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DYNAMICS AND STRUCTURE OF WORLD SEABORNE TRADE IN 2009-2023: IMPACT OF COVID-19 PANDEMIC AND UKRAINIAN WAR

ДИНАМІКА ТА СТРУКТУРА СВІТОВОЇ МОРСЬКОЇ ТОРГІВЛІ У 2009-2023: ВПЛИВ ПАНДЕМІЇ КОРОНАВІРУСУ ТА ВІЙНИ В УКРАЇНІ

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Abstract. *This paper examines the dynamics and structural changes of the world seaborne trade for the period of 2009-2023 with a special focus on its vulnerability to such recent external shocks as the covid-19 pandemic outbreak and the Ukrainian war. Besides, the world seaborne trade is decomposed into major components – dry bulk trade, containerized trade and tanker trade. The volume of seaborne trade is considered in two different measurement units. The outcome of the analysis suggests that behavioral patterns of examined datasets coincide with minor differences. Over the period under examination the volume of the world seaborne trade measured in tonnes demonstrated a general upward trend, except for 2020 and 2022. Dry bulk and container seaborne trades experienced similar changes, while the world oil and chemical seaborne trade dropped in 2019 and 2020, after which recovered. As opposed to tonnes measurement, the dry bulk seaborne trade measured in tonne-miles was under negative growth regime only once in 2022. As to tanker trade measured in tonne-miles, it declined on a year-by-year basis throughout three consecutive years – 2019, 2020, 2021. It is ascertained that volumes of global seaborne trade faced short-term impacts of said external shocks, and recovery from sudden events and adjustment to changes in macroeconomic environment and shift of trade patterns took relatively low time (from 1 to 2 years max). It was confirmed that regardless of how the market was measured, the share of each segment was identical. While the percentage of fleet in number of ships was not representative, the percentage of fleet in deadweight tonnes, as well as the percentage of trade in tonnes and tonne-miles could equally truly describe the share of each market in the shipping industry. As for the end of 2023, dry bulk sector occupied around 45-48% of the shipping industry, containership segment – approximately 15%, and wet bulk (tanker) sector – around 26-30%. In addition, an observation is made that tonne of global seaborne trade per world fleet deadweight capacity tends to follow the downward trend mainly due to emission compliance-driven decrease of vessels' speed and increase of average haul caused by trade patterns modifications, especially the most recent.*

Key words: *shipping, seaborne trade, maritime economics, covid-19, Ukrainian war, dry bulk trade, container trade, tanker trade, merchant fleet.*

Анотація. *Метою даного дослідження є аналіз динаміки та структурних змін світової морської торгівлі за період з 2009 по 2023 роки з акцентом на її вразливість до таких*

нещодавніх зовнішніх потрясінь, як пандемія коронавірусу та початок війни в Україні. Окрім того, світову морську торгівлю розкладено на найбільш значні компоненти – перевезення сухого вантажу навалом, контейнерна торгівля та торгівля нафтою, нафтопродуктами та хімічними речовинами. Обсяги морської торгівлі розглянуто у двох різних одиницях вимірювання. Результати проведеного аналізу свідчать, що поведінкові патерни досліджених масивов даних схожі, маючи незначну кількість розбіжностей. За розглянутий період обсяги світової морської торгівлі, що вимірюються у тоннах, продемонструвала загальну тенденцію до зростання, за винятком 2020 і 2022 років. Морська торгівля сухими вантажами та контейнерами зазнала подібних змін, тоді як світова морська торгівля нафтою та хімічними речовинами впала в 2019 і 2020 роках, після чого відновилася. На відміну від виміру в тоннах, морська торгівля сухими вантажами, виміряна в тонно-милях, упала лише один раз у 2022 році. Що стосується танкерної торгівлі, виміряної в тонно-милях, вона зменшувалася з кожним роком протягом трьох років поспіль – 2019, 2020, 2021 рр. Встановлено, що обсяги світової морської торгівлі зазнали короткострокових впливів зазначених зовнішніх шоків, а відновлення після цих раптових подій і пристосування до змін макроекономічного середовища та зміни регіональних особливостей торгівлі зайняло відносно короткий час (від 1 до 2 років максимум). Було підтверджено, що незалежно від того, як чисельно вимірювати ринок, частка кожного сегмента була однаковою. Хоча відсоток конкретного флоту, виражений в кількості суден, не був репрезентативним, відсоток флоту, виражений в тоннах дедвейту, а також відсоток торгівлі в тоннах і тонно-милях однаково точно описують частку кожного ринку в судноплавній галузі. Станом на кінець 2023 року сектор сухих навалочних перевезень займав близько 45-48% судноплавства, сегмент контейнерних перевезень – приблизно 15%, а сектор наливних (танкерних) – близько 26-30%. До того ж, було зроблено спостереження, що тонна глобальної морської торгівлі на дедвейт світового флоту має тенденцію до зниження, головним чином через зниження швидкості суден, викликане необхідністю відповідати вимогам щодо викидів в атмосферу, і збільшення середньої дистанції, що проходить судно, спричинене трасформаціями регіональної структури морської торгівлі, особливо найбільш останніми.

Ключові слова: *шипінг, судноплавство, морська торгівля, економіка морського транспорту, пандемія коронавірусу, Українська війна, торгівля сухим вантажем навалом, торгівля контейнерами, торгівля нафтою та нафтопродуктами, морський торговельний флот.*

Introduction. Being truly international, the shipping industry is perceived as a circulatory system of global trade and subsequently the entire world economy. Maritime transportation accommodates for the movements of almost 90% of the goods transferred worldwide (UNCTAD, 2023), so seaborne trade is instrumental in keeping the world economy ball rolling. The shipping industry as well as seaborne trade is rather complex and heterogenous, not static but ever-changing.

Like any other market, the shipping market is subjected to typical market attributes, such as cyclicality and risks. This paper dwells on the dynamics of structural development of the world seaborne trade from 2009 to 2023 inclusive – the period which covers consequences of the world financial crisis 2008, European debt crisis, as well as recent external shocks.

Macroeconomic shocks are phenomena the world has recently faced in abundance. The covid-19 pandemic outbreak disrupted and completely modified the flow of commercial shipping in 2020. Having started slowly recovering, the world economy was suddenly hit from a political event – the outbreak of the war in Ukraine in early 2022 caused a new imbalance. Apparently, both events significantly distorted shipping cycles in all segments.

