Chapter III

Freight rates, maritime transport costs and their impact on consumer prices and economic activity

At the end of 2023 and into 2024, disruptions in the Red Sea, the Suez Canal and the Panama Canal caused container shipping rates to rise and become more unpredictable. This surge in prices followed a period of relative stability in 2023, which came after several years of extreme fluctuations, including record highs. The performance of the container shipping market was mixed across different trade routes, influenced by changes in supply and demand throughout 2023.

Similar to the container market, in the dry bulk sector, disruptions led to higher freight rates from late 2023 into 2024. This was a change from 2023 when rates were generally low and unstable due to issues with ship supply. In 2024, tanker freight rates for both crude (unrefined oil) and product tankers (which carry refined oil such as petrol and diesel) stayed high and unpredictable, much as in 2023. This was driven by the disruptions and limited supply caused by geopolitical and other key factors.

The disruptions to the Suez Canal, the Red Sea and the Panama Canal significantly impacted freight rates. In time, this could lead to a rise in global consumer prices and a decline in real GDP, with a disproportionate impact on SIDS and LDCs. Higher prices would also present a significant food security risk.

Evidence from a new Trade-and-Transport Dataset developed by UNCTAD and the World Bank (2024) shows that developing countries, particularly SIDS and LDCs, have higher maritime transport costs than developed countries. However, investments in transport infrastructure, including ports, can reduce maritime transport costs.

To mitigate the impact of higher freight rates, it is important to adopt a comprehensive approach. This involves closely monitoring and analysing freight rates and disruptions and their impact, including effectively managing the supply of ship capacity, supporting the shift to more energy-efficient vessels, and improving the resilience and efficiency of ports.

In this chapter, key developments in the freight market from 2023 to mid-2024 are examined, taking into account supply and demand trends discussed in earlier chapters. The container, dry bulk and tanker segments are analysed, covering both spot freight rates and long-term contracts, as well as the impact of recent disruptions and environmental regulations on freight rate markets. More specifically, a quantitative analysis is provided of how recent disruptions to the Red Sea, Suez Canal and Panama Canal have affected freight rates, and the broader implications for consumer prices and global economic output. Policy considerations based on these findings close out the chapter.

A. Trends in freight markets

Container freight rates in 2023: A return to normalcy

In 2023, container shipping freight rates entered a period of relative stability following the exceptional highs of 2021 and the significant fluctuations of 2022. Overall in 2023, container freight rates began a gradual return to pre-pandemic levels. However, these rates varied significantly across different trade routes. Rates on the East–West trade lanes declined, due to lower trade volumes and an influx of new vessel capacity. In contrast, rates increased on the North–South trade lanes, which includes routes serving Africa, South America, India, the Middle East and inter-Asia, mainly due to heightened activity on these routes.

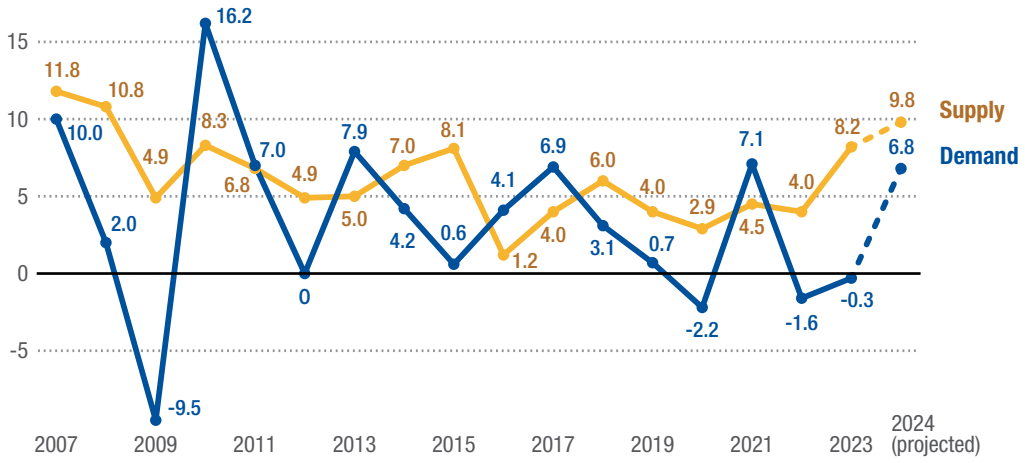
An analysis of the supply and demand dynamics of the container shipping market in 2023, measured in terms of container capacity (TEU), shows a marked growth rate in the global supply of shipping capacity of 8.2 per cent (see chapter I). During the year, the growth rate for demand declined slightly by 0.3 per cent, compared to a larger decline of 1.6 per cent in 2022 (see chapter I) (figure III.1). Projections for 2024 indicate that both supply and demand will keep growing, but the gap between these growth rates will narrow, with the market remaining oversupplied. These trends are discussed in the following section and in more detail in chapters I and II.

The Shanghai Containerized Freight Index (SCFI), a key metric used to track the spot rates for shipping containers from Shanghai to various major ports around the world, remained relatively stable during 2023, averaging around 1,000 points. This was in stark contrast to its peak of about 5,067 points in January 2022. The Index did spike again in late 2023 due to the Red Sea and Suez Canal disruptions and vessels having to be diverted away from this area, which significantly impacted the supply–demand balance (figure III.2).

