleaning system. Also, a comprehensive set of guidelines to support the consistent implementation of the lower 0.50 per cent limit on sulphur in ship fuel oil and related amendments to the Convention were approved in May 2019 (IMO, 2019b, annex 14)."

((UNCTAD), 2020, p. 128)



consideration also the large investments made by the refineries for the production of this new grade.

Following the announcement of this regulation, the impact on the oil market was already evident: the high sulphur fuel oil price would drop and low sulphur fuel oil and gasoil prices would rise; the credit market has had already a great shift: there's a bigger debt exposure of the shipowners to modify their vessels according to the new regulations, as well as the bunker suppliers and traders had to impose shorter payment terms.

As expected, CO₂ emissions being a new variant in calculating the shipping costs and risks, they have become an issue to be taken fully into consideration in the bunker risk management. For example, the slow steaming strategy (speed reduction), is very good for minimizing operational costs, but also for emission reduction (Gu, et al., 2016, pp. 2-3).

The long-term goal of shipping decarbonization is linked to the Initial IMO Strategy on reduction of greenhouse gas emissions from ships, which is aimed at cutting annual emissions by at least 50 per cent by 2050 and the carbon intensity of emissions by 40 per cent by 2030 and 70 per cent by 2050, compared with 2008 levels. Maintaining the commitment to reach this goal will require significant resources and investment.

Notwithstanding the impacts of the pandemic, this long-term goal remains a priority for the industry (Shell International, 2020). This is due to the increased awareness that technical progress to improve sustainability of operations can help unlock savings and generate new commercial opportunities and that there is a need to adapt to a changing regulatory environment as a result of the Initial IMO Strategy. During the first semester of 2020, several companies announced that they were maintaining, and even initiating, investment plans related to developing carbon-neutral



fuels and new technologies, and setting new ambitious company targets to reduce carbon-dioxide emission (Maersk, 2020b; S and P Global, 2020). ((UNCTAD), 2020, p. 58).

Overall, the decarbonization of shipping remains and will remain for the next decades a decisive business decision factor, not only in the oil market, but in the maritime sector in general: *"More stringent environmental requirements continue to shape the maritime transport sector. Carriers need to maintain service levels and reduce costs, and at the same time ensure sustainability in operations. Greenhouse gas emissions from international shipping continue to rank high on the international policy agenda. Progress was made at IMO towards the ambition set out in its initial strategy on reduction of greenhouse gas emissions from ships. These include ship energy efficiency, alternative fuels and the development of national action plans to address greenhouse gas emissions from international shipping"* ((UNCTAD), 2020, p. 12).

4.4.2 The pandemic

The pandemic became very quickly a global game changer in the beginning of 2020. The coronavirus situation can be perceived as a type of oil shock. Although initially spotted only in China, the fast spread on a global level led to consecutive disruptions to societies and economies, including transport and trade. Supply chain disruptions, extremely slow supply and demand have a major hit to the global economy, and the uncertainty prevailed ((UNCTAD), 2020, p. 19)

With lockdowns effected on worldwide level, all the economic activities and trade were disrupted. Consumer habits changed and it seemed like everything slowed down. *Even as major economies eased out of lockdown, the situation remained problematic and continued to evolve amid uncertainty about the pandemic and possible new spikes.* ((UNCTAD), 2020, p. 20)



As it happened with most of the economic activities on international level, during the pandemic, the oil prices fell dramatically⁵⁷: due to travel and transportation restrictions, the sailing was the bare minimum, the ports were closed or partially operating. All these unprecedented situations, in combination with the warm winter in 2020, resulted in weak demand⁵⁸ for oil (Han & Wang, 2021, pp. 1-2)

With the coronavirus pandemic the last couple of years, the global interdependency of nations has been underscored now more than ever, and the intense shifts in the maritime sector and global trade, in terms of consumption habits and supply chain designs keep on materializing ((UNCTAD), 2020, p. xi).

