Measuring the Bulk Market Concertation Level in the Red Sea During Covid-19 and the Russian Ukrainian War

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Abstract:

The measurement of the concertation level in the Red Sea bulk market during the Covid-19 pandemic and the Russian-Ukrainian war provides valuable insights into the dynamics of coordination among market participants during times of significant geopolitical events. These events had profound impacts on global trade and supply chains, leading to disruptions and uncertainties in the bulk market. This study aims to analyze the concertation level in the Red Sea bulk market during two significant geopolitical events: the Covid-19 pandemic and the Russian-Ukrainian war. Concertation refers to the extent of coordination

and cooperation among market participants in terms of pricing and other market-related activities.

The study revealed that there is a significant concentration of market share among the top four ports. The Concentration Ratio (CR4) for this timeframe was calculated at 70.64%, indicating a substantial level of concentration and the emergence of a monopolistic structure. These findings suggest a trend towards high concentration in the Red Sea bulk ports market throughout the study period. Additionally, the Herfindahl-Hirschman Index (HHI) exhibited a decrease in the Red Sea ports market. Starting at a value of 1416 in 2018, the HHI reached its peak in 2020 at 2021, and subsequently decreased to 1418 in 2022. The average HHI value for the entire study period was determined to be 1682, indicating a medium level of concentration within the market.

Key words: Bulk Market, Concertation Level, Red Sea, Covid-19, Russian Ukrainian War.

<u>المستخلص:</u>

يوفر قياس مستوى تركيز سوق البضائع الجافة في سوق البحر الأحمر السائب أثناء جائحة Covid-19 والحرب الروسية الأوكرانية رؤى قيمة حول ديناميكيات التنسيق بين المشاركين في السوق خلال أوقات الأحداث الجيوسياسية الهامة. وكان لهذه الأحداث تأثيرات عميقة على التجارة العالمية وسلاسل التوريد، مما أدى إلى الاضطرابات والشكوك في السوق بالجملة. تهدف هذه الدراسة إلى تحليل مستوى تركيز سوق البضائع الجافة في سوق البحر الأحمر خلال حدثين جيوسياسية مهمين؛ جائحة كوفيد -١٩ والحرب الروسية الأوكرانية. يشير التناغم إلى مدى التنسيق

والتعاون بين المشاركين في السوق من حيث التسعير والأنشطة الأخرى المتعلقة بالسوق.

أظهرت الدراسة أن هناك تركيزًا كبيرًا لحصة السوق بين أربعة من أهم الموانئ. تم حساب نسبة التركيز (CR4) لهذه الفترة عند ٧٠.٦٤٪ ، مما يشير إلى وجود مستوى كبير من التركيز وظهور هيكل احتكاري. تشير هذه النتائج إلى وجود اتجاه نحو تركيز عال في سوق موانئ البضائع الجافة في البحر الأحمر على مدار فترة الدراسة. بالإضافة إلى ذلك ، أظهر مؤشر هيرفندال-هيرشمان (HHI) انخفاضًا في سوق موانئ البحر الأحمر. بدءًا من قيمة ١٤١٦ في عام ٢٠١٨ ، بلغ HHI ذروته في عام ٢٠٢٠ عند ٢٠٢١ ، وانخفض بعد ذلك إلى ١٤١٨ في عام ٢٠٢٢. تم تحديد القيمة المتوسطة لمؤشر HHI لفترة الدراسة بواقع ١٦٨٢ ، مما يشير إلى وجود مستوى متوسط من التركيز داخل السوق.

الكلمات الدالة: سوق البضائع الجافة، البحر الأحمر، كوفيد -١٩، الحرب الأوكرانية الروسية.

1. INTRODUCTION:

Maritime transport bears responsibility for transporting 90% of the total global trade volume, which considered the lifeblood of the global economy. Furthermore, without maritime transport, no achievement in commercial transactions will be possible between the different continents of the world in terms of raw materials, food, or manufactured products (UNCTAD, 2018). Shipping industry consist of four interlinked shipping markets, which can be categorized as follows: The freight market, second-hand vessels market, new building market, and vessel demolition market. The freight market has many sectors like tankers, passenger, containers, heavy lift and dry Bulk. As it can be

affected by supply and demand, world economy status, international maritime trading and fuel prices also it can be affected by the other shipping industry elements.

The spread of Covid-19 in all countries of the world has negatively affected not only the maritime transport sector, but also the movement of air, travel, trade, and shipping. Indeed, this has been negatively reflected in the decline and fluctuation of financial markets and the decline in oil prices to their lowest levels. In addition, disturbance in world trade and supply has caused a decline in global manufacturing activity. Consequently, this has led to lower rates of both economic growth and global trade. It is noticed since the beginning of 2020 that covid-19 pandemic took a lot of lives all over the world and affected most of the life sectors specially the economic sectors in the whole world which caused many of those economic sectors to shut-down their business and release their employees fully or partly due to the lockdowns that paralyzed the economic sectors (Dorofeev et al., 2020; News, 2020).

Most of the international traders ship their cargos by sea especially the dry cargos such as the main commodities like clinker, pet coke, coal, cement, steel, wood, scrap, dolomite, silica sand in addition to all kind of Fertilizers (Rock phosphate, Urea, potash) and Grains (wheat, barley, corn) also other general cargos use mainly bulk dry ships from coasters up to cape size bulk carriers. Therefore, since logistics and supply chain were

affected by covid-19 Due to the lockdowns all over the world leading to changed demand, supply for all commodities, the freight market also was affected in general, and the bulk freight market got affected in particular (Lose, 2020).

The lockdowns resulted in many people being unable to go to their work leading to loss of production of essential and regularly consumed goods whoever since the demand is the same, the prices shot up owing to lack of supply. As the logistics and supply chain are very important parts of the international economic system, it also affected by covid-19, which reflected in the change of demand and supply of the commodities.
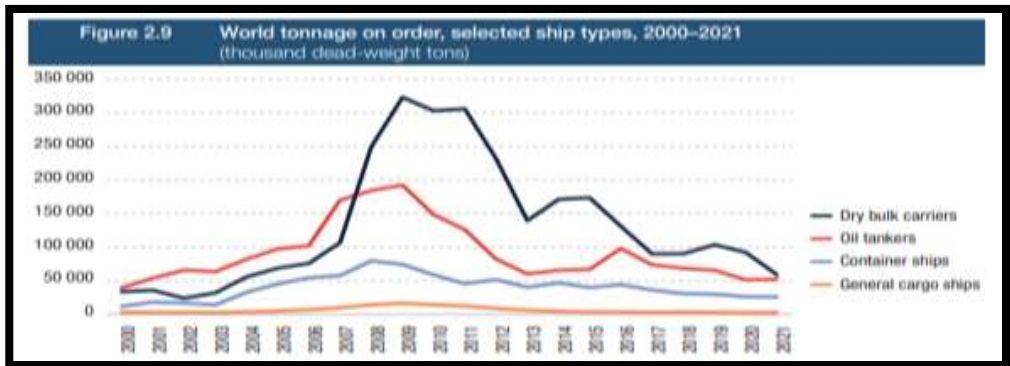

Figure (1): World tonnage on order selected by ships types from 2000 to 2021.