Figure III. 1

Demand and supply in container shipping

(Percentage change)

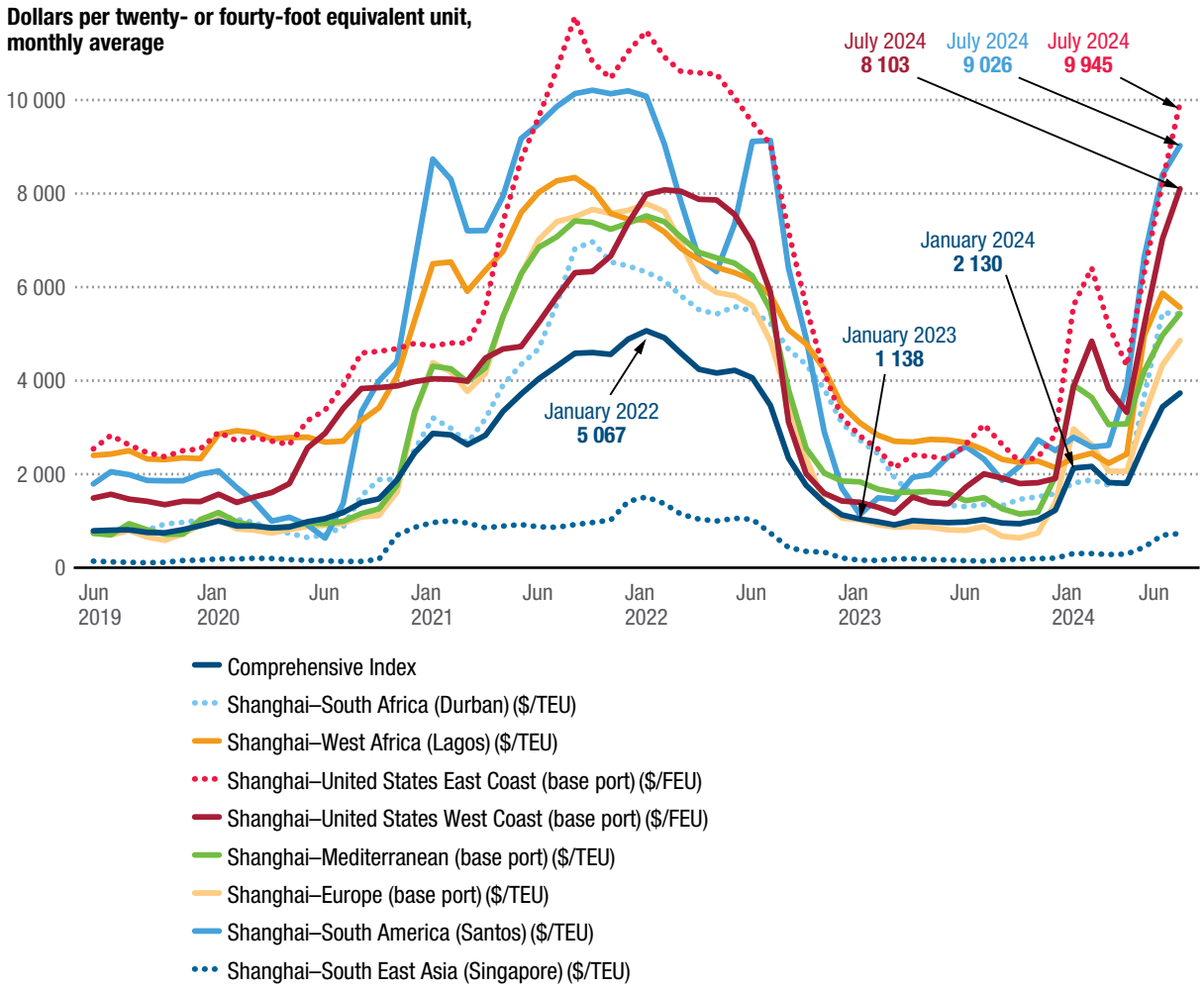


Source: UNCTAD calculations. Demand is based on data from MDS Transmodal, World Cargo Database from chapter I (TEU), and supply is based on data from Clarksons Research, Container Intelligence Monthly, various issues.

Note: Supply data refer to total capacity of the container-carrying fleet (TEU), including multipurpose and other vessels with some container-carrying capacity.

Projections for 2024 indicate that both supply and demand will keep growing, but the gap between these growth rates will narrow, with the market remaining oversupplied

Figure III. 2
Shanghai Containerized Freight Index spot rates



Source: UNCTAD calculations, based on data from Clarksons Shipping Intelligence Network.

Since December 2023, disruptions in the Red Sea, the Suez Canal and the Panama Canal **caused freight rates to increase and fluctuate**

Container freight rates surged in 2024 due to global disruptions and longer distances

Since December 2023, disruptions in the Red Sea, the Suez Canal and the Panama Canal caused freight rates to increase and fluctuate. Ships had to be diverted onto longer routes, reducing the availability of shipping capacity and affecting demand. With vessels being diverted away from the Red Sea, ships on the most affected East–West routes took longer routes, either around the Cape of Good Hope or by switching to trans-Pacific routes in the case of Asia–North America trade. Consequently, from mid-December 2023 to June 2024, the demand for additional capacity increased by around 12 per cent to accommodate for these increased distances (see also chapters I and II) (Clarksons Research, 2024a). In addition to absorbing excess capacity, these diversions led to a need for increased vessel speeds to meet delivery schedules.