This research presents an attempt to identify the development trends in the world seaborne trade and specifically in the three sectors (dry bulk commodities maritime transportation, container shipping trade and tanker trade) which cumulatively account for almost 90% of the world seaborne trade. The remaining slightly more than 10% comprising gas trade, car trade, reefer trade, other dry trade are out of scope of the current paper. Changes in the regional structure of the world seaborne trade are also considered.

Following this introduction, the remainder of this paper is organized as follows: the purpose of research is formulated, the next section provides a review of the literature on the issue, thereafter main research results are discussed, and the final section concludes on the findings.

The purpose of research is to analyse the qualitative and quantitative changes of the world seaborne trade structure over the period under examination as well as to identify trends stipulating the seaborne trade development in the world and in particular shipping segments.

Recent literature review. The dry bulk segment is engaged with transportation of dry bulk commodities which are subdivided into major bulk (iron ore, coal, grain) and minor bulk (steel products, forest products, fertilizer, bauxite, cement, petcoke, sugar, etc.) (UNCTAD, 2023). Iron ore as a key steel ingredient is consumed by construction of industrial and domestic buildings, machinery, merchant ships, motor cars (Stopford, 2009). The main iron ore seaborne trade routes are mainly concentrated in the East, with Australia being the major exporter (58%), followed by Brazil (24%), and China the primary importer (73%), followed by Japan (8%) (UNCTAD, 2022).

Coal trade is mostly performed in the same region, with Indonesia (38%) and Australia (28%) as the leading exporters and India (20%), China (19%) as the leading importers. Grain is utilized for baking and as a raw material for factory farming of meat – both bread and meat are the staple foods of modern society (Stopford, 2009). As too geography of its trade, Asian countries are importing the highest volumes of grain (China – 27%), however, grain export is predominantly driven from the West – Brazil (24%), US (23%), Argentina (12%) (UNCTAD, 2023).

Park, Kim and Kwon (2022) examined covid and post-covid period and verified that when the dry bulk freight rates exceeded the normal range, they were determined by specific demand of market participants rather than by actual supply and demand.

Containerships carry various types of commodities in containers which are miscellaneous consumer products, home and building products, furniture, industrial machines and parts, textile, clothing, miscellaneous industrial products, autos and auto parts, consumer electronics, iron/steel, toys, sport equipment, wood pulp, lumber, peas, beans, lentils, wastepaper, hay/alfalfa, fresh and frozen meat, soya beans, malt, newsprint, scrap metal, etc. (Stopford, 2009).

Between 1975 and 2007 the containerized cargo grew much faster than other parts of the shipping business (Stopford, 2009). Alizadeh and Nomikos (2009) confirm that the largest growth from 1970 to the present [2009] was in the container fleet mainly because of the containerisation of trade in manufactured goods and the increase in the number of large container carriers in recent years, due to the expansion of trade between the Far East, Europe and North America. In addition, the containerisation of some commodities, previously carried by general cargo or reefer ships, has also contributed to the growth of the container fleet. In 2022 the main East—West routes dominated (38%) with the high importance of intraregional routes (28%) reflecting dynamic intra-Asian container shipping activity and the manufacturing supply chain specific to East Asian countries (UNCTAD, 2023).

As to tanker sector, each type of tankers is utilized at different stages of industrial process and performs function of either primary sea transport (moving raw material to plant) or secondary one (transferring produced commodity from plant). Crude oil tankers transport crude oil from extraction places to refineries while oil products tankers carry oil products, such as fuel oil, diesel, gasoil, gasoline, jet fuel, naphtha, further to consumption centers (Stopford, 2009). The most sophisticated oil products carriers are close to chemical sector. Chemical tankers carry a range of specialised chemicals, i.e. ‘easy’ aromatics, MTBE, vegetable oils, inorganic acids, exported mainly from the US and the Middle East (Clarksons, 2015).

Regions wise in 2022 Asia consumed the highest volume of crude oil and oil products. China imported 23% and India 12% of transported crude oil, South-East Asia and UK imported 17% of oil products each. Obviously, exports were driven from the Middle East (Gulf) – 47% of crude oil and 18% of oil products transported by sea. Total Europe exported 34% of oil products transported by ships (UNCTAD, 2023).

Published in 2020, two papers by Michail and Melas (2020a) are worth mentioning. Exploring the relationship between seaborne commodity trade and freight rates, the scientists revealed that seaborne trade volumes strongly impacted dry bulk and dirty tanker indices, but not clean tanker since the latter vessels are universal cargo wise and can carry both dirty and clean oil products.

Michail and Melas (2020b) were first to try to evaluate how the particular shipping markets reacted to an exogenous shock, namely coronavirus disease spread. The scholars reviewed the Baltic freight indices of the dry bulk (BDI), the clean tanker (BCTI) and the dirty tanker (BDTI) markets and concluded that the pandemic had negatively affected the dry bulk and the dirty tanker indices, while it had not directly affected the clean tanker segment. Dry bulk and clean tankers segment appeared to be highly affected by the demand side of the economy, while the dirty tankers (vessels which transport crude oil) did not register such a relationship. The suggested rationale behind this scientific observation is quite business-driven: while commodities transported by dry bulk vessels and clean tankers cannot be easily stored given both their nature and the need for specific facilities, crude oil can be stored much more easily given that it can simply remain in the vessel. However, retrospectively, we got to know that the dirty tanker sub-segment stagnated considerably after the covid-19 outbreak, however, with a time lag compared to other segments.

Fei *et al.* (2020) conducted the research which looked at how external environment (financial crisis, environmental crisis, crude oil agreement) impacted the Baltic Dirty Tanker Index, particularly on different routes, and proved that index was interfered by the external factors – the observation which has a direct relation to the current paper.

Michail (2020) examined how the world economic growth impacts the global demand for seaborne trade and subdivided the world economy into three groups of countries by income (high, middle and low). The results of the research revealed that seaborne trade was affected by changes in the world economic growth, albeit to a different extent: refined petroleum products demonstrated the strongest effect from an increase in world GDP in comparison to crude oil and dry cargo. The positive reaction of seaborne trade demand on GDP shock has to be mainly attributed to the high- and middle-income countries. As to low-income countries, who are normally net exporters of oil and petroleum products, economic growth negatively impacted seaborne trade, as the highest the income – the highest the domestic consumption and the lowest the exports. The oil price appeared to have a small negative effect on the amount of goods transported, supporting the view of demand inelasticity with regards to price.