Source: UNCTAD, 2021.

With the taking a toll on the global coronavirus 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. 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; UNCTAD, 2021).

During the first six months of 2020, the market for dry bulk freight rates continued to be shaped by imbalances in supply and demand, which was aggravated by the impact of the pandemic and resulted in high fluctuations, namely among larger vessels during this period. As discussed earlier, overcapacity was already affecting the dry bulk market, as supply growth had been outstripping demand for many years. This was further exacerbated by the negative demand shock caused by the pandemic, which added downward pressure on shipping freight rates (UNCTAD, 2020; UNCTAD, 2021).

And the noticeable rise in oil around the world, which recorded 130 dollars per barrel in March 2022, and also the increase in basic food commodities, especially wheat, by 40% to reach 396 dollars per ton, and also the increase in corn prices by 21%, as a result of the disruption of the movement of agricultural exports in Ukraine, The Black Sea was classified as a dangerous area due to an increase in the insurance prices required for shipping goods, shipment delays, and port congestion. Ship charter prices by 20% because of the rise in marine fuel because it is linked to oil prices.

2. LITERATURE REVIEW:

This section will be divided into three sections. The first will illustrates the impact of Covid-19 on bulk market around the world. Secondly will review the impact of war between Russia and Ukraine on maritime industry and bulk market. Finally, researcher will review recent studies that measure concentration ratios in different sectors.

2.1 The impact of Covid-19:

COVID-19 can be identified as one of the most dangerous pandemics in the world, which took place in 2019, and it is the most dangerous forced pandemic at the world to pay attention to it and record the reactions related to it. However, the research studies haven't paid attention to the entire sea fright market and its many major segments, such as dry bulk market, oil tanker market etc., are rather than shipping companies so far. Moreover, the literature on the issue of the effects of COVID-19 on different industries is extensive, and the bulk shipping business as one of the most important elements in the shipping industry, which plays an important role in the global economics, however the studies related to the effect of COVID-19 on bulk shipping, is rather limited. Studies focused particularly on the bulk freight market does not exist on the limits of the researcher's knowledge.

Loske, (2020), mentioned the impact of COVID-19 on transport volume and freight capacity dynamics: An empirical

analysis in German food retail logistics, the researcher has developed case study in two depots of a large German full range food retailing company, which are responsible for the complete and on time delivery of 820 supermarket stores. The transport volume comprises, all orders placed by the grocery shops including five assortment groups: (1) dry products containing, (2) frozen products, (3) fresh and perishable fruits and vegetables, (4) dairy products, and (5) raw fish and meat.

Yazir et al., (2020) studied the effects of COVID-19 on maritime industry as a review, To understand the newest challenges and figure out potential solutions for the maritime industries (including dry bulk, tanker, container, and cruiser sector) and reviewed these industries, post COVID-19, the selected four shipping industries, The review has provided a timely and relevant study to understanding the four major sectors in maritime industries with practical insights. It has conducted a systematic and concise overview of contemporary issues of maritime operations and management. It attempts to conclude with a useful discussion of challenges and disruptions that are being faced by the maritime industries. In this context, Michail. N et al., (2020) addressed the problem as shipping markets in turmoil: An analysis of the Covid-19 outbreaks and its implications, as they examined the impact of exogenous effects in the shipping industry by employing data from the recent

Covid-19 pandemic outbreak and explore the reactions of freight rates for dry bulk, clean, and dirty tankers.

Gossling S. et al., (2021) explained the effects of Pandemics, tourism, and global change: a rapid assessment of COVID-19, the novel corona virus (COVID-19) is challenging the world. With no vaccine and limited medical capacity to treat the disease, no pharmaceutical interventions (NPI) are the main strategy to contain the pandemic. Unprecedented global travel restrictions and stay-at-home orders are causing the most severe disruption of the global economy since World War II. With international travel, bans affecting over 90% of the world population and widespread restrictions on public gatherings and community mobility, tourism largely ceased in March 2020. Early evidence on impacts on air travel, cruises, and accommodations have been devastating.

While highly uncertain, early projections from UNWTO for 2020 suggest international arrivals could decline by 20 to 30% relative to 2019. Tourism is especially susceptible to measures to counteract pandemics because of restricted mobility and social distancing. The paper compares the impacts of COVID-19 to previous epidemic/pandemics and other types of global crises and explores how the pandemic may change society, the economy, and tourism. It discusses why COVID-19 is an analogue to the ongoing climate crisis, and why there is a need to

question the volume growth tourism model advocated by UNWTO, ICAO, CLIA, WTTC and other tourism organizations.

Dong X. (2021) indicated about the impact of Covid-19 on Chinese international shipping companies and countermeasures the promotion of government, and analysis of how this pandemic impact on the shipping company operations and the suggestions for them, Moreover, the impact of this outbreak on China and other countries is actually an effect on a rapidly changing global supply chain, and thus, so many countries are involved in and so hard situation that have to face, moreover the shipping companies do meet bigger problems when COVID-19 occurred. Then, inspired and related to the similarity of the 2008 economic crisis, focused on if and how the financial flexibility could affect the shipping companies and their performance after pandemic.

Ho. et al., (2021) investigated the impact of COVID-19 on freight transport evidence from China, and they used the monthly panel data of 13 Chinese provinces (cities) over the period from December 2019 to August 2020, and analyzed the overall impact of the epidemic on China's freight transport from a macro-level perspective, which added to the pandemic literature, through subsample analysis, the empirical results helped fill in the gaps in the COVID-19 transport literature supporting new consumption behavior during the COVID-19 outbreak, moreover the researchers followed the multi-region demand model topo

examine the impact of COVID-19 on China's freight transport, however the result showed that COVID-19 has a positive impact on the road freight transport turnover, this effect is pronounced under the higher numbers of COVID-19 confirmed cases and the lower level of gasoline production, and vice versa, in addition these results were robust after using different dependents and independents.

However, the results have several implications, which is First. COVID-19 causes people to increase their consumption behaviors through freight transport. If the COVID-19 was not controlled, it causes occurrences of the expected loss of income and stockpiling behavior. That is, the increase in freight transport may be the result of stockpiling behavior. Some economists argue that market failure results from soaring prices due to the panic—people who are really in need of the product cannot afford to buy it, or need to pay more for it. Second, governments and relevant departments should try their best to expose market information, reduce irrational consumer behaviors caused by the COVID-19, and make the price mechanism re-operate in the market.