Sailing speeds increased by approximately 25 per cent, from 16 to 20 knots. This tripled bunker consumption (Offshore Energy, 2024), increased freight rates and shipping costs, and generated higher risk insurance premiums.

At the same time, external factors such as climate change also contributed to fluctuating rates. An El Niño-driven drought reduced shipping capacity through the Panama Canal, forcing carriers to reroute through the Suez Canal and the Strait of Magellan and around the Cape of Good Hope. In the case of container shipping, vessels had to use the North American land bridge, an overland route that uses intermodal transport services to connect ports on the west coast of North America by land with Chicago or New York.

In January 2024, the SCFI averaged 2,130 points, more than double its December 2023 level, but still more than 50 per cent below its COVID-19 pandemic peak, as shown in figure 3.2. Rates eased through April 2024 as operators managed the initial disruption. However, rates remained elevated, averaging 1,820 points in March 2024, 15 per cent below the January peak. Rates spiked again in May 2024, averaging approximately 2,644 points, due to general rate increases coinciding with the peak season for container trade (Clarksons Research, 2024b) together with various additional surcharges, including those related to the European Union ETS (see box III.1), Panama Canal tolls and increased war risk insurance premiums, among other factors. Spot freight rates on most routes were affected.

Container freight rates on the Asia–Pacific to Europe routes rose sharply in November 2023. A record weekly spike of $500 was observed in the last week of December 2023 (UNCTAD, 2024).

The trans-Pacific routes which connect Asia with North America, also saw a surge in freight rates. By January 2024, the SCFI Shanghai–United States West Coast and SCFI Shanghai–United States East Coast routes more than doubled their December 2023 levels, which continued to fluctuate and increase, reaching a shipping cost of $8,103/FEU on the West Coast routes and $9,945/FEU on the East Coast routes in July 2024, the highest levels since the COVID-19 pandemic.

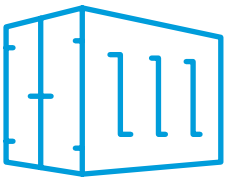
Freight rates on other routes also surged. The average rate on the SCFI Shanghai–South America route climbed by approximately 224 per cent from January 2024, reaching $9,026/TEU in July 2024, the highest level since September 2022. The average rate on the SCFI Shanghai–South Africa route increased by around 199.6 per cent from January 2024 to $5,426/TEU in July 2024, the highest level since July 2022. The SCFI Shanghai–West Africa route increased by 137 per cent from January to $5,563/TEU by July 2024, the highest level since August 2022.

Disruptions in the Red Sea and the Suez Canal exacerbated congestion at major ports in Asia and the Middle East, increasing charges and freight rates. For instance, waiting times at Jebel Ali Port in the United Arab Emirates rose from an average of 54 hours in March 2024 to 65 hours in May 2024. Similarly, in Singapore, waiting times nearly doubled, from 24 hours to 40 hours during the same period. Port Klang in Malaysia experienced an increase from 20 hours to 26 hours (Drewry, 2024) (see also chapter IV). Hub ports in the Western Mediterranean also faced increased demand and congestion.[1] By mid-June 2024, port congestion meant that vessel capacity of 2.5 million TEU were waiting at anchorages (deep water areas where ships can wait, usually off the coast) around the world. This represented 8.4 per cent of the global fleet (Linerlytica, 2024) and also contributed to the increase in freight rates.

In January 2024, the **SCFI** averaged 2,130 points, more than double its December 2023 level, **but still more than 50% below its COVID-19 pandemic peak**

Disruptions exacerbated **congestion at major ports, increasing charges and freight rates**

[1] MDS Transmodal.



Furthermore, the **impact on empty containers** has been evident

Furthermore, the impact on empty containers has been evident, with carriers prioritizing shipments to high-paying markets, such as the United States and Europe, potentially at the expense of regions such as Africa, a trend reminiscent of the challenges observed during the COVID-19 pandemic (Business Day Africa, 2024).

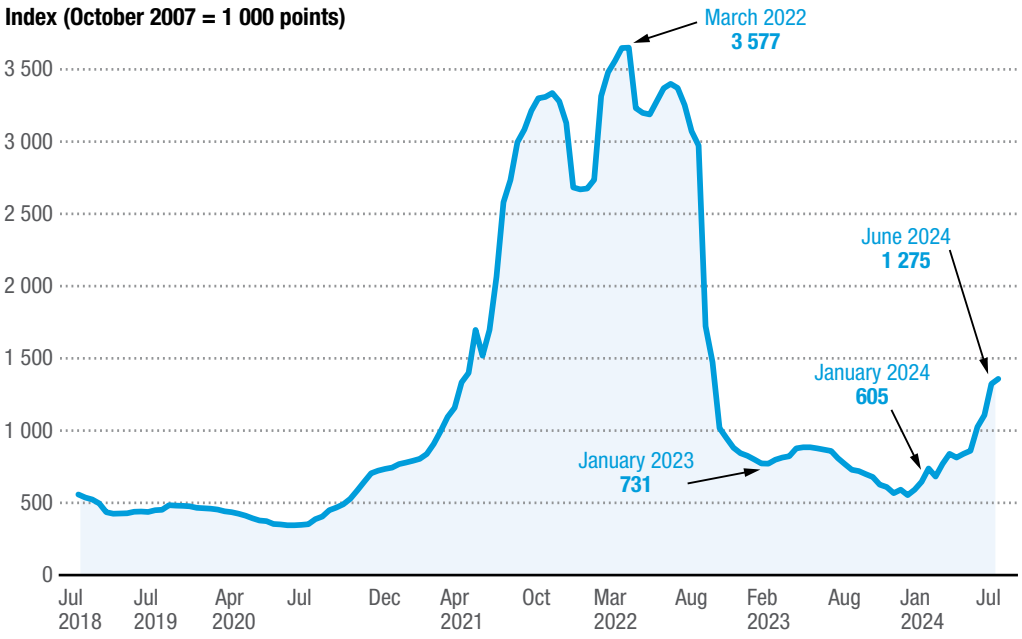
Charter container ship rates stabilized in 2023, are rebounding in 2024, yet still facing disruptions