Although the maritime sector is more than familiarized and prepared for extreme unexpected events of every kind such as natural disasters, conflicts, strikes and security incidents, the pandemic is a unique situation – still ongoing – taking into consideration the scale, speed and direct impact on global supply chains, transport and trade ((UNCTAD), 2020, p. 19): "*Risk assessment and management are common practice in business and policymaking processes, especially with the emergence of*

⁵⁷ "The pandemic has had a significant impact on trade in oil and gas. Global oil demand fell with the freezing of large parts of the global economy, restrictions on travel and transport, and cuts in industrial activity and refinery output. Together, these factors have depressed demand, as volumes of both crude oil and refined petroleum products have declined. Supply-side factors are another consideration. A surplus in oil production has practically filled all oil inventories, with many vessels being used as floating storage (see chapter 2). The implementation of supply cuts by the extended group of the Organization of the Petroleum Exporting countries in early May 2020 is expected to reduce the availability of crude oil. Disruptions in oil infrastructure in Libya, alongside declining outputs in the Islamic Republic of Iran and the Bolivarian Republic of Venezuela, are also curtailing growth (Clarksons Research, 2020j). The outlook for liquefied natural gas shipping is also affected by the pandemic. Disruptions in early 2020 depressed import demand in China during the first quarter. With the global outbreak of the pandemic in March 2020, global demand for liquefied natural gas also came under pressure. ((UNCTAD), 2020, p. 26)

⁵⁸ "The drop in demand in 2020 did not affect all fuels evenly. Oil was by far the hardest hit, with restrictions on mobility causing demand for transport fuels to fall by 14% from 2019 levels. At the peak of restrictions in April, global oil demand was more than 20% below pre-crisis levels. Overall, oil demand was down by almost 9% across the year" ((IEA), 2021, p. 7).



various risks – security threats, environmental risks, changing weather patterns and rising social unrest. However, it would appear that the likelihood of a disruption of the type and scale of the COVID-19 outbreak was not foreseen or it was underestimated. Many factors may be at play, including competing policy priorities, immediate versus longer term concerns, budget pressures and institutional capacity constraints" ((UNCTAD), 2020, p. 19).

Even though the established consumer habits and transportation of goods has been shaken tremendously due to the pandemic, on the other hand, it seems there's potential for growth, with the boosted e-commerce ((UNCTAD), 2020, p. 27), which of course is favourable for the container shipping.

All the trade sectors were hit in global level, and consequently every sector in shipping *With the coronavirus taking a toll on the global economy and seaborne trade in early 2020, freight rates in shipping were strongly affected and continued to be determined by the way supply capacity was handled. This was the case of the container ships segment, which practiced blank sailing and applied other capacity-management measures to adapt supply capacity to reduced demand for seaborne trade and allow freight rates to remain strong. Tanker freight rates were also affected not only by repercussions of the lockdowns relating to the pandemic, but also by geopolitical events, oil price fluctuations and the increased use of vessels for storage floating, which led to a rise in freight rates, mainly in March–April 2020. Dry bulk freight rates, pulled down by an oversupplied market, were further affected by the shock of negative demand, namely from China, owing to the outbreak of the coronavirus disease.* ((UNCTAD), 2020, pp. 49-50)

As it was expected, in 2020 was the biggest ever oil annual decline: *"Measures to restrain the spread of Covid-19 and the ensuing recession triggered an estimated 8.5 mb/d (8.8%) drop in oil demand in 2020 – the largest ever decline in both absolute*



and relative terms. The transport sector, responsible for around 60% of total oil demand, was severely impacted by mobility restrictions in 2020. Jet fuel and kerosene demand dropped by 3.2 mb/d (41%), with air passenger traffic 66% below 2019 levels, and gasoline demand declined by over 3 mb/d (12%). Fuel oil demand dropped by 0.5 mb/d (8%) as bunker fuel demand declined along with international trade. Continued freight transport activity mitigated the decline in gasoil demand to 1.8 mb/d (6%), and LPG/ethane and naphtha demand was roughly unchanged as petrochemical feedstocks benefited from increased sales of packaging, hygiene and medical equipment. ((IEA), 2021, p. 14)

As the debate on the global recovery continues to develop, it is becoming clear that disruptions caused by the COVID-19 pandemic will have a longer – than - expected - lasting impact on shipping and trade⁵⁹. These disruptions of course may initiate deep shifts in the overall operating landscape, together with an intensified sustainability and resilience-building imperative. Possible shifts could be from changes in globalization patterns to modifications in supply-chain design, just-in-time production models, technology uptake and consumer spending habits. Depending on how these patterns unfold and interact, the developments for maritime transport can be remarkable. Further, risk assessment and management, as well as resilience-building to safe and sustainable supply chains and maritime transport, are likely to prevail more *prominently on policy and business agendas*. While maritime transport could certainly be considered as a catalyst supporting some of these trends, it will also need to brace

⁵⁹ “Despite an expected annual increase of 6.2% in 2021, global oil demand is set to remain around 3% below 2019 levels. Oil use for road transport is not projected to reach pre-Covid levels until the end of 2021. Oil use for aviation is projected to remain 20% below 2019 levels even in December 2021, with annual demand more than 30% lower than in 2019. A full return to pre-crisis oil demand levels would have pushed up CO2 emissions a further 1.5%, putting them well above 2019 levels.” ((IEA), 2021, p. 2)



itself to adapt and be well prepared for needs of the post-COVID-19 pandemic world ((UNCTAD), 2020, p. 1).