Jones et al., (2008) introduced the Pandemic Influenza, Worker Absenteeism and Impacts on Freight Transportation, and focused on freight transportation services, particularly rail and port operations. It develops models to assess the likely impacts of varying levels of worker absenteeism on the performance of

these critical systems. Using current data on performance of specific rail and port facilities, the researcher reached some conclusions about the likelihood of severe operational disruption under varying assumptions about the absentee rate and draw out implications that would be of government concern. The study result showed that the analysis here is that at the level of absenteeism projected in the mid-level scenario (13.6% peak absentees), it is very likely that there will be reasonably widespread problems in the rail system as specific locations are unable to handle volumes coming into them over a 6–8-week period. There are likely to be persistent "waves" of congestion and disruption across the system as various yards become overly congested and adjustments are made, only to move the problem somewhere else.

However, the analysis done here indicates that there is significant likelihood of major breakdowns in the freight transportation sector under the more severe influenza scenarios as a direct result of large-scale worker absenteeism. This may affect distribution and availability of a wide variety of consumer goods as well as availability of raw materials for many other industries. Planning for actions to reduce the rate of infection and to slow the transmission of the disease is very important and will create benefits via the transportation sector as well as in easing the load on the health care sector.

Chowdhury et al. (2020) examined the effects of the COVIDI9 pandemic on international trade and shipping. In the same while March et al. (2021) examined that human activity in the ocean have been radically altered by the COVID-19 pandemic, with reports of port restrictions and changes in consumption pattems impacting multiple maritime sectors, most notably fisheries, passenger ferries and cruise ships, however Čurović et al (2021) analyzed the Impact of COVID-19 on environmental noise emitted from the port, at least leadless to mention Mofijur et al., (2021) have studied the Impact of COVID-19 on the social, economic, environmental and energy domains: Lessons learnt from a global pandemic.

2.2 The impact of the war between Russia and Ukraine:

Karen Jacob (2022), explained that the reason behind the closure of the Ukrainian ports was because there was a very large disruption in the European supply chains and led to a shortage of maritime logistics services, and also maritime transport was greatly affected by the war of Russia, as well as the ports, and that there was the shedding of merchant ships Damaged because of the war, and shipping operators of cargo have to redirect the transport of goods and transfer the ships to another safe destination, and most of the large companies have stopped shipments under the pretext of the war between Russia and Ukraine, and the Russian navy ships have been injured at least 10 commercial ships since the war began.

He prevented about 80 merchant ships in the Black Sea from arriving, and confirmed that before the start of the war, the Black Sea ports reached 90% of the country's exports of grain and seeds, a third of which is shipped to Africa, China and Europe, but with the supply chain disrupted and There is no redirection of goods to roads and railways, and this has led to congestion at the stations and this puts the logistics services at risk.

Hussein and Knol (2023) recently noted, that the suffering and crisis between Ukraine and Russia represented a conflict for the global economy that led to growth and price hikes, a slowdown in growth and an increase in inflation, the most

important of which was an increase in the price of commodities such as food and energy, and conflicts exist especially In trade and supply chains, Russia and Ukraine are among the largest wheat producing countries, but because of the war the supply chains were cut off, and this led to a significant increase in world prices, especially natural gas and oil, not only oil, but also in the cost of food such as wheat. Russia accounts for 30% of world wheat exports.

In addition, Chains et al., (2022) mentioned that the war between Russia and Ukraine caused not only a psychological impact, but also the economies of the countries, which were affected by it, and spread a state of fear in terms of supply chains that provide foodstuffs and other commodities, but also the basic tools that It supports the industrial and agricultural sector in the country and has led to the collapse. On the other hand, sanctions have been imposed on the Russian economy, and this has led to the suspension of companies' activity in companies that amount to more than 750 companies spread around the world, including in North America and Europe. The publisher expects that There is a decrease in the economic value of the inflation rate from 25% to 30%.

Next section will review recent studies that measure market structure using Concentration Ratio and Herfindahl-Hirschman

Index in addition to different indexes in measuring market structure.

2.3 Market concentration level in the Red Sea:

Market structure encompasses the arrangement and organization of firms operating within a particular market, with a focus on the level of competition among them. The determination of market structure involves analyzing factors such as the number of competing firms and their respective market shares. An essential tool for evaluating market structure is concentration measurement, which is widely utilized in various countries including the United Kingdom, United States, and Canada. Concentration analysis provides valuable insights into the competitive landscape of a market, enabling policymakers and regulators to assess the degree of competition and make informed decisions to promote market efficiency and consumer welfare (Ismail, 2019).

Concentration measurement in market structure analysis often involves assessing indicators such as the percentage of output, employment, or throughput within an industry. These indicators provide valuable insights into the level of dominance held by a small number of firms operating within the market. Higher concentration levels indicate a market where a few firms hold a significant market share, suggesting the possibility of reduced competition. By evaluating concentration levels,

policymakers and regulators can better understand the competitive dynamics within a market and implement appropriate measures to promote competition and safeguard consumer welfare.

The analysis of market structure and concentration provides valuable insights for policymakers, economists, and industry stakeholders, enabling them to comprehend the dynamics of a market and anticipate its implications on competition, pricing, and market efficiency. This knowledge plays a crucial role in guiding decision-making processes, formulating effective regulatory policies, and devising strategies that foster fair and healthy market competition while safeguarding consumer interests. By understanding the market structure and concentration, stakeholders can work towards creating an environment that encourages innovation, efficiency, and sustainable growth, ultimately benefiting both businesses and consumers alike (Obrębalski and Walesiak, 2015; Crozet, 2017).

Market concentration refers to the number of firms that account for the total production within a given industry at a point in the time. Industrial concentration is necessary for investors, consumers and regulators (Akomea and Michael, 2013). The main idea is to identify how many firms account for the majority of the product that is produced within a given market. In this research, market structure will be assessed by using concentration indices. The next section

illustrates the features and limitations of concentration indices used in this research.

There are many tools used to measure the market concentration such as: Hall-Tideman index "HTI" index, Entropy index (E)", The Comprehensive Industrial Concentration Index (CCI), The Hannah and Kay Index (HKI), Gini coefficient (GC), The U Index (U), Hachman Index and The Hause Indices (H). The reasons why the researcher used only these two indexes; the N-Firm Concentration Ratio (CRN) and Hirschman-Herfindahl Index (HHI) index to analyze the dynamics of bulk terminals' market because they are the most common and simple measures that are used in earlier studies such as (Hayuth, 1988; McCalla, 1999; Notteboom, 2006; Notteboom, 2010; Elsayeh et al., 2011; Maksimović and Kostić, 2012; Pehlivanoğlu and Tiftikçigil 2013; Akomea and Adusei (2013); Harmse, 2014; Elsayeh, 2015, Krivka, 2016; Yaşar and Kiracı, 2017; Crozet, 2017) to determine market concentration, as shown in appendix 2.2. The next section demonstrates features and limitations of the different concentration indices that are used in this research. As shown in the next table (1). In this research; only two indexes used to measure concentration level in the Red Sea, which are the Concentration Ratio and the Herfindahl-Hirschman Index.