In 2023, container ship charter rates moderated and were significantly lower than in 2022, a year marked by exceptionally high rates driven by the post-COVID-19 demand boom. Rates remained relatively stable throughout the year, with some fluctuations toward the end of the year due to disruptions in the Red Sea, similar to the trends in container spot freight rates.

The cost of chartering a container ship – known as charter rates – is tracked by the New ConTex Index, a benchmark for assessing time charter rates for container ships. The Index averaged 2,566 points in 2022 compared to 714 points in 2023 (figure III.3). In January 2023, the New ConTex Index stood at 731 points, well below its historical peaks of 3,577 points in March 2022.

Charter rates initially responded slowly to the disruptions in the Red Sea but began to surge from January 2024 onwards. Rates increased across different vessel sizes, driven by higher demand for larger charter vessels (needed for rerouting), while smaller vessels saw an increase in rates due to the cascading effects of the disruption. By June 2024, the Index showed a significant increase, standing at around 1,275 points (end of June), a strong sign of a market rebound.

Figure III. 3
New ConTex Index shows fluctuations in charter rates



Source: UNCTAD calculations, based on data from the New ConTex Index for container ship chartering produced by the Hamburg Shipbrokers Association. See http://www.vhss.de (accessed on 5 June 2024).
Note: The New ConTex Index is based on assessments of the current day charter rates of six selected container ship types, which are representative of their size categories: Type 1,100 TEUs and Type 1,700 TEUs with a charter period of one year, and Types 2,500, 2,700, 3,500 and 4,250 TEUs with a charter period of two years.

There is a shortage of vessels in the charter market, particularly larger or more energy-efficient ships; there are signs that charter rates will continue to increase through 2024, driven by continued disruption in the Red Sea.

Contracted freight rates and associated costs dropped in 2023

In 2023, "contracted" freight rates (which include the costs of the rate of shipping plus additional charges such as terminal handling fees) dropped sharply. This decline is consistent with the general trend in spot freight rates and was influenced by factors such as demand–supply imbalances, an oversupplied market which intensified competition among carriers and trade imbalances.

Table III.1 shows the actual base freight rates (in United States dollars per FEU) on various routes, including intraregional routes, and how they have changed over time.

The "unweighted" average rate decreased by 39 per cent from 2022 to 2023, dropping from $4,716 to $2,857 (an unweighted average means that each rate is treated equally, without considering any extra factors or importance). A significant decrease in rates can be seen on routes from Asia, such as Asia to Oceania (78 per cent), Asia to Europe (76 per cent), and Asia to North America (61 per cent). The substantial decreases in rates from Asia may reflect a change in trade flows and reduced demand for shipping capacity. Ports have also played a critical role in this dynamic, with reduced congestion contributing to lower rates. Moderate declines in rates were seen on routes such as Europe to North America (40 per cent), Europe to Oceania (44 per cent) and Europe to South America (36 per cent). However, some routes, such as Africa to South America, saw an increase of 20 per cent, while North America to North America increased by 8 per cent.

Despite the significant decreases, the rates in 2023 remained higher than those recorded in 2018 and 2019, suggesting that the market is adjusting to a new post-pandemic equilibrium and coping with an operating landscape where disruptions have become a key feature.

2024 and beyond: Managing container fleet capacity and enhancing efficiency for a resilient future

As the shipping sector navigates 2024, the landscape for trade and economic development remains challenging. Geopolitical complexities and climate change continue to exacerbate the operating environment and drive container freight rate dynamics. Freight container rates will keep changing, due to ongoing imbalances in supply and demand, disruptions in trade and fleet deployment, regulatory requirements and the growing need for ports and ships to go green.

Over the past few years, there has been a greater supply of shipping capacity than demand. The supply of container shipping capacity has consistently outpaced demand in TEU, the standard measurement for ship cargo capacity. However, recent disruptions caused by the COVID-19 pandemic, drought in the Panama Canal and geopolitical tensions, including the war in Ukraine and the Red Sea crisis, have intermittently reduced supply capacity, driving up freight rates.

In 2024, the demand for container shipping is expected to grow by around 7 per cent. At the same time, a significant number of new ships will be added to the global fleet, increasing total shipping capacity by 9.8 per cent (figure III.1). These dynamics will continue to be impacted by disruptions, which will affect rerouting, operations and capacity, resulting in high and volatile freight rates.