5. FORECASTING - SPECULATION

Living in the era of overinformation, refined and structured information is a great asset, in order to take good business decisions. Speculation is based on available data and information. The news play their role as well. News everyday spike discussions and assumptions, which in turn, create a feeling and trigger decisions and actions.

Forecasting is an endless issue when linked with oil price. High oil price levels and its intense volatility have made the possibility of forecasting even more necessary (Maniam, et al., 2017, p. 209). It can certainly be considered one of the determinant factors of the oil price. Looking into the available sources, in regards to the role/ impact of the speculation in the creation of price, we notice a shift on how it's perceived: initially, it wasn't considered a strong factor, if not at all (Fattouh, et al., 2012). However, during the end of the decade, we see that it's recognized as a significant factor, among other ones⁶⁰. Based on that, it cannot be ignored the fact that fluctuations in oil price can be also a byproduct of futures market and the forecasting mechanisms in general, though it's not very evident and difficult to be proved.

There's a whole financial mechanism established, based on the forecasting of prices: oil futures market. In that marketplace, traders can lock a price for a specific quantity, for a specific date in the future. This futures contract can be retraded (Fattouh, et al., 2012, p. 1). Also, the futures contracts can be a helpful tool for

⁶⁰ For example, there are different types / categories which define the oil price: supply shocks driven by geopolitical disruptions (exogenous supply), demand shocks associated with immediate consumption (flow demand), stock demand shocks reflecting forward looking – behavior (speculative demand) (Fattouh & Economou, 2018, p. 4) (Newmann & Morgenstern, 1953)



reducing the risk of highly volatile prices⁶¹, for different types of commercial and non-commercial players⁶², such as refineries, oil producers, traders, investment banks and hedge funds.

Fuel hedging is an extensively used instrument of bunker risk management in maritime transportation. It offers, somehow, a peace of mind against the highly volatile bunker prices, and especially for those types of shipping which are well planned ahead, such as liner shipping, where also bunker needs can be planned (Gu, et al., 2016, p. 3)

With the introduction of these financial mechanisms, new and non shipping related players entered the market and redefined it. In particular, the fact that non related to oil players are participating in the futures market has changed the way we think about oil prices and how we can predict their trend⁶³: it's one more factor to take into consideration when trying to predict, including possible unforeseeable events, such as political crises or extreme weather conditions (Levine, et al., 2014, p. 34).

⁶¹ "To reduce these risks, the refinery can hedge its physical purchases in the spot market by also purchasing futures contracts that rise in value when oil prices rise and fall in value when oil prices fall. The result is that when prices (and, hence, the refiner's acquisition costs) increase in the spot market, the value of the futures contracts will rise to offset the additional cost of oil, and vice versa. The refiner could use NYMEX gasoline and heating oil futures to lock in refined product prices, thus reducing its exposure to volatile refining margins. In a similar fashion, an oil producer could sell NYMEX crude oil futures contracts to lock in crude prices to protect its cash flows from spot market volatility. In this instance, the sold contracts will rise in value when spot oil prices fall and fall in value when oil prices rise. The result is that when prices are low, the value of the futures contracts will rise to offset the lower price of oil received by the producer from its spot market sales." (Levine, et al., 2014, pp. 33-34)

⁶² "These non-commercial traders may include investment banks, hedge funds and other commodity investors who hold oil futures contracts as part of a diversified investment portfolio, or who buy and sell futures contracts in response to contract prices, seeking to earn a return for bearing risk." (Levine, et al., 2014, p. 34)

⁶³ "...futures markets provide valuable information about the market's expectations regarding future supply and demand conditions in the physical market—conditions that will ultimately determine the price for oil." (Levine, et al., 2014, p. 34)



Ultimately, it has become evident that anybody – any significant player – can be a speculator, which might also lead to the manipulation of the market.