Table (1) previous studies on measuring the market concentration in ports.

N	Authors	Applied concentration indicators	Research Area	Results
1	Akomea and Adusei (2013)	CRM and HHI	The paper examines the concentration levels of the banking industry in Ghana between the years 2003 and 2010.	Over the past eight years, the banking industry in Ghana has consistently exhibited a high level of competition, showing no indications of concentration
2	Pehlivanoğlu and Tiftikçigil (2013)	CR4, CR8, CR12 and HHI	The paper examines the concentration levels of the banking industry in Ghana between the years 2003 and 2010 Defining the market structure of the Turkish Iron-Steel and metal industry during the period 1995-2001.	The iron-steel and metal industry having a non-concentrated market structure based on the HHI index value, a market structure of monopolistic competition was observed based on the CR4 index value whereas the CR8 and CR12 index values typically led to an oligopolistic market structure, except for some years.
3	Liu and Altshuler (2013)	CR4	The paper assesses the burden of the corporate income tax on wages under imperfect competition in the US industries.	The empirical results suggest that labor bears a significant portion of the burden of the corporate income tax. The elasticity of wages with respect to the corporate marginal effective tax rate increases with industry concentration.
4	Nguyen and Stewart (2013)	CR3, CR5 and HHI	The objective of the study was to analyze the level of concentration and efficiency within the Vietnamese banking system during the period of 1999-2009.	Empirical findings reveal that the banking industry in Vietnam has experienced a notable decrease in concentration levels. Despite this trend, it is important to note that large commercial banks continue to wield significant influence and dominate the overall banking system.

5	Hoxha (2013)	CR5 and HHI	The study explores the effect of banking concentration and banking competition on the volatility of the growth of value added of the manufacturing sectors in developing countries.	Banking concentration has a dampening effect on the volatility of growth of the industries. As banking competition increases, the volatility of the growth of industries increases, also.
6	Naldi and Flamini (2014)	HHI and CR4	Market shares in the U.S. consumer book industry, the civil aviation industry and the mobile phone industry.	Monotonic relationship that may expect between the CR4 and HH is not confirmed
7	Susilo and Axhausen (2014)	HHI	They examined the market concentration in terms of daily travel habits and location.	They found that the repetitiveness of individual activity–travel–mode–location combinations is highly influenced by the individuals' out-of-home commitments, the intra-household conditions and the availability and the accessibility of the activity locations
8	Obrębalski and Walesiak (2015)	HHI	To measure sectorial concentration to determine regional functional specialization	Each region has individual and diversified potential, regional identity and the level of economic competitiveness
9	Çalmaşur and Daştan, 2015	CR4, CR8, HHI and E Index	The main objective of this study is to analyze the market structure of the Turkish Cement Industry for the period of 2010-2014.	It can be stated that, the industry has a competitive market structure, in the light of HHI and E Index. As a result of CR4 and CR8 analysis carried out, the industry is determined to be a weak oligopolistic.
10	Pavic et al. (2016)	CR and HHI	US economy	There is no difference between the CR and the HHI
11	Krivka (2016)	HHI	The paper analyses the phenomenon of market concentration in the context of the most popular industrial organization approaches	The author's opinion, (HHI) should be applied to concentrated markets.

12	Crozet (2017)	HHI	Rail freight in Europe	The market structure in rail freight is still characterized by a strong concentration, indicating that competition in this sector is classified as imperfect competition.
13	Yaşar and Kiracı (2017)	CRM and HHI	They examined the market structure and competition level of the airline market in the world between 2006 and 2015.	The market structure is generally competitive, but significant changes in market structure have taken place over the years.
14	Hossain, et al. (2017)	HHI	The study focused on the period from 1995 to 2015 and aimed to identify potential areas of growth and expansion within the industry that would enable Bangladesh to increase its exports to China.	China exposes high comparative advantage over 12, medium over 9 and low over 14 products in its import from the world in this industry.

Source: by author.

Gap analysis and contribution:

From the above literature we found that no previous research has tried to measure concertation level in the Red Sea bulk market. Therefore, this research will fill this gap by measuring concertation level in the Red Sea bulk market using two different ratios CR and HHI.

3. RESEARCH AIMS AND OBJECTIVES:

This research aims to find out the effect of covid-19 pandemic and the Russian Ukrainian war on the bulk freight market, ship owners, ship operators, charterers, shipbrokers, investors in shipping business, international traders and port managers and the governments. In addition, find solutions to

mitigate some effects of such things like pandemic in the future. Research objectives are follows:

- To study the effect of covid-19 pandemic and the Russian Ukrainian war on the bulk freight market.
- To measure the market concentration in bulk market in the Red Sea.

4. RESEARCH PROBLEM:

COVID-19 outbreak is a disaster in human history, which changed the world system and affected many life sectors such as the world economic sector, which was seriously damaged due to fluctuation and imbalance of demand and supply. Ocean freight is an important means of transporting goods and commodities globally, the year of COVID-19 and its aftermath revealed a wide range of challenges for this type of transportation, such as the high cost of sea freight, which led to an increase in the prices of goods for consumers (Thomas, 2020).

By comparing, the performance of the freight rate in 2019 and 2020 before and after the outbreak of the COVID-19 pandemic, the index of Panamax and capsize dry bulk carriers fell by 16.92%, 24.56% and 38.94%, respectively (Clarksons Research Studies, 2022).

In addition, the division of Russia's invasion of Ukraine started a new global economic crisis in Europe. And that this war greatly affected global growth, which was suffering from the repercussions of the Corona pandemic, which held back the

world's economies through port closure measures, and also explained that the military operations carried out by Russia in Ukraine contributed to the disruption of the global supply chain, which is still even during the war, it did not recover from the negative effects of the pandemic.

5. RESEARCH QUESTIONS AND HYPOTHESIS:

There is only one question, Is the market concentration in the bulk market is moving towards perfect competition?. To achieve research aims and objectives there are one hypothesis, the market concentration in the bulk market is moving towards perfect competition.