In 2023, "contracted" freight rates (which include the costs of the rate of shipping plus additional charges such as terminal handling fees) **dropped sharply**

Table III. 1
Annual full container load gate-in, gate-out rates

From	To	2018	2019	2020	2021	2022	2023	Change 2023 vs. 2022	Change 2023 vs. 2018
		(United States dollars per fourty-foot container)						(percentages)	
Africa	Africa	1 812	1 849	1 924	2 013	3 382	2 880	-15	59
Africa	Asia	748	750	775	664	2 313	1 459	-37	95
Africa	Europe	1 431	1 643	1 747	1 487	2 463	1 753	-29	23
Africa	South America	2 010	1 860	1 979	1 616	2 388	2 870	20	43
Asia	Africa	1 800	1 927	2 112	2 733	7 094	3 565	-50	98
Asia	Asia	737	747	821	1 194	2 214	1 043	-53	42
Asia	Europe	1 782	1 847	1 916	3 285	8 880	2 136	-76	20
Asia	North America	2 426	2 603	2 711	3 820	9 610	3 761	-61	55
Asia	Oceania	1 770	1 790	1 850	2 800	8 241	1 824	-78	3
Asia	South America	2 290	2 075	2 230	3 589	10 154	4 117	-59	80
Europe	Africa	1 595	1 650	1 858	1 727	2 907	2 240	-23	40
Europe	Asia	967	870	1 004	1 225	2 109	1 312	-38	36
Europe	Europe	804	881	976	1 077	1 757	1 471	-16	83
Europe	North America	1 518	1 742	2 256	2 304	6 340	3 801	-40	150
Europe	Oceania	1 996	1 933	2 077	2 319	6 795	3 839	-44	92
Europe	South America	1 019	1 302	1 376	1 465	4 026	2 591	-36	154
North America	Africa	2 890	3 112	2 981	2 639	3 972	3 444	-13	19
North America	Asia	1 009	1 111	1 269	1 385	2 646	1 575	-40	56
North America	Europe	858	1 109	1 323	1 053	1 742	1 638	-6	91
North America	North America	1 534	1 429	1 584	1 362	2 589	2 784	8	81
North America	Oceania	2 538	2 634	2 996	2 475	6 060	5 888	-3	132
North America	South America	1 254	1 318	1 486	1 064	2 153	2 017	-6	61
South America	Africa	1 778	1 951	2 000	2 187	5 432	4 926	-9	177
South America	Asia	1 623	1 963	1 802	1 841	4 106	3 817	-7	135
South America	Europe	1 313	1 977	1 961	1 767	4 369	2 770	-37	111
South America	North America	1 521	1 882	1 745	1 969	7 397	3 881	-48	155
South America	South America	1 349	1 699	1 539	1 243	6 179	3 741	-39	177
Unweighted average		**1 569**	**1 691**	**1 789**	**1 937**	**4 716**	**2 857**	**-39**	**82**

Source: UNCTAD, based on data provided by Transporeon - A Trimble Company.
Note: The data provides unique insights into routes that are not normally covered by publicly available data on exports from China, building on anonymized contract freight rates from shippers on most major routes. The data set provides regional averages for 40-foot container dry cargo freight, as negotiated for routes on representative main ports. All rates are "gate-in, gate-out", that is, including terminal handling charges and all charges and surcharges of ocean transport. The rates also include (temporal) surcharges or adders for contract rates during the reporting year to represent paid rates. Not included are pre- and on-carriage or classical administrative services of forwarders (customs clearance, booking and freight audit fees, etc.).

Compliance with new environmental regulations is also expected to increase operating costs for shipping companies (see box III.1). These costs are likely to be passed on to shippers through higher transport costs and freight rates.

The recent surges in freight rates are becoming a critical concern in the global supply chain. Forecasts suggest that ocean cargo prices could soar to $20,000 per FEU on the Transpacific route – possibly even approaching the peaks of $30,000 per FEU seen during the time of the COVID-19 pandemic – and that these rates may persist at elevated levels through 2025 (CNBC, 2024).

When the Red Sea crisis began, there was sufficient container capacity in the market to handle the additional tonnage required to divert around the Cape of Good Hope. However, any further disruptions could severely strain supply chains, potentially leading to additional increases in freight rates (Sea Intelligence, 2024a). If there is a sudden and sustained rise in demand for container ships, as seen in the unexpected growth in United States container demand in the second quarter of 2024, this could lead to much higher freight rates, even with the addition of extra ships (Sea Intelligence, 2024b). Meanwhile, if the disruption in the Red Sea eases or ends, this could reveal a risk of overcapacity in the global fleet.

Effective supply management and strategic vessel recycling decisions will be critical for balancing supply and demand and managing freight rates.

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Box III. 1
Impact of the green transition on shipping cost and freight rates

The new environmental regulations introduced by the IMO and the European Union have an impact on shipping operating costs and freight rates and are expected to continue influencing industry dynamics.

Compliance with short-term measures from IMO, such as the Carbon Intensity Indicator, means slower vessel speeds, especially for less energy-efficient vessels (World Cargo News, 2024), and longer retrofit times for energy-saving technologies. If prolonged, this could lead to further supply-side constraints, thereby impacting freight rates.

In early 2024, shipping was included in the European Union ETS, which, for the first time, imposed a cost on maritime carbon emissions. This inclusion has led operators to introduce surcharges to cover the additional CO_2 costs charged to shippers. These costs can vary significantly depending on specific port call rotations. With route diversions due to disruptions in the Red Sea, this will result in higher costs. For example, a 20,000–24,000 TEU vessel on a Far East–Europe route around the Cape of Good Hope will incur an estimated additional cost of $0.4 million per voyage at current CO_2 prices (Clarksons Research, 2024b).