In the pertinent literature there was a recent attempt (Arslankap, Marini and Tumbarello, 2019) to connect AIS data with trade activity. Having taken Malta as a benchmark and having used AIS-based port calls data, the scholars introduced ‘cargo numbers’ and ‘cargo loads’ to trace maritime and trade activity. ‘Cargo number’ included vessels calling at ports, and ‘cargo load’ stood for changes in ships’ draughts proving the fact of loading or discharging occurred at port. Thereafter the obtained data was assessed against the official reports and the results (0.75 and 0.65 correlation coefficients respectively) could act as a proof of credibility of this method to predict trade volumes by means of AIS data and to nowcast them (evaluate in live).

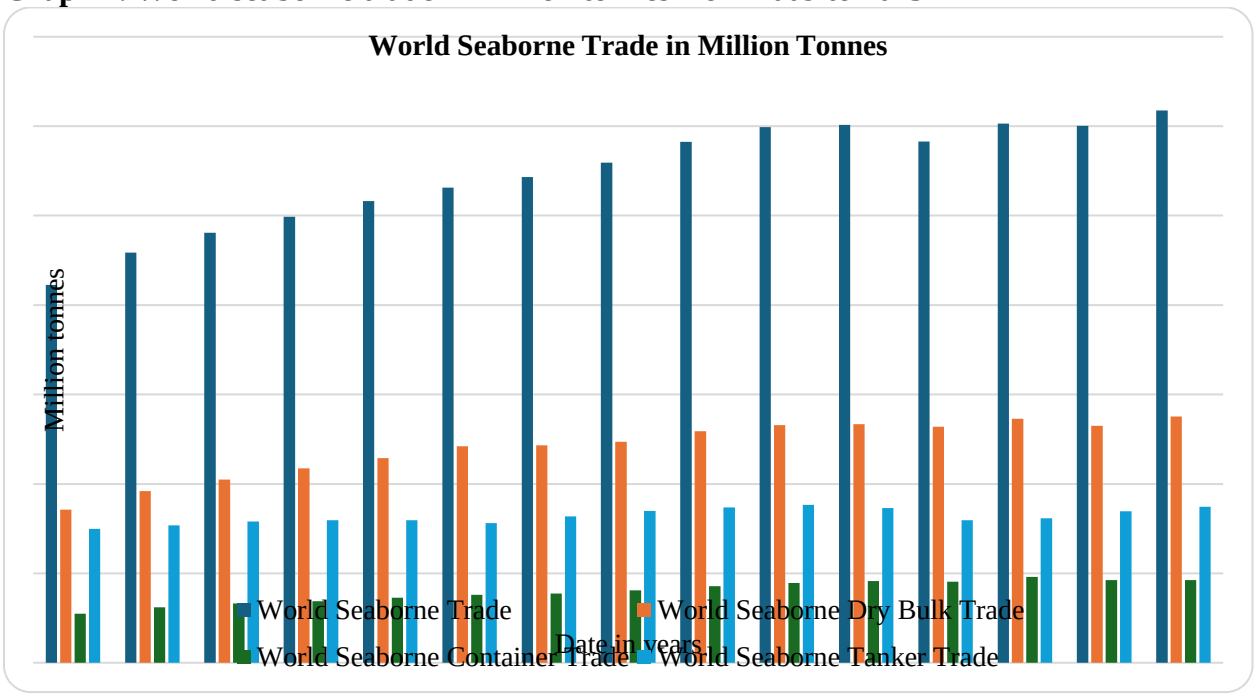
Nowcasting trade flows is crucial for all market players as official trade reports are always released with delays. By introducing the GTI (Global Trade Intelligence) index calculated based on AIS data and by comparing it with official trade data, Cerdeiro, Komaromi, Liu and Saeed (2020) concluded that based on the high final correlations such a methodology achieved a good match with official statistics and reports may be produced with 5-10-day lag in comparison to 11-15 weeks it takes officials to publish the same data about trade activity.

However, while the pandemic impact on the shipping has been researched in the literature, there has not been an attempt yet to examine the cumulative effect of both covid-19 and the Ukrainian war. Thus, the current paper comes to fill in the gap in the existing literature by exploring effects of both external shocks. On another note, the innovativeness offered by this paper is the comparison of two methods as to measurement of separate shipping segments.

Main research results. Over the period under examination (2009-2023) the volume of the world seaborne trade expressed in million tonnes demonstrated a general upward trend apart from 2020 and 2022 when it dropped on a year-on-year basis. Identical trend development is applicable to the world dry bulk seaborne trade and the world container seaborne trade, while the world oil and chemical seaborne trade experienced two consequent drops earlier – in 2019 and 2020, after which the volume of tanker trade increased, although still has not reached the all-period maximum observed in 2018. Contrary to the wet bulk trade, both the dry bulk trade and overall volume of the seaborne

trade reached the highest value in 2023, and the containership trade in 2021 – recovery in 2023 was not enough to outmaneuver the 2022 reduction.

Graph 1. World seaborne trade in million tonnes from 2009 to 2023



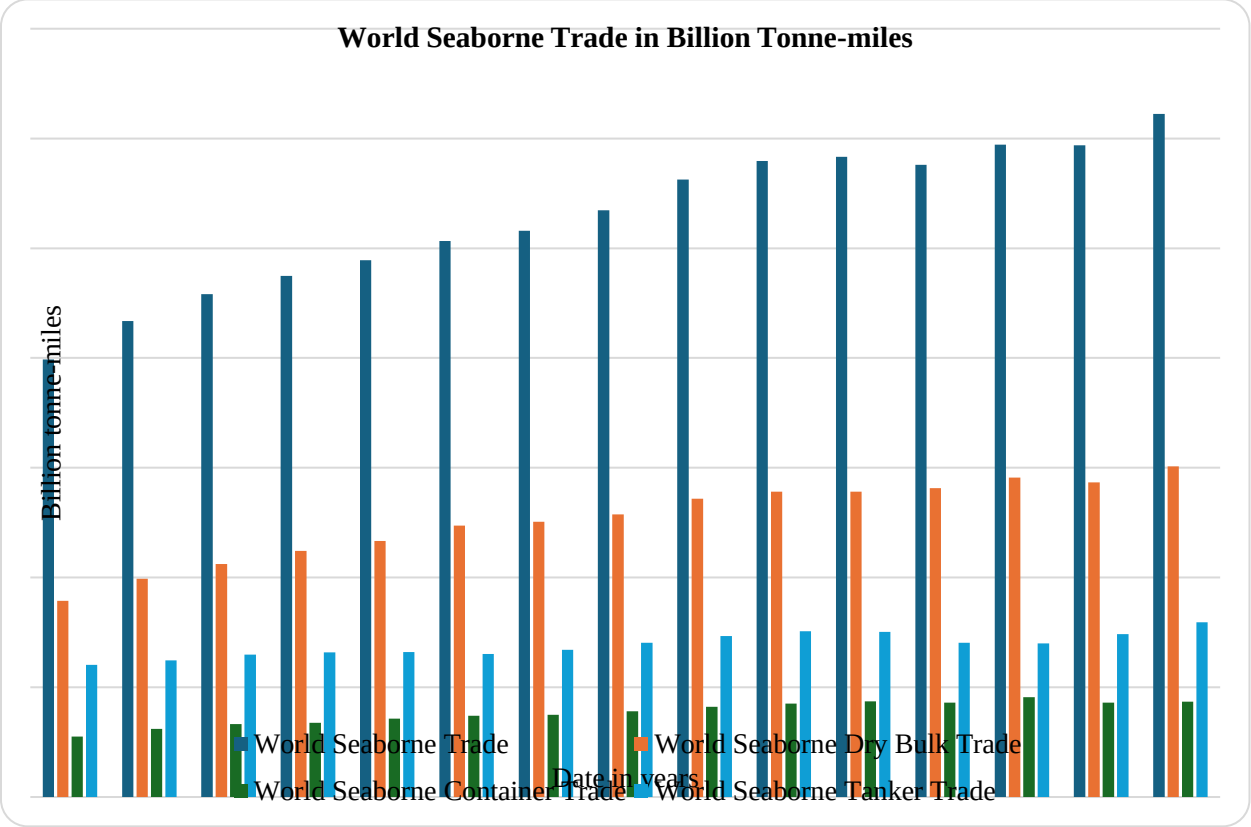
Source: compiled by author on data retrieved by the Clarksons SIN.