6. RESEARCH METHODOLOGY:

This research aims to define the impact of COVID-19 pandemic on the dry bulk freight market. This research follows deductive "quantitative" approach through measuring the bulk market concentration using two different indexes such as Concentration Ration (CR) and Herfindahl-Hirschman Index (HHI). In addition, make an interview with managers in bulk terminal to identify how they treats with COVID-19 pandemic, the war between Russia and Ukraine; and how to deal with any future pandemic.
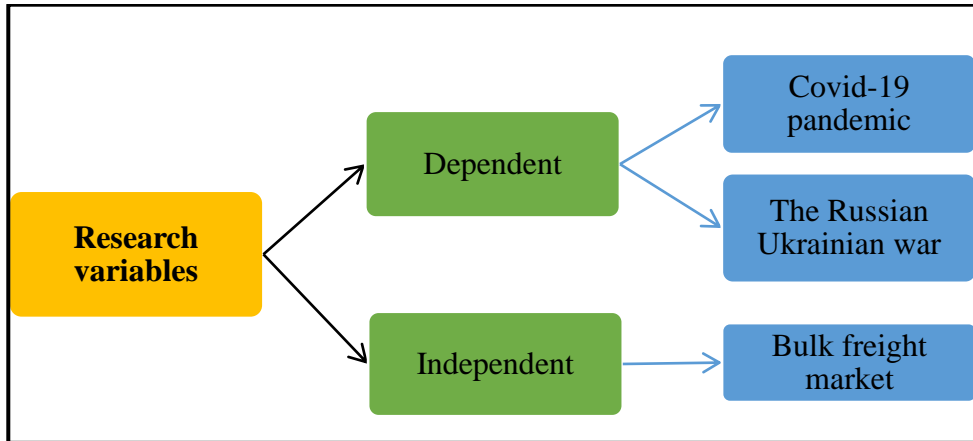
6.1 Research Variables:

Figure (2) Research variables.
Source: By authors.

6.2 Concentration Ratio:

Concentration Ratios are used to determine the market structure and competitiveness of the market. The proportion of total market output produced by the *N* largest firms in an industry. The Concentration Ratio is used as a measure of the degree of monopolization of a market. A market with a low value of the N-firm Concentration Ratio is more competitive than one with a high value of the ratio. CRN defined as the sum of market shares of the largest market in the industry. The range of the Concentration Ratio is from almost zero for perfect competition to 100 percent for monopoly. A low indicates a CR refers to a high degree of competition. On the other hand, a high concentration ratio indicates an absence of competition and the closer to an oligopolistic or monopolistic type of market structure.

For new investors to enter the market, concentration ratios, which show how competitive an industry is, maybe a barrier. Calculating concentration ratios often involves using the market share of k, which refers to the largest ports in terms of TEU (Varan and güldem, 2014). The definition of CR_K is:

$$CR_K = \frac{\sum_{i=1}^{k} TEUi}{\sum_{i=1}^{n} TEUi}$$

Where:

CR_K, which stands for concentration ratio of k is the largest ports in the port system.

K: denotes the quantity of the largest ports used for measuring.

TEU_i: stands for the ith port's throughput of containers.

n: denotes the system's total number of ports.

The concentration ratio has a range of 0 to 100%. It is considered "low concentration" and nearly perfectly competitive when the port system's concentration ratio is between 0 and 40%. The port system is described to as having "high concentration" when the concentration ratio surpasses 70%, implying that a small number of operators have a substantial amount of power and that inter-firm competition is restricted (Nguyen et al., 2020).

6.3 Hirschman-Herfindahl Index:

Hirschman-Herfindahl Index is a commonly accepted measure of market/trade concentration (Crozet, 2017). It is the most well-known measure of specialization and concentration

constructed on the basis of structural data in economics. HHI index was postulated by both Hirschman (1945 and 1964) and Herfindahl (1950) as a measure of trade and industry concentration (Hossain et al., 2017). It plays a significant in the enforcement process of antitrust law in banking sector of the United States (Tushaj, 2010).

Herfindahl-Hirschman Index is defined as the sum of the squared market shares (Elsayeh et al., 2011; Crozet, 2017). According to this research, HHI index is the sum of the squared values of each port's market share that is obtained by comparing the throughput of each port against the total throughput of the defined ports in the market, as shown in the equation 4-2. Therefore, it is sensitive to inequality in the distribution of the market shares (Maksimović and Kostić, 2012). The higher the HHI value, the more concentrated the industry and the greater the potential for market power (Yaşar and Kiracı, 2017). It is believed that the Herfindahl-Hirschman Index is more precise measure because it takes into account all companies (Pavic et al., 2016).

It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers, and can range from close to zero to 10,000. The value of the index increases when the number of companies decreases (Crozet, 2017). These values range from 0 to 10000, and as the number gets smaller, the market can be said to be more

competitive. As impossible as it is, if the value is 0, a full competitive market is observed, even though this is very difficult to come by today. If the HHI value is 10000, the market is a monopoly (Yaşar and Kiracı, 2017). HHI index can be explained as:

$$HHI_{1...n} = \sum_n S_n^2$$

According to this research, S is the throughput of port n on the Egyptian market and n is the total number of the defined ports in the market. Classifications made for HHI values are as follows: $0 \leq HHI < 2000 \rightarrow$ Low Concentration, $2000 \leq HHI < 4000 \rightarrow$ Medium Concentration and $4000 \leq HHI \leq 10000 \rightarrow$ High Concentration (Yaşar and Kiracı, 2017).

In addition to this classification, the value between 0-1000 represents full competition, implying low concentrated markets, HHI values between 1000-1800 represent medium concentration markets and HHI values between 1800-10000 are concentrated markets (Elsayeh et al., 2011). The main advantage of the HHI index is computational simplicity. Also, Elsayeh (2015) mentioned two advantages for using Herfindahl index are that it considers all firms in an industry, and it gives extra weight to a single firm that has a particularly wide market share. However, HHI has three main disadvantages. Firstly, the definition of the market is arbitrary. Secondly, it accounts neither localized

competition within the market nor the competition outside the market.

According to this research, HHI index is the sum of the squared values of each port's market share that is obtained by comparing the throughput of each port against the total throughput of the defined ports in the market. The higher the HHI value, the more concentrated the industry and the greater the potential for market power. As mentioned in chapter three, the main advantage of the HHI index is its computational simplicity.

7. EMPIRICAL ANALYSIS:

7.1 Measuring concertation level in the Red Sea bulk market using CR:

From the next table (4-1) we found that Aqaba took the first ranked in 2018 and 2019 but Jeddah took his place in 2020 with 18.91% market share and 16.46% in 2021, but un expected Sokhna port took the first ranked port in 2022 with market share 20.33%. Jeddah took the second ranked port in 2018 and 2019 and the fifth ranker port in 2022 with market share 13.23%.