Under the ETS, ships will have to pay for 40 per cent of their emissions in 2024, rising to 70 per cent in 2025 and 100 per cent in 2026. These rising ETS costs will have an impact on the shipping industry, including ports, likely leading to higher freight rates and charges, which operators will continue to pass on to shippers and, ultimately, consumers (Transport and Environment, 2024).

Dry bulk freight rates 2023 were low, then volatile due to supply issues

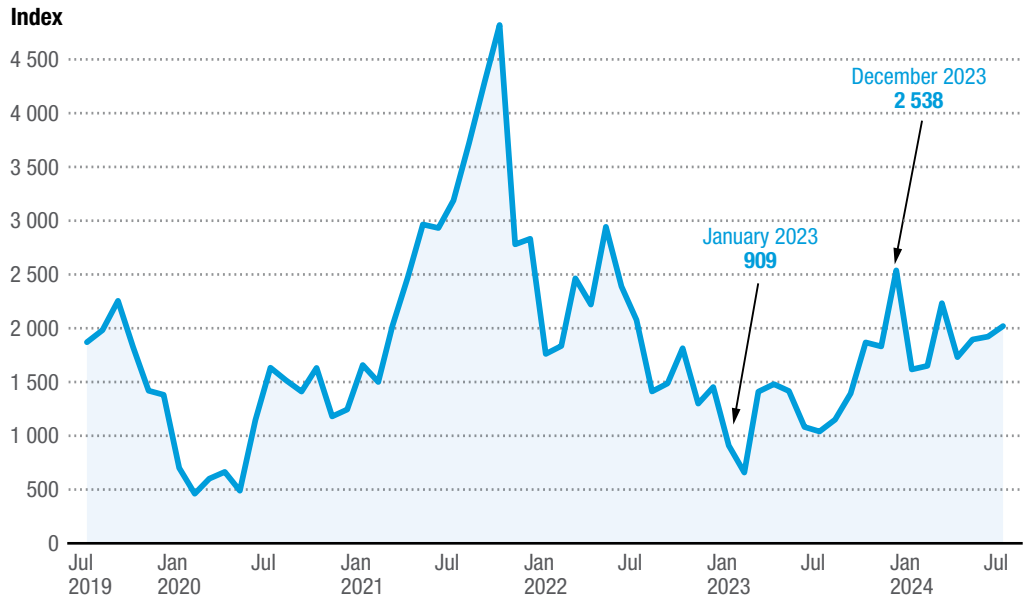
Dry bulk fleet growth has led to **lower fleet utilization and freight rates in 2023**

In 2023, the dry bulk freight market saw significant volatility and lower rates. The Baltic Dry Index, which tracks shipping costs for commodities such as coal, iron ore and grain, averaged 1,398, down from 1,930 in 2022, close to the 10-year average of 1,318 (figure III.4).

In 2023, even though global demand for dry bulk commodities grew by 4 per cent (or 5 per cent in terms of ton miles, i.e. taking into account the distance shipped), mainly due to increased imports by China (see chapter I), the total shipping capacity grew by 3.1 per cent, reaching about 1,004 billion tons (see chapter II). This dry bulk fleet growth has led to lower fleet utilization and freight rates. Also, as port congestion from the COVID-19 pandemic has eased and more ships have become available, freight and charter rates have dropped even further.

Throughout 2023, the Baltic Dry Index fluctuated significantly, starting at 909 in January, dropping to 658 in February, varying between 1,000 and 1,480 until September, and rising steadily to peak at 2,538 in December. These fluctuations were influenced by several factors, including increased supply in bulk carrier capacity, shifting trade dynamics across regions and commodities, developments in port congestion, and disruptions in the Panama Canal, the Suez Canal and the Red Sea, which resulted in increased ton-mile demand and pushed freight rates up. For example, disruptions at the Panama Canal forced United States grain shipments to be rerouted through the Suez Canal, and increased Chinese imports of iron ore and soybeans from Brazil contributed to the overall increase in ton-miles (Danish Ship Finance, 2023). Moreover, record loading congestion at ports in Brazil due to low river levels also led to a shortage of available vessels and caused freight rates to increase (BRS Group, 2024).

Figure III. 4
Highs and lows of the Baltic Exchange Dry Index



Source: UNCTAD calculations, based on data from Clarksons Shipping Intelligence Network.

Time charter rates also showed significant declines in 2023. Supramax vessels, which are medium-sized ships used for bulk cargo, saw their rates fall by 49 per cent. Kamsarmax vessels, slightly larger ships used for similar purposes, experienced a 38 per cent drop in their rates. However rates for Capesize vessels, the largest dry bulk ships that carry very large amounts of cargo, remained relatively stable (BRS Group, 2024).

The decline in Supramax and Kamsarmax rates was primarily due to excess capacity and reduced demand in key trade areas such as the Atlantic and eastern coast of South America. The closure of the Black Sea grain corridor in July 2023 led to an oversupply of Handysize (small bulk cargo ships) and Supramax vessels in the Mediterranean, keeping rates low on conventional routes. In contrast, Capesize vessels, mainly used for iron ore and coal, benefited from a particular set of trade conditions, such as increased bauxite shipments to Asia and logistical challenges of ports in Brazil.

Economic uncertainties and cautious market sentiment led charterers to favour shorter-term contracts for Supramax and Kamsarmax vessels, causing greater rate volatility. In contrast, the Capesize market remained relatively stable due to consistent demand for iron ore and coal. In 2023, one-year time charter rates fluctuated significantly: Supramaxes ranged from $6,874 to $17,213/day, Kamsarmaxes from $7,277 to $21,966/day and Capesizes from $2,246 to $54,584/day. These wide variations highlight the importance of timing in securing contracts (BRS Group, 2024).