Interestingly, that if we employ a different approach to numerically assess the general shipping market – from the perspective of the seaborne trade volume measured in billion tonne-miles, most of above observations will remain actual, however, some differences are still worth mentioning. As opposed to the million tonnes measurement, the dry bulk seaborne trade measured in tonne-miles was under negative growth regime only once in 2022, which means that 2020 slowdown in tonnage of dry bulk trade was compensated by increased milage. Translating years into events, we may suggest that the covid-19 pandemic outbreak (2020) was less notable external shock for the dry bulk trade than the Ukrainian war (2022).

Apparently, the reasoning behind this fact is the leading role Ukraine occupied in the grain exporters ranking, accounting for 10% of the world grain export by 2022 (UNCTAD, 2022). Port closures caused by the Ukrainian war outbreak were mitigated by the launch of the Black Sea initiative and recommencement of grain shipments from Ukraine, although volumes were still considerably lower than pre-war. Some grain-importing countries (including African) had to rely on alternative exports, like the USA, Brazil or Argentina, which required longer hauls. To quote from the Review of Maritime Transport (UNCTAD, 2023), vessels transporting grains covered longer distances in 2023 than any other year on record.

At the same time the volumes of coal shipped out of the Russian Federation were not affected – 13% of global amount. In general, dry bulk tonne-milage demonstrated high resilience and quick rebound after external shocks for the reason that large portion of dry bulk trade was aimed to be consumed in China, so apart from closely located exporters, commodities needed to also travel long hauls from Argentina, Brazil and the United States – South and North American countries experienced the highest uplift of share as dry bulk exporters.

Graph 2. World seaborne trade in billion tonne-miles from 2009 to 2023



Source: compiled by author on data retrieved by the Clarksons SIN.

The world seaborne container trade followed more obvious development trends, having performed similarly regardless of the measurement units (tonnes and tonne-miles), however, we omit TEU measurement which is normally more intrinsic to containerized trade in shipping but less relevant for the current research as the aim is to conduct consistent and comparative analysis of the major shipping segments.

So, the world container trade fell in 2020 and 2022 (as the world trade in general and the dry bulk trade) but experienced strong recovery in 2021 hitting all-period high by a significant margin. It was accompanied by unprecedented growth of containership charter rates along with surge of vessel assets cost. To exemplify the boom, the fast-paced growth of secondhand asset prices in the containership segment reached the turning point in July 2021 when the price of the 10yo containership of 2750 TEU capacity surpassed the price of newbuild containership of the same capacity – USD 38m vs. USD 36.5m! Moreover, the gap between these prices has increased for the following months (Clarksons SIN; Zaidman, Dominese, Yakubovskiy and Rodionova, 2021) – this clearly met the pre-requisites of stage 3 (peak) of the short shipping cycle, as per Stopford.

The Review of Maritime Transport (UNCTAD, 2022) suggests the reasons for this may lay in changes instigated by the covid pandemic which resulted in a boom of e-commerce for consumer goods mainly carried in containers, however, this does not exhaustively explain the unprecedented and sharp growth. The swift increase of containership charter rates could not have a basic demand-related justification, as the volume of containerized trade was relatively stable and no major port's throughput indicator (Singapore, Hong Kong, Los Angeles) appeared to have an effect on containership charter rate. US industrial production, Maersk market capitalization and steel price were named as factors potentially causing that unique spike (Zaidman, Dominese, Yakubovskiy and Rodionova, 2021).

In respect of regional characteristics of containerized trade, UNCTAD (2023) underscores the predominance of intra-Asian containerized trade flows which in turn reflects global manufacturing trends with China and neighboring East Asian countries remaining on top of the world manufacturing. The involvement of several East Asian countries in regional and global supply chains permanently increase, and the expansion of intra-Asian trade volumes underlies the shorter distances container cargo travel. This is opposite to what we observe in the other two considered segments and since dry

bulk and tanker trades are more massive than container trade volume wise, the global seaborne trade does not follow container trade path in this aspect.

Another difference revealed by the comparison between approaches as to how to access seaborne trade volume pertains to the tanker trade. If measured in tonnes, it dropped both in 2019 and 2020, however, if measured in tonne-miles, it declined on a year-by-year basis throughout three consecutive years – 2019, 2020, 2021. Clearly, in 2019 and 2020 the world wet bulk and especially oil market collapsed with almost two times reduction of oil price in 2020 compared to 2018 (USD 41.96 per barrel of Brent crude oil vs USD 71.34). It recovered in 2021 back to 2018 level (Statista, 2024), however, the world oil and chemical seaborne trade still decreased in billion tonne-miles.