Yanbu industrial port in Saudi Arabia took the second market share with 16.41% in 2020, and the third ranked port in 2021 with 9.36% market share. But it took the fourth market share with a 15.40% in 2022. In addition, Yanbu commercial port in Saudi Arabia took the fourth market share with 10.34% in 2018, and the third ranked port in 2020 with 15.31% market share. But it took the fourth market share with a 15.34% in 2022.

In addition, table (2) explains the degree of the concertation level in the Red Sea bulk market using CR ratio between 2018 and 2022. The analysis reveals that the market share of the top four terminals decreased from 66.47% in 2018 to 64.43% in 2019 but increased in 2020 to 78.05% and 77.49% in 2021 and 66.75% in 2022; with average 70.64% during the period of the study.

Sokhna port in Egypt ranked as the sixth position in 2018, 2019 and 2021. In addition, it took the seventh ranked port in 2020. Suez port has the last ranker port during the period of the study from 2018 to 2022 with average market share 0.15%. But Hudaidah port in Yemen took the sixth ranked port 4.62% in 2020, the eighth ranked port 5.79% in 2018 and with market share 2.97% in 2021 and the eighth ranked port in 2022 with market share 3.07%.

Table (2) Measuring concertation level in the Red Sea bulk market using CR ratio.

Port	2018 TEUs	2018 Market share	Port	2019 TEUs	2019 Market share	Port	2020 TEUs	2020 Market share	Port	2021 TEUs	2021 Market share	Port	2022 TEUs	2022 Market share
Aqaba	7777833	20.97%	Aqaba	6509039	19.02%	Jeddah	42155051	37.70%	Jeddah	32442534	35.28%	Sokhna	18178288	20.33%
Jeddah	7012811	18.92%	Jeddah	5604394	16.40%	Yanbu industrial	18381088	16.42%	Yanbu commercial	23273415	25.29%	Aqaba	14088097	15.69%
Adabiya	6029400	16.25%	Adabiya	5224000	15.27%	Yanbu commercial	17124008	15.31%	Yanbu industrial	8614139	8.19%	Yanbu industrial	11752362	13.40%
Yanbu commercial	3834483	10.34%	Yanbu industrial	4602638	13.69%	Jazan	3664288	3.63%	Jazan	6954839	7.56%	Yanbu commercial	15697143	13.34%
CR4		66.47%	CR4		64.43%	CR4		72.85%	CR4		77.40%	CR4		66.75%
Yanbu industrial	3483365	8.99%	Yanbu commercial	3778342	8.19%	Aqaba	6840670	6.13%	Aqaba	8502134	7.15%	Jeddah	11827454	13.29%
Sokhna	2756780	7.42%	Sokhna	2864008	8.89%	Hudaidah	5044023	4.62%	Sokhna	8133088	6.87%	Adabiya	6999000	7.84%
Safaga	2833800	7.10%	Safaga	2656008	7.75%	Sokhna	4964700	4.47%	Adabiya	2735280	2.99%	Safaga	4302000	4.92%
Hudaidah	2148370	5.79%	Jazan	1367508	3.99%	Adabiya	4422408	3.87%	Hudaidah	2737388	2.97%	Jazan	3604300	4.54%
Jazan	1157518	3.12%	Hudaidah	1699742	4.98%	Safaga	3061400	2.74%	Safaga	2389008	2.60%	Hudaidah	2740537	3.07%
Suez	64000	0.17%	Suez	67008	0.20%	Suez	93008	0.08%	Suez	115800	0.13%	Suez	135000	0.15%
CR10		100.00%	CR10		100.00%	CR10		100.00%	CR10		100.00%	CR10		100.00%
Total	37094578		34238375			111820220			92021000			89298393		

Source: Author own calculation.

	Aqaba	Jeddah	Adabiya	Yanbu commercial	Yanbu industrial	Sukhna	Safaga	Hudaidah	Jazan	Suez
2018	20.97%	18.91%	16.25%	10.34%	9.93%	7.42%	7.10%	5.79%	3.12%	0.17%
2019	19.01%	16.46%	15.27%	9.86%	13.69%	8.80%	7.75%	4.96%	3.99%	0.20%
2020	6.13%	37.70%	3.95%	15.31%	16.41%	4.42%	2.74%	4.62%	8.63%	0.08%
2021	7.15%	35.28%	2.99%	25.29%	9.36%	6.67%	2.60%	2.97%	7.56%	0.13%
2022	15.69%	13.23%	7.84%	15.34%	15.40%	20.33%	4.92%	3.07%	4.04%	0.15%
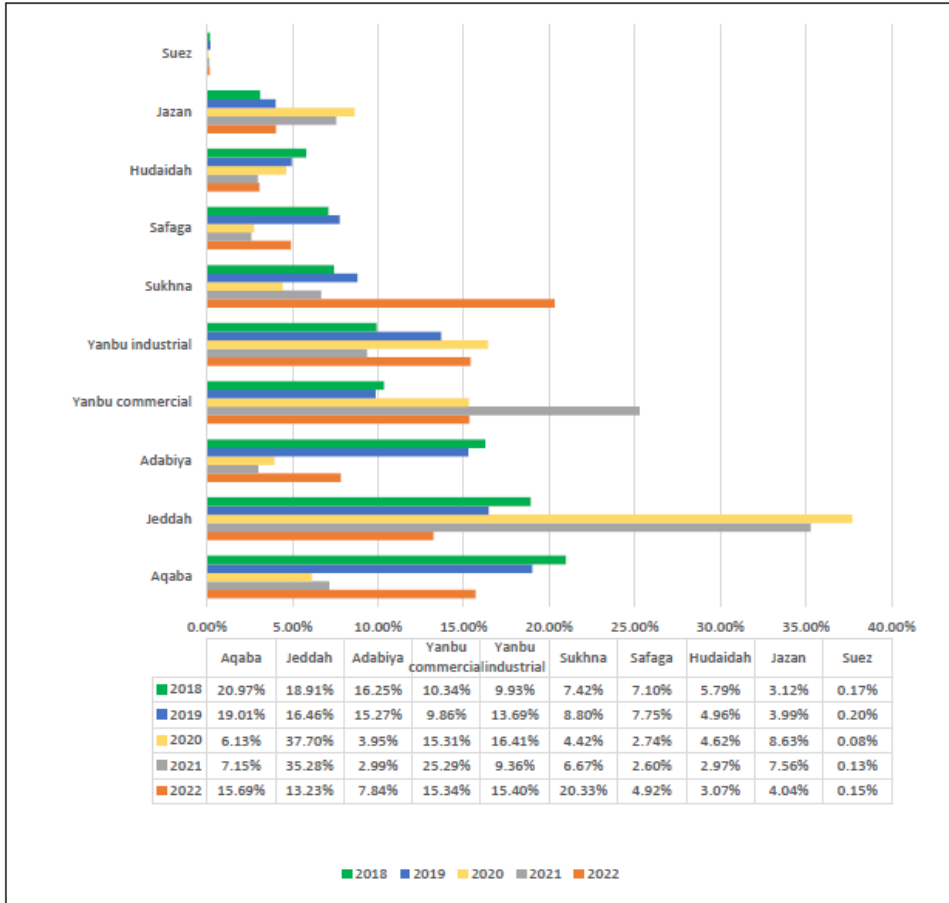
Figure (3) Measuring concertation level in the Red Sea bulk market using CR ratio.
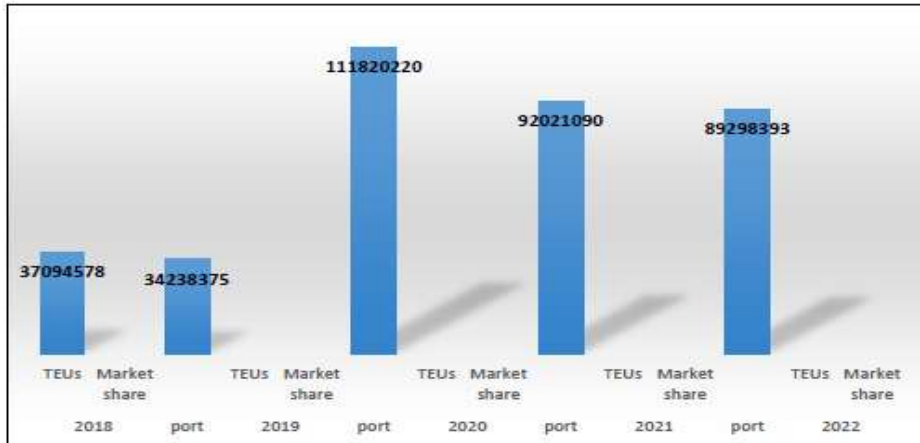Source: Author own calculation.