The dry bulk freight rate landscape in 2024 and beyond: Disruptions, fleet changes and demand play a role

Dry bulk freight rates have been impacted by the disruptions in the Red Sea, leading many shipowners to reroute around the Cape of Good Hope. As a result, the number of bulk vessels transiting the Suez Canal dropped by 22.3 per cent in the first quarter of 2024 and by 97.8 per cent in the second quarter of 2024 compared to the same periods last year (Clarksons Research, 2024c). The situation particularly affected Ultramaxes, medium-sized cargo ships used for transporting various bulk materials. Ultramaxes often use the Suez Canal for their routes and the disruption affected their operations and rates.

Drought at the Panama Canal also limited transits, which were down by about 20 per cent in the first quarter of 2024 compared to the same period in 2023. These disruptions contributed to higher freight rates, particularly in the larger ship segments (Danish Ship Finance, 2024).

Looking ahead, several factors will shape dry bulk freight rates beyond 2024. Disruptions due to the situation in the Middle East and drought in the Panama Canal may continue to affect routes and transit times, keeping rates high if conditions are sustained or worsen. At the same time, changes in demand, supply and fleet profiles, influenced by environmental compliance, will also affect the outlook for dry bulk freight rates in different ways for the different segments.

Fleet growth is expected to shift towards Kamsarmax and Ultramax vessels to meet the demand for more versatile and energy-efficient vessels. This could help stabilize rates by aligning fleet growth with market needs (Danish Ship Finance, 2024) (see also chapter I). However, the demand outlook is mixed. Larger ship segments may struggle due to declining demand for iron ore and coal, influenced by the economic context in China and the weakening of its real estate sector. Conversely, smaller ship segments could benefit from an increase in grain trade.

Key factors to watch are geopolitical events, changes in fleet structure and trends in commodity demand. These factors will influence dry bulk shipping rates in the coming years.

Geopolitical events, changes in fleet structure and trends in commodity demand will influence dry bulk shipping rates in the coming years

Tanker freight rates: 2023 volatility and 2024 highs amid strong demand and disruptions

In 2023, freight rates in the crude oil tanker market dropped, but remained high and unstable. This volatility was driven by a range of factors affecting the market. The global crude oil landscape saw significant changes, including strong growth in oil supply from the Atlantic Basin, which boosted demand for tankers to transport this new oil. Refinery expansions in Asia and a greater number of long-haul voyages, partly due to economic restrictions on the Russian Federation, also played a role. Additionally, OPEC+ supply cuts, disruptions in key transit routes such as the Red Sea, Suez Canal and Panama Canal, low growth in the tanker fleet and new environmental regulations all contributed to the fluctuating rates and market conditions (see chapters I and II).

In early 2024, crude and product tanker market spot rates **remained high and volatile**

The Baltic indices for tankers transporting crude oil ("dirty" index) and tankers transporting refined oil products ("clean" index) declined in 2023 from the highs of 2022 but remained high with significant fluctuations. The Baltic Dirty Tanker Index averaged 1,149, dipping to 756 in September, while the Baltic Clean Tanker Index averaged 803, dropping to 610 in June 2023 (figure III.5).

Crude tanker spot earnings are the earnings that tankers make from transporting crude oil on short-term contracts or single voyages. These spot earnings outperformed those of product tankers. The higher earnings for crude tankers were due to increased cargo movement, including the redirection of crude oil exports from the Russian Federation to Asia, an increase in west to east crude oil trade, and record exports from the United States and South America. Average spot earnings for crude tankers rose by 21 per cent to $53,541 per day in 2023 compared to 2022, while product tanker earnings decreased by 14 per cent to $32,181 per day, although they remained well above the 10-year average due to longer travel distances and limited fleet growth (figure III.6).

Very Large Crude Carrier (VLCC) freight rates reached record highs, mainly due to the west to east shipping routes and strong oil demand from China. This surge in demand for VLCCs was also driven by rising crude oil exports from the United States (Tankers International, 2024).

High volatility in the tanker market in 2023 led to significant increases in time charter rates, especially for long periods. Companies increased these long periods to secure capacity and buffer uncertainty in the market. Time charter rates rose by about 50 per cent for crude tankers and 30 per cent for clean tankers, with the highest charter rates matching those of 2022. Average time charter rates for eco-tankers, including Aframax (medium-sized tankers), Suezmax (tankers designed to fit the Suez Canal) and VLCC, reached new highs (BRS Group, 2024). This reflects expectations of higher spot freight rates for larger tankers, increased asset values, and a shortage of eco-friendly vessels.