Oil and product tankers are normally employed as oil storage platforms during low oil prices and subsequently low freight rates – something which was observed during the 1990s oil crisis (Stopford, 2009) and later during the coronavirus crisis (Michail and Melas, 2020b). This explains both the decrease of the world oil seaborne trade in 2019 and 2020, however, not the drop of tonne-miles trade in 2021. This observation is worth expanding on and exploring: the tonne-milage of tanker trade dropped in 2021, however, the tonnage of tanker trade increased within the same period. Maths-driven explanation suggests that in this case milage decreased which means that oil and oil products stored in tanker vessels in 2019-2020 when oil price plummeted appeared to be located rather close to ultimate consumption markets, so the vessels did not need to cover high distances to reach the cargo buyers further in 2021. From the geopolitics perspective, this might be explained by the US easing sanctions against Iran during nuclear negotiations (Bard, n.d.) which allowed Iranian oil to travel shorted distances to reach consumers in Europe and China.

After the disruption, the world oil trade was permanently growing, having reached all-period high in tonne-miles in 2023 while in tonnes the all-period high level was retained by 2018. As UNCTAD (2023) points out, in 2023 surged oil cargo distances were mainly driven by disruptions caused by the Ukrainian war, since Europe turned to alternative than Russia energy suppliers while the Russian Federation itself sought new export market for its crude oil and refined products. Clarksons (2024) called this a helpful 'distance kicker' as 7% of oil and 10% of oil products tonne-mile growth predetermined the biggest world trade tonne-mile increase since 2017 (5% in 2023 on year-on-year basis).

To assess the significance and the role of different shipping segments, we calculated the share of each segment (dry bulk, tanker and container trade) in the world seaborne trade and evaluated their dynamics retrospectively. This was again performed twice for seaborne trade data measured both in million tonnes and billion tonne-miles. The analysis suggests that the trends are typical regardless of the units of measurements.

The dry bulk sector accounts for almost half of the shipping industry and it expanded over the last 15 years – from 41% in tonnes and 45% in tonne-miles to 45% and 48% respectively. The role of the containerized trade remains steady – around 15% of the world seaborne trade in both units. The wet bulk trade's share fell over the period under consideration – from 36% in tonnes and 30% in tonne-miles to 28% and 26% respectively.

Table 1. Share of each segment (dry bulk, container trade, tanker) in the world seaborne trade

Year	Share of seaborne dry bulk trade		Share of seaborne container trade		Share of seaborne tanker trade	
	In tonnes	In tonne-miles	In tonnes	In tonne-miles	In tonnes	In tonne-miles
2009	41%	45%	13%	14%	36%	30%
2023	45%	48%	15%	14%	28%	26%

Source: calculated by author on data retrieved by the Clarksons SIN.

Having analysed development of seaborne trade as a whole and of particular types of cargo, for the sake of further critical comparison of the bulk, tanker and liner shipping segments, this paper suggests considering the dynamics of development of world fleet as a whole and of particular vessel types. Again, two units of measurement are utilized as we examine world fleet development in (a) deadweight and (b) number of ships. The shares of each vessel type (bulk carrier, containership and tanker) in the overall world fleet are calculated for 2009 and 2023 and summarized in Table 2.

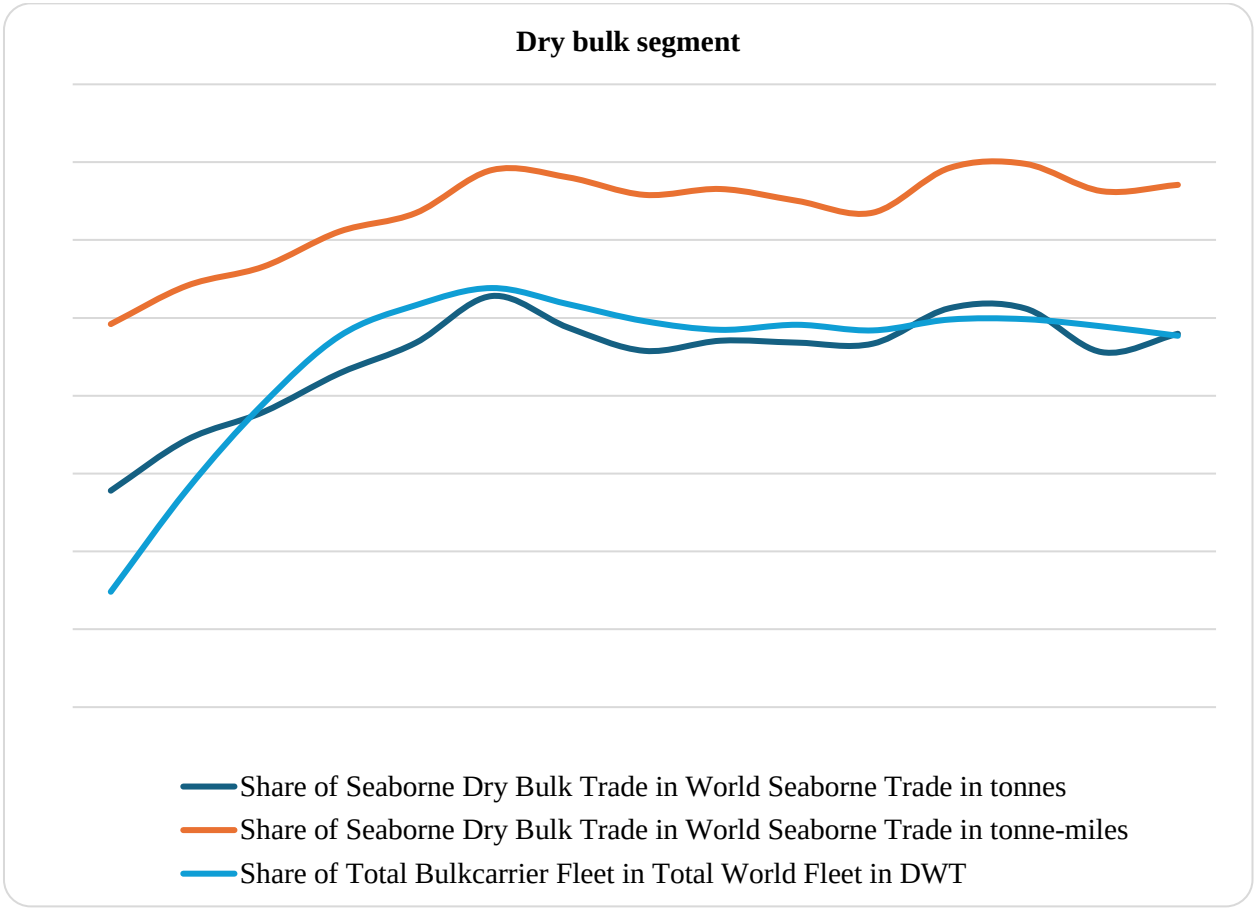
Table 2. Shares of each vessel type (bulk carrier, containership, tanker) in the overall world fleet in 2009 and 2023

Year	Share of dry bulk carriers in world fleet		Share of containerships in world fleet		Share of tankers in world fleet	
	In deadweight	In numbers	In deadweight	In numbers	In deadweight	In numbers
2009	38%	16%	14%	10%	37%	26%
2023	45%	20%	15%	9%	32%	25%

Source: calculated by author on data retrieved by the Clarksons SIN.