Figure (4) Total market share in the Red Sea bulk market share from 2018 to 2022.
Source: Author own calculation.

The above figure shows that the total market share increased from 34.238.375 M tons in 2019 to 111.820.220 M tons in 2020 due to global economic growth; increase in global trade, technological innovation and political and trade stability. But decreased to 92.021.090 M tons in 2021 due to Covid-19, and continued to decreased to 89.298.393 in 2022 due to Russian Ukrainian war.

From the table (2) above, it turns out that, during the period of the study from 2018 to 2022, the Concentration Ratio (CRN) of the average Concentration Ratio of the top four ports during the period of the study is 70.64% which reveals a very high degree concentration and monopolistic structure emerges. Therefore, the Red Sea bulk ports market is moving towards high concentration. In the next section, the Hirschman-Herfindahl

Index (HHI) is used to provide further elaboration of the changes in the ports' market shares in relation to the total market share.

In the next section, the researcher measures market structure of the red sea bulk terminals' using the Hirschman-Herfindahl Index (HHI).

7.2 Measuring concertation level in the Red Sea bulk market using HHI:

The concertation level in the Red Sea bulk market can be measured using the Herfindahl-Hirschman Index (HHI). This index provides a quantitative measure of market concentration by considering the market shares of individual participants. In the case of the Red Sea bulk market, the HHI can be calculated by summing the squared market shares of all the players in the market. A higher HHI value indicates a greater level of concentration, while a lower value suggests a more competitive market. By utilizing the HHI, analysts and researchers can assess the degree of concertation in the Red Sea bulk market and gain insights into its competitive dynamics. This information can be valuable for market participants, policymakers, and stakeholders in making informed decisions and promoting market efficiency and competition.

Table (3) Red Sea bulk market share from 2018 to 2022.

| Port	2018	2019	2020	2021	2022
Aqaba	7777633	6509316	6849270	6582184	14009997
Suez	64000	67900	93600	115900	135000
Safaga	2633300	2654300	3065400	2389800	4392000
Adabiya	6029400	5226900	4422400	2755200	6999600
Sukhna	2750700	3014300	4944700	6135500	18150200
Yanbu industrial	3683365	4688639	18353881	8614139	13752362
Jazan	1157516	1367500	9646266	6954830	3604300
Jeddah	7015811	5634516	42155281	32462534	11817454
Yanbu commercial	3834483	3375842	17124599	23273615	13697143
Hudaidah	2148370	1699162	5164823	2737388	2740337
Total	**37,094,578**	**34,238,375**	**111,820,220**	**92,021,090**	**89,298,393**

Source: Different autho
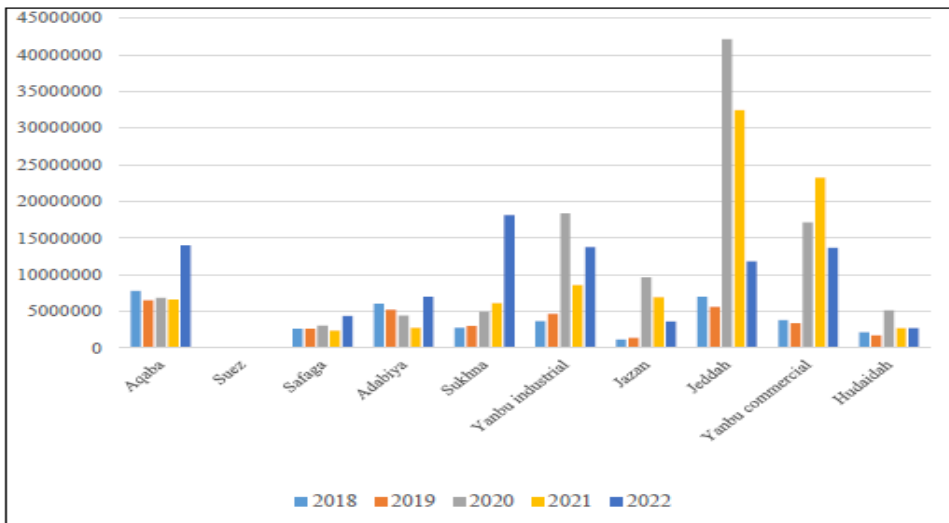
Figure (5) Red Sea bulk market share from 2018 to 2022.
Source: Author own calculation.

The HHI efficiency score gives the terminal management a warning signal that the lower their HHI score, the greater

probability a terminal has of failure. Therefore, HHI is very useful for identifying the least efficient terminals; such as Suez port.