In order to predict the oil price, it's crucial to have a very deep understanding of the shipping markets and the possible reactions in the shipping cycles. Although there are specific functions of the four markets, this doesn't necessarily mean that they can easily be predicted. Due to the fact that people handle these markets, their psychology plays a great part to their performance⁶⁴. For example, depending on whether the freight market is up or down, the secondhand and newbuildings markets respond accordingly (Stopford, 2016, pp. 250-251).

Generally, trying to apply the current market situation data in order to predict the future, might work positively occasionally, but, ultimately, the fragile market balance makes it incompletely inefficient, or even completely inaccurate. Another method of forecasting is the analysis of the course that will be followed by the factors that affect it in the future. This is a method used by business consultants and tries to come to conclusions, with mathematical calculations. It is also important to try to calculate the competition and to participate in the changes that take place internationally, in order not to lose the economic advantage⁶⁵. Of particular value is the insight of maritime experts, who know the situation, have the appropriate

⁶⁴ "The fact that every participant is influenced by the anticipated reactions of the others to his own measures, and that this is true for each of the participants, is most strikingly the crux of the matter (as far as the sellers are concerned) in the classical problems of duopoly, oligopoly, etc. When the number of participants becomes really great, some hope emerges that the influence of every particular participant will become negligible, and that the above difficulties may recede and a more conventional theory become possible. These are, of course, the classical conditions of "free competition". (Newmann & Morgenstern, 1953, p. 13)

⁶⁵ "The desirability of holding oil stocks may change, for example, in response to news about oil discoveries, or as traders anticipate wars in the Middle East, or as traders respond to increased uncertainty about future oil supply shortfalls. None of these expectations shifts can be captured using standard models of flow demand and flow supply" (Kilian & Murphy, 2014, p. 455)



experience and can more easily assess the possible impact of some events. In fact, any method applied cannot take into account the effect that some random but important events will have on the formation of prices, such as e.g. a sudden war, which no one had foreseen before its occurrence, nor its probable extent, duration or final consequences (Βλάχος & Ψύχου, 2011, p. 148).

The last years, it has become more apparent how important and almost necessary is the research and analysis of data, from day to day business operations, to long-term development plans and decisions. New departments and companies are established for this specific task only, and there's certainly more room for this type of service to grow: *"Ship movements, schedules and port traffic data are often available at short notice, before official statistics on economic growth or trade are published. There is an opportunity to make use of maritime data to obtain an early picture of physical trade in goods. The trends reported above show that during the first quarter of 2020, the total fleet deployment in most economies was still above that of the first quarter of 2019. For the second quarter, carriers started to significantly reduce capacity. China, for example, started with positive growth in the first quarter of 2020, compared with the first quarter of 2019, but then recorded a negative year-on-year growth in the second quarter. Most European and North American countries saw a steep decline between the first and second quarter. Such data is being used and analysed by international organizations and professional forecasters aiming to predict the economic and trade growth of upcoming weeks. Ports and shipping companies will at least to some extent plan their fleet deployment for the same upcoming period, based on such predictions. It is important not to fall into circular reasoning, where pessimistic forecasts may lead to a further withdrawal of shipping capacity, which in turn may lead to further worsening predictions of growth ((UNCTAD), 2020, p. 98)".*



Additionally, analysts should develop an even more critical way of thinking, by recognizing the info which is not factual/ true: this will to have a better understanding or forecast in regards to future price levels (Mabro, 2001).

There are challenges in forecasting real time future oil prices. Even though there's an organised macroeconomic way to try to predict the oil price, by using forecasting models based on ex-post revised data, there are high chances that the results from such comparisons can be misleading. The data available at hand, at a specific time required to be revised constantly, and so an estimate of this month's global oil production, may take long time till it's released (Kilian, 2011)

There's a generalized sense that all the available tools and ways of analysis used in order to predict the oil price are never enough and cannot be trusted completely. All of them work complementary to each other and there's still a long way till the tools we have can be improved. The amount of data used is enormous and becomes obsolete by the time a new batch of information is added. So, it becomes difficult to create and trust specific patterns of forecasting, specially in automated tools. They need constant reprogramming, in order to always depict the current situation, the "now" which is not possible. The patterns created are relative only for a specific amount of time, which can be very short. Reevaluation of data is necessary and should be done frequently. The percentage of having a strong predictive result is relatively low (Kilian, 2011).