Comparison between calculations outcome presented in Tables 1 and 2 suggests that regardless of how we measure the market, the share of each segment is identical either in terms of fleet deadweight or in terms of seaborne trade. As for the end of 2023, dry bulk sector occupies around 45-48% of the shipping industry, containership segment – approximately 15%, and wet bulk (tanker) sector – around 26-30%. Graphs 3-5 are constructed separately for each segment to illustrate the pace of development of its share in the global shipping over the period of 2009-2023, however, shares of vessel types in numbers are made redundant from the graphs being irrelevant for the subject as above analysis confirms.

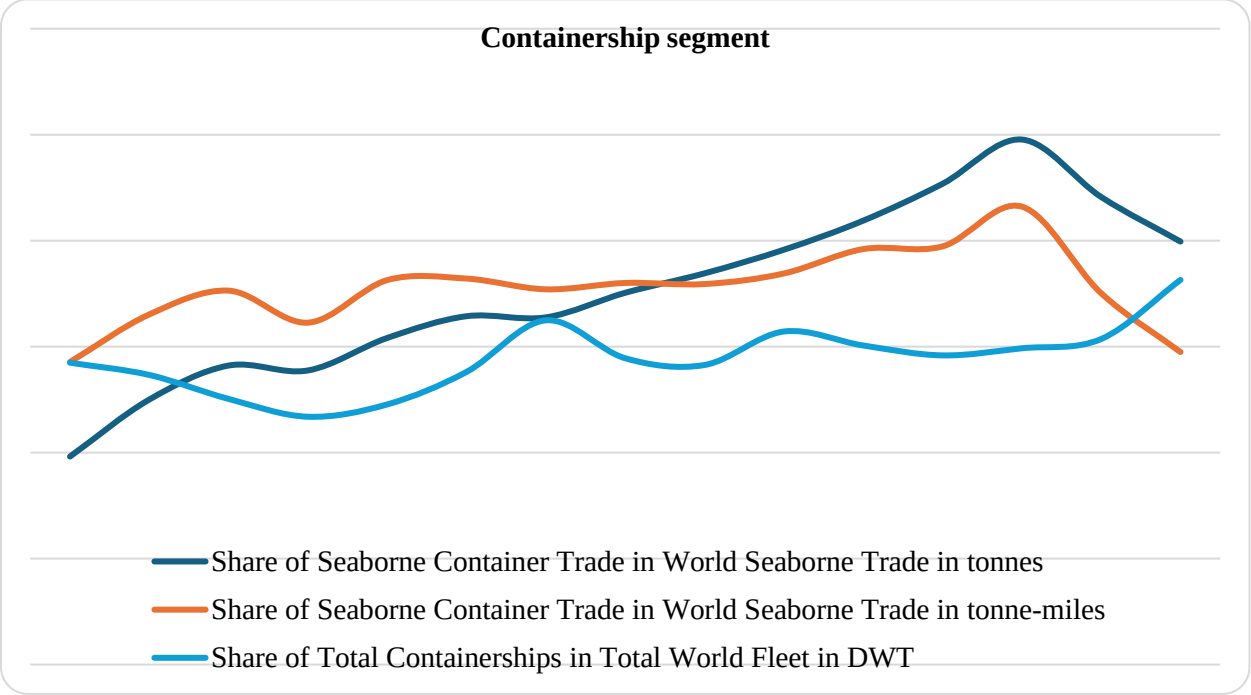
Graph 3. Dry bulk segment: share of dry bulk trade in world seaborne trade and share of bulk carriers in world fleet



Source: calculated and compiled by author on data retrieved by the Clarksons SIN.

As seen, dry bulk carriers account for 20% of the world cargo fleet in number of vessels and for 45% of the world cargo fleet in terms of cargo carrying capacity. Clearly, the share of dry bulk carriers in the world fleet significantly expanded in the last 15 years. Dry bulk fleet is the only vessel segment which demonstrated positive dynamics share wise over the considered period which emphasizes the growing demand in transportation of dry bulk commodities. Major dry bulk cargoes (iron ore, coal and grain) are predominantly consumed by construction of buildings and machinery as well as bakery and factory farming (Stopford, 2009) – in fact pillars of modern consumption.

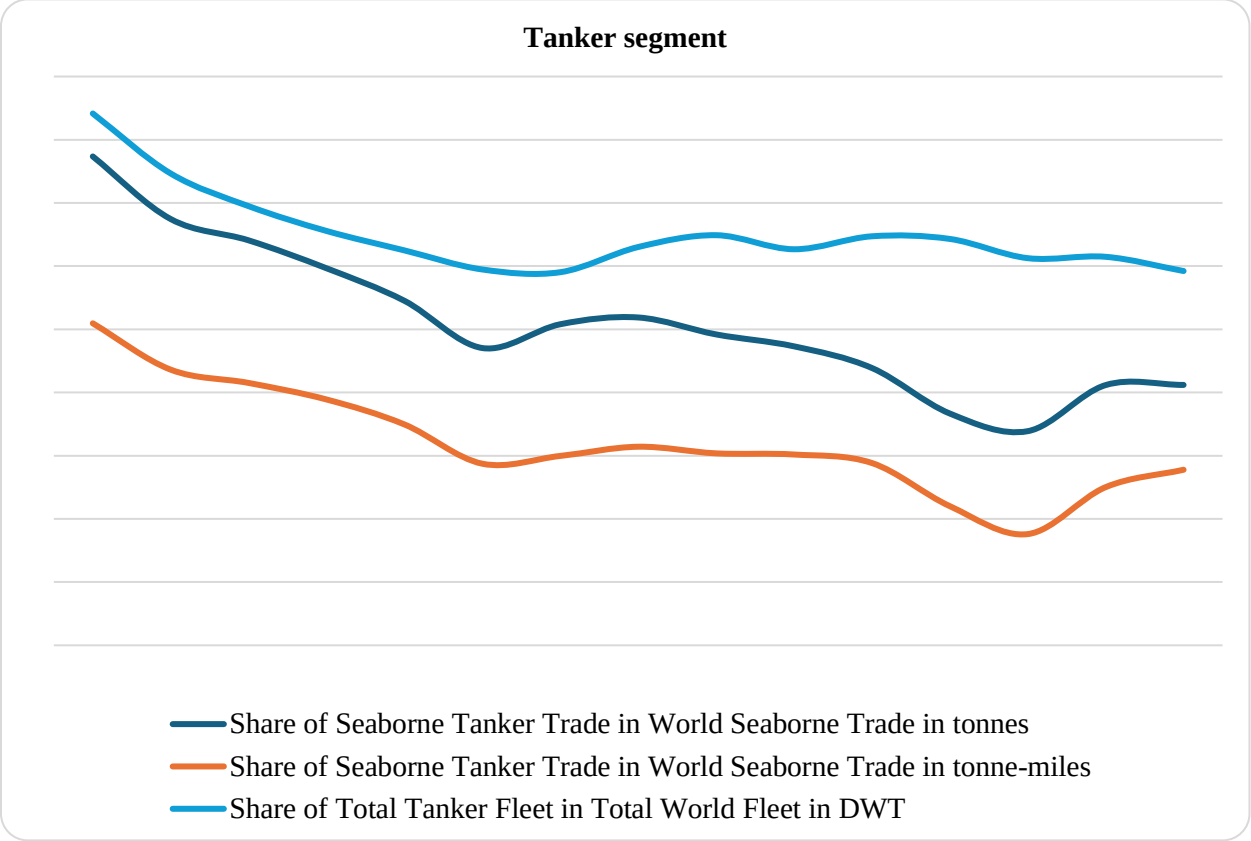
Graph 4. Containership segment: share of seaborne container trade in world seaborne trade and share of containerships in world fleet