In this context, there is a decrease in the HHI of the Red Sea ports as shown in table (4-3) below, in 2018 it was 1416, the peak of the value of the HHI for all terminals was 2021 in 2020, and started the decrease in 2022 to be 1418. The average HHI value during the period of the study during 2018 and 2022 is 1682; which indicates medium concentration markets

Table (4) Measuring concertation level in the Red Sea bulk market using HHI from 2018 to 2022.

|	2018	2019	2020	2021	2022
Aqaba	20.97	19.01	6.13	7.15	15.69
Suez	0.17	0.20	0.08	0.13	0.15
Safaga	7.10	7.75	2.74	2.60	4.92
Adabiya	16.25	15.27	3.95	2.99	7.84
Sukhna	7.42	8.80	4.42	6.67	20.33
Yanbu industrial	9.93	13.69	16.41	9.36	15.40
Jazan	3.12	3.99	8.63	7.56	4.04
Jeddah	18.91	16.46	37.70	35.28	13.23
Yanbu commercial	10.34	9.86	15.31	25.29	15.34
Hudaidah	5.79	4.96	4.62	2.97	3.07
HHI	**1416**	**1328**	**2101**	**2149**	**1418**

Source: Author own calculation.
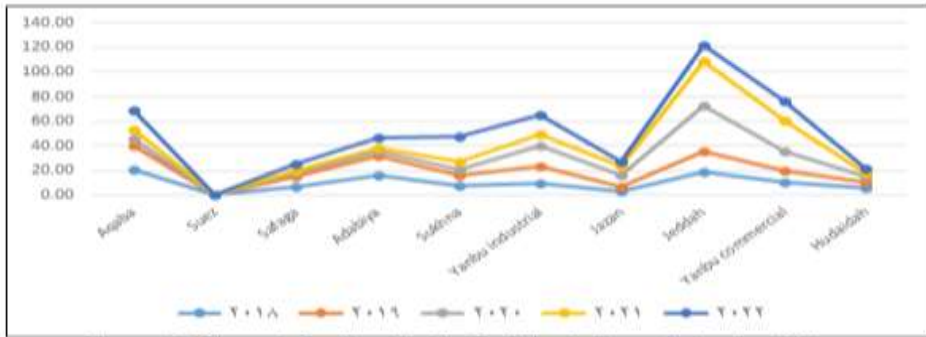
Figure (6) Concertation level in the Red Sea bulk market using HHI from 2018 to 2022.
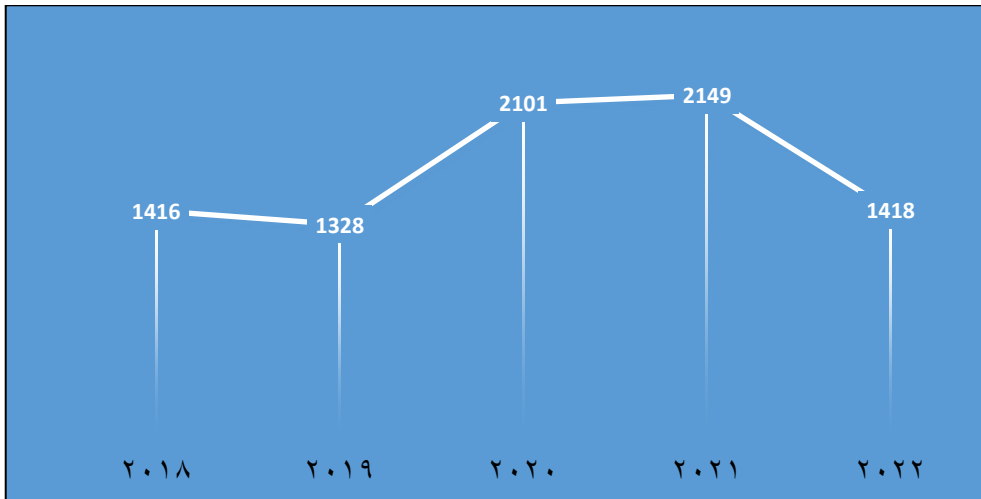**Source: Author own calculation.**

Figure (7) Average HHI level in the Red Sea bulk market from 2018 to 2022.
Source: Author own calculation.

The previous figure (7) shows that there is a downward trend in HHI index from 1416 in 2018 to 1328 in 2019, but upwards t 2101

in 2020 and 2149 in 2021 but turned again downwards to 1418 in 2022.

8. CONCLUSION AND RECOMMENDATIONS:

Between 2018 and 2022, an analysis of the Red Sea bulk ports market indicated a significant concentration of market share among the top four ports. The Concentration Ratio (CR4) for this period was calculated at 70.64%, reflecting a substantial level of concentration and the emergence of a monopolistic structure. These findings suggest that the Red Sea bulk ports market has been trending towards high concentration during the study period of 2018 to 2022. The Red Sea ports market experienced a decrease in the Herfindahl-Hirschman Index (HHI) as. In 2018, the HHI value stood at 1416, reaching its peak at 2021 in 2020, and subsequently declining to 1418 in 2022. The average HHI value over the study period from 2018 to 2022 was calculated as 1682, indicating a medium level of concentration in the market.

Measuring the concertation level in the Red Sea bulk market involves assessing the degree of coordination and cooperation among market participants in terms of pricing and other market-related activities. While it is challenging to quantify concertation precisely, several indicators and approaches can provide insights into the level of coordination in the market. Here are a few methods that can be considered:

- Price Stability: Examining the stability of bulk shipping rates in the Red Sea over a specific period can indicate the level of

concertation. If prices remain relatively stable and show limited fluctuations despite changing market conditions, it could suggest a higher degree of coordination among market participants.

- Price Patterns: Analyzing the patterns and movements of bulk shipping rates in the Red Sea can provide insights into potential coordination. If prices consistently follow similar trends or exhibit synchronized changes, it may indicate coordinated behavior among market players.

- Market Concentration: Assessing the market structure and the degree of concentration among key players in the Red Sea bulk market can offer clues about the potential for concertation. If a small number of companies dominate the market, there may be a higher likelihood of coordination.

- Communication and Information Sharing: Monitoring communication channels and information sharing practices among market participants can provide indirect indications of coordination. Regular meetings, conferences, or industry forums where market players exchange information may suggest a higher level of concertation.

- Regulatory and Legal Framework: Evaluating the regulatory environment and legal framework surrounding the Red Sea bulk market can shed light on the level of coordination. Regulations promoting fair competition and preventing anti-

competitive practices can discourage concertation, while the absence of such regulations may contribute to a higher likelihood of coordination.

It is important to note that assessing concertation in any market, including the Red Sea bulk market, can be challenging due to the potential covert nature of coordination efforts. Therefore, a comprehensive analysis combining multiple indicators and a careful consideration of market dynamics is crucial to gain a better understanding of the concertation level in the Red Sea bulk market.

For further research, researcher could make papers about Measuring the concertation level in the Red Sea bulk market using different indexes such as Hall-Tideman index "HTI" index, Entropy index (E)", The Comprehensive Industrial Concentration Index (CCI), The Hannah and Kay Index (HKI), Gini coefficient (GC), The U Index (U), Hachman Index and The Hause Indices (H).

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