Some of the factors that define the oil price can be anticipated – up to a certain point – since they are events and situations with expected outcomes. However, a very significant amount of random and unpredictable situations may arise and so decisions have to be revisited⁶⁶.

⁶⁶ "...how this forecast changes with changes in the economic environment." (Kilian, 2011)



Ultimately, the forecasting process should be seen as a process of identifying the possible risk, instead of creating a seemingly solid certainty (Stopford, 2016, p. 192).



CONCLUSIONS

Maybe now, more than ever, we live in the era of the uncertainty and constant change. Difficult decisions have to be taken, in an instance, by always keeping in mind the unstable environment, on a global level. The shipping industry, by its nature, is used to that [unstable, constantly changing] reality. It is a fluid market, yet coherent at the same time. Structural changes in shipping though are slow and players usually intend to speed up when they have a better market.

The shipping industry happens in "now". Every little movement or plan that is currently decided, could have a massive effect later on. And this is the reason why every action that takes place in the present, is usually very well thought out in terms of future balance / impact.

Successful decision in shipping is all about taking risks based on educated information. Depending on the type of investment, we will attempt to do either a short-term or long-term decision, with the data available at hand, at a specific moment. At the same time, we have to keep in mind that the human factor inevitably dominates in presumably rational economic and other decisions, and this is the reason we're trying to be prepared for what might come.

When trying to identify the all the possible key factors that determine the oil price, we see that these are numerous and could differentiate from time to time. Due to that, it was necessary to depict them in broad categories in order to have a specific framework which could help us organize and understand the immense amount of data that has to be taken into consideration each time. It certainly helps to have a good memory of all the important events. It's undeniable that retrospection in the past events, is very important to give us a good base for understanding the future.



Most of those factors, it could be said that they have a dual function: on one hand they are the background, the fundamentals themselves, and at the same time they can be influential elements, shaping the oil price.

Moreover, the shipping cycles constitute very good context based on which we can understand better the way the oil price is determined. Essentially, in order to understand oil, you need to understand shipping.

Generally, it's difficult to measure or even catalogue all the actual factors that define the oil price. Apart from some specific and objective benchmarks being set by the market itself, the rest is a fluid bunch of events of every kind, both international and local, which also play their part.

Our intention with analyzing the factors that determine oil price is essentially to bring to the surface their complexity and interdependence, as well as highlight the challenges and the importance of combining information, in order to minimize the risk in the decision making process. Most of the literature available focuses primarily on the dynamics of a specific factor that affects the oil price. With this analysis, we're attempting a more holistic approach of all the different types of factors and the way they interact with each other. This analysis could function as a preliminary guide which could set the mindset for a deeper understanding the mechanisms that define the oil price. It's a way of training our mind to look into as many details as possible and have a solid standpoint when interpreting all the available information at hand.

Living in a data centered era, the amount of data that has to be taken into consideration is massive, and so the role of the analyst becomes of primary importance. They are the ones who can manage and refine the information given. A critical approach is required from analysts and from market players in order to single out the fuss of unlimited and unstoppable information.



Of course, the debate still remains: is speculating / forecasting a key factor? It is certainly a condition difficult to be measured. However it can be a supplementary instrument which can indicate some possible trends. Speculators are no different than the rest of the other factors, which might be the source and the outcome of the oil price change; it's inevitable not to exist, nor not to be taken into consideration either.

The last years, and now more than ever maybe, it's been realized that the era of oil is gradually coming to an end. Lately, we've seen low oil demand growth, mainly due to slow global economic growth and the commitment to decarbonisation. The trend for alternatives sources of energy keeps on developing and is expected to be bigger and bigger every year. The climate change cannot be ignored, and so do all the elements that have contributed to that.

As always, the shipping industry had to adhere to very strict regulations and restrictions, in order to safeguard its existence and success. Now maybe more than ever, sanitary restrictions and green targets towards decarbonization are added on top, so that the sector can accommodate properly.

Based on that, it becomes evident, more and more the last years that the environmental regulations regarding to the CO2 emissions are playing a more definitive part in the formation of the oil price. Whether regulations are already enforced or will be at some time in the future, their role is decisive in affecting the oil market. These events could even be either crises or shocks in the market.

Even though the intention, on a global level, is to generally not use fuel at all, for now it still remains the prevailing way of energy. Till this comes to an end, the weight of the different factors that shape the oil price will be shifted according to the given circumstances each time, and the appropriate instruments and experts will be there to document and analyse them.



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