Source: calculated and compiled by author on data retrieved by the Clarksons SIN.

In turn, containerships were firm in respect of their weight in the world fleet – in 2023 they occupied 15% of the cargo fleet in deadweight terms and 9% if counted in vessel units. As soon as number of containerships had decreased since 2009 while cumulative containership deadweight capacity had increased, the conclusion can be made that there is an overall upward trend of the average size of containership during the period under examination. This trend indicates that economies of scale principle is still actual for shipping and container trade in particular. The demand for gigantic containerships is proven by figures: as of start of 2024, almost 80% of the containership orderbook was for neopanamax tonnage and larger (8000 TEUs +) (Clarksons SIN).

Graph 5. Tanker segment: share of seaborne tanker trade in world seaborne trade and share of tankers in world fleet



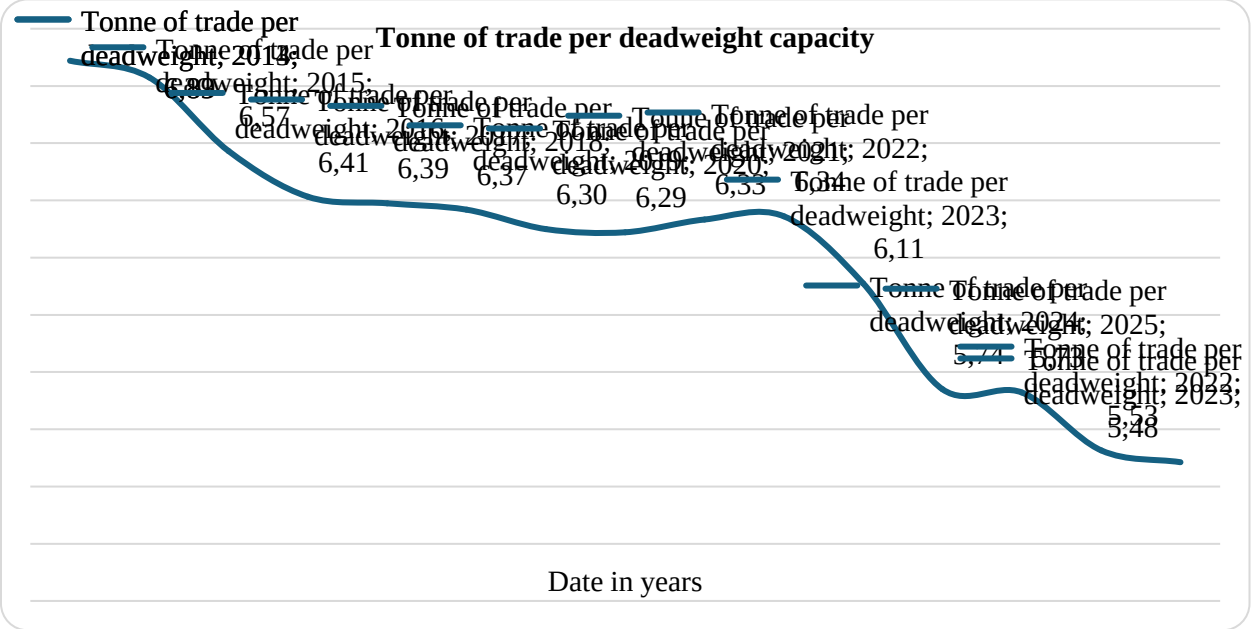
Source: calculated and compiled by author on data retrieved by the Clarksons SIN.

Shrinking share of tankers in the world fleet has been observed – tankers occupy 32% of the world fleet in deadweight and 25% in vessel numbers. Since 2009 tankers have lost 5% of deadweight and 1% of vessel units which underlines that the trend is towards reduction of the average size of tankers. Wet bulk cargoes transportation gained lower significance for the shipping industry and the world economy mainly due to decarbonization which is one of two primary mega-trends stipulating the changes of the world of today (the second one is digitalisation).

With the fourth propulsion revolution on the march and development of future alternative low- or zero-carbon fuels, such as LNG, ammonia, hydrogen, biofuels and electrofuels consumed by and far beyond the maritime sector (DNV, 2022), the need in transportation of conventional oil fuels gradually goes down. Furthermore, renewable energy derived from natural resources gains momentum in various fields by substituting non-renewable fossil fuels. These are solar, ocean, geothermal, wind energy and hydropower utilized for multiple industrial and household purposes (United Nations, n.d.). Although full transition to 'green' and decarbonization to net zero cannot happen overnight, above is in line with the global environmental regulatory framework and aimed at hitting targets set up by the Kyoto Protocol (1998), the Paris Agreement (2015) (international treaties covering climate change mitigation) and the Sustainable Development Goals established by the United Nations (United Nations Development Program, n.d.).

As time passes, the power of environmental regulations and decarbonization initiatives towards how modern shipping exists and develops will only grow. And it should be taken into serious consideration not only by industry practitioners from a business perspective but also by maritime economists examining seaborne trade. We observed that the growth rate of the seaborne trade in tonnes was behind the growth rate of the world fleet. To expand on this issue, we divided the annual volumes of global seaborne trade by the annual world fleet carrying capacity and the outcome of the calculation is presented on graph 6.

Graph 6. Tonne of global seaborne trade per world fleet deadweight capacity from 2009 to 2023



Source: calculated and compiled by author on data retrieved by the Clarksons SIN.

Clearly, there is a downward trend signifying that vessel's space is as if utilized less 'efficient' since it carries lower amount of cargo. In fact, this is true mathematics wise, however, we may name two major factors practically driving this. The first one is reduction of vessels' speed which is dictated by emission control rules entering in force and becoming more stringent literally every year. The other factor is the increase of average haul. Average haul stands for the distance travelled by cargo and is calculated by dividing world seaborne trade in million tonne-miles by world seaborne capesize trade in million tonnes). Its increase is caused mainly by a shift of trade patterns – obvious impact of the onset of the war in Ukraine. Graph 6 illustrates that tonne of trade per vessels' deadweight had not been increasing within 2009-2018, however, the downfall which started in 2019 was incomparably sharper.

Another finding from the analysis is that three lines on each graph 3-5 follow the same trend making all three indicators (share of fleet in deadweight tonnes, percentage of trade both in tonnes and tonne-miles) equally valid to assess each market. It is especially valuable finding since, as far as different cargoes have different stowage factors, meaning the same weight of different cargoes requires different amount of space to be stored in, it is commonly accepted by maritime economists that the most correct way is to measure demand for maritime transportation in tonne-miles, while the total tonnage of cargoes that demand transportation is just one of the factors that constitute the transportation demand. The performed research reveals that for the segments under examination and during the period under examination both methods of seaborne trade volumes evaluation are valid and could equally truly describe the share of each market in the shipping industry. It is recommended for future research that this observation is further monitored and examined against its persistence during forthcoming periods and for those shipping segments which were left out of scope of the current paper.

Conclusions. This paper examined the dynamics and structural changes of the world seaborne trade for the period of 2009-2023 with special attention to the major segments of the shipping industry – dry bulk trade, containerized trade and tanker trade which account for almost 90% of the world seaborne trade. Impact of two recent external shocks – covid-19 pandemic and the war in Ukraine – were specifically discussed. The research is of a descriptive and explanatory nature and the following quantitative analysis techniques are employed: graphs, charts, descriptive statistics, as well as comparative analysis.

For the sake of deep analysis from several angles, the volumes of seaborne trade within 2019-2023 were considered in tonnes and tonne-miles, the latter unit of measurement being the most respected inside the community of maritime economists as it represents demand for maritime transportation in the most appropriate fashion. The research suggested that whatever approach was adopted with the aim to numerically assess the global seaborne trade, most of observations in respect

of behavior of the considered indicators persisted. Over the period under examination the volume of the world seaborne trade demonstrated a general upward trend, except for 2020 and 2022 when it fell on a year-on-year basis. Dry bulk and container seaborne trades demonstrated the same behavioral pattern, while the world oil and chemical seaborne trade experienced two consequent drops earlier – in 2019 and 2020, after which the volume of tanker trade increased, although still has not reached the all-period maximum observed in 2018.

As opposed to tonnes measurement, the dry bulk seaborne trade measured in tonne-miles was under negative growth regime only once in 2022. As to tanker trade, it dropped both in 2019 and 2020 if measured in tonnes, while when in tonne-miles, it declined on a year-by-year basis throughout three consecutive years – 2019, 2020, 2021.

Despite above observations, the conclusion should be made that volume wise the global seaborne trade demonstrated healthy rebound from covid-19 and relatively quick adjustment to the new geopolitical challenge posed by the outbreak of the Ukrainian war, i.e. high resilience and low vulnerability (from 1 to 2 years max) of the global seaborne trade should be noted. The world seaborne trade volumes have not, so far, been significantly affected by the war in Ukraine – just shifts of trade patterns were observed.

Dry bulk trade appeared to demonstrate more sensitivity to the outbreak of the war in Ukraine compared to the pandemic, mainly due to the role of Ukraine on the grain exports map. However, the consumers of dry bulk cargoes (including the leading ones) managed to shift towards alternative suppliers having improved the exporting positions of South and North American countries while volumes of coal exported out of Russia remained stable.

Containerized trade reacted totally differently to both external shocks. While covid-19, after a short-term slowdown, pushed the containership trade to unprecedented highs, the Ukrainian war did not impact it much. Regionalization of containership activity and dominating role of intra-Asian containerized trade predefined this. In container segment China and East Asian countries prevail as players.

Tanker trade was affected by both external shocks. It clearly collapsed in 2019 and 2020. Once oil prices regained ‘usual’ value, the world oil trade permanently normalized. Disruptions caused by the Ukrainian war prompted European consumers to turn to alternative than Russia energy suppliers while the Russian Federation itself sought new export market for its crude oil and oil products. Tanker hauls increased, and as such, tanker trade measured in tonne-miles reached its all-period high in 2023.

In addition, tonne of global seaborne trade per world fleet deadweight capacity was calculated for the period under examination and this indicator followed the downward trend. We identified two reasons behind that – emission compliance-driven decrease of vessels’ speed and increase of average haul caused by trade patterns modifications, especially the most recent.

Furthermore, the dynamics of development of the world fleet of particular vessel types was assessed and compared with the dynamics of development of seaborne trade of particular types of cargo. The share of each segment (dry bulk, container trade and tanker) in the world seaborne trade and the percentage of each vessel type (dry bulk carriers, containerships and tankers) in the overall world fleet for the period of 2009-2023 was calculated and analyzed retrospectively. It was ascertained that within the considered period the role of containership segment remained stable, the role of dry bulk segment permanently increased while of tanker segment decreased.

It was confirmed that regardless of how the market was measured, the share of each segment was identical. While the percentage of fleet in number of ships was not representative, the percentage of fleet in deadweight tonnes, as well as the percentage of trade in tonnes and tonne-miles could equally truly describe the share of each market in the shipping industry. As for the end of 2023, dry bulk sector occupied around 45-48% of the shipping industry, containership segment – approximately 15%, and wet bulk (tanker) sector – around 26-30%. Interestingly, after sharp growth (1975-2007), since 2009 the share of containerships in total world fleet deadweight remained steady. Dry bulk segment relentlessly improved its role in the global shipping over the period under consideration while tanker sector shrank not least because of global attempts to decarbonize the society and explore the alternative energy sources.

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