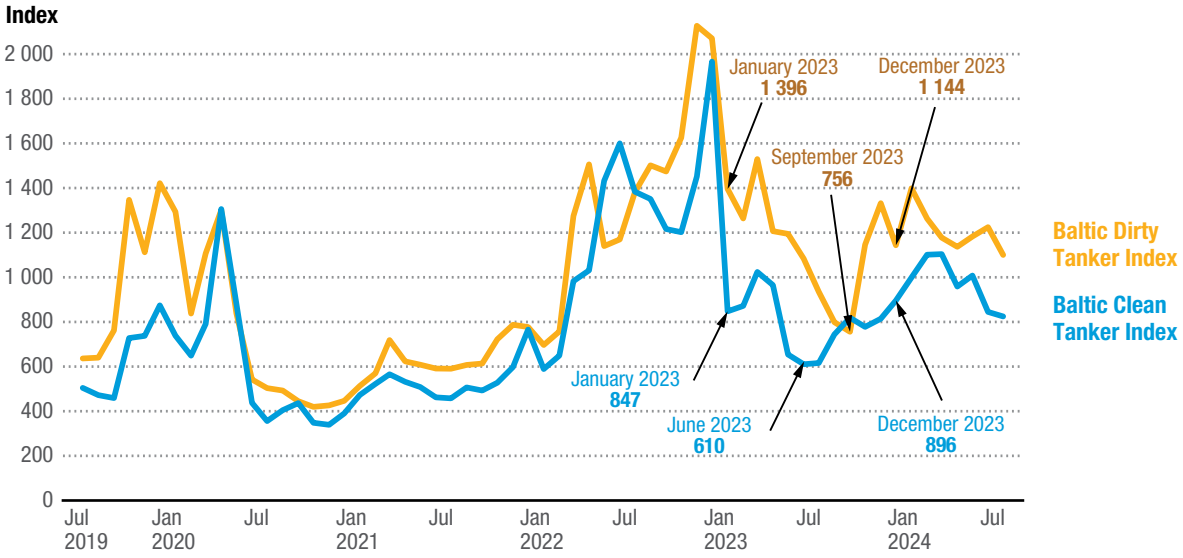
In early 2024, crude and product tanker market spot rates remained high and volatile largely due to disruptions in the Red Sea, Suez Canal and Panama Canal. This meant tankers had to divert to longer routes, increase tanker ton-miles, exacerbate regional fleet imbalances or increase transit times (as in the case of disruption in the Panama Canal), all of which sustained the high rates (Clarksons Research, 2024d).

Tanker freight rates are expected to remain strong in 2024, driven by continued demand and limited fleet growth in 2024 (less than one per cent) (Clarksons Research, 2024d). Ongoing disruptions, increased Chinese import and refinery capacity expansion, combined with limited fleet growth are key factors. Furthermore, new environmental regulations like the ETS, which may reduce available capacity, are likely to keep tanker freight rates high.

Despite current expectations of a limited number of new tanker orders, there is still a risk of an oversupply in the market. If there are more tankers than needed and demand does not grow fast enough, it could lead to lower spot and charter tanker rates. There is a possibility that demand for crude oil and oil products could decrease more than anticipated, influenced by the development and adoption of renewable energy. Meanwhile, the need to comply with growing environmental regulation and to shift towards green or eco-friendly tanker vessels will also shape the dynamics of the tanker freight market (both the demand for these vessels and operations).

Figure III. 5

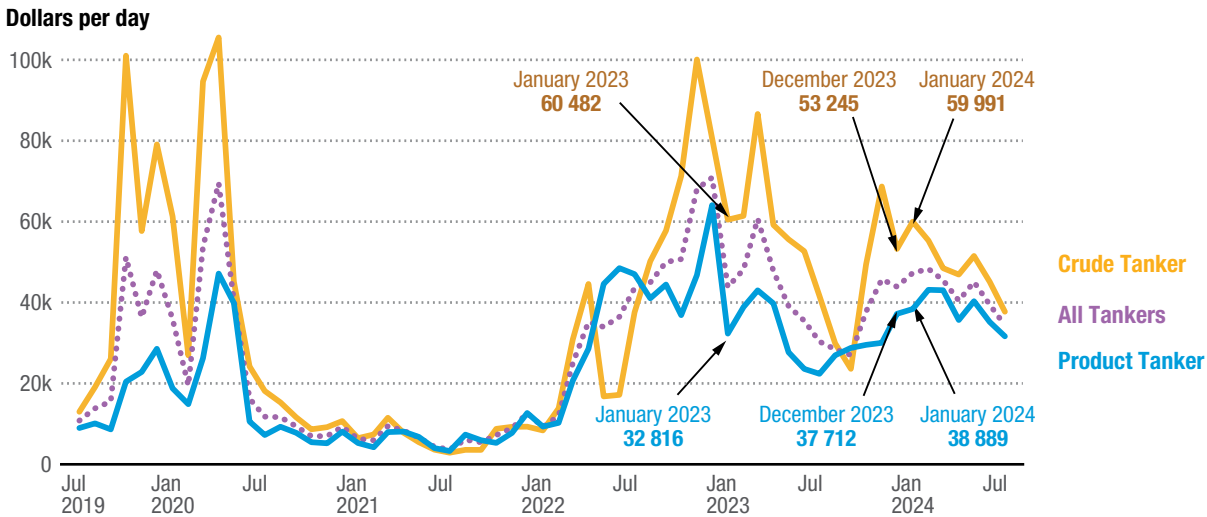
From COVID-19 lows to 2022 peaks, Baltic Dirty Tanker Index and Baltic Clean Tanker Index in 2023 and 2024 remain high with large fluctuations



Source: UNCTAD calculations, based on data from Clarksons Shipping Intelligence Network.

Figure III. 6

Average earnings, crude and product tankers, highly volatile in 2023 and 2024



Source: UNCTAD, based on data from Clarksons Shipping Intelligence Network.
Note: Average earnings across range of tanker sizes, weighted by the number of ships in each sector.

B. Impacts of the disruptions in the Red Sea, Suez Canal and Panama Canal on freight rates, consumer prices and economic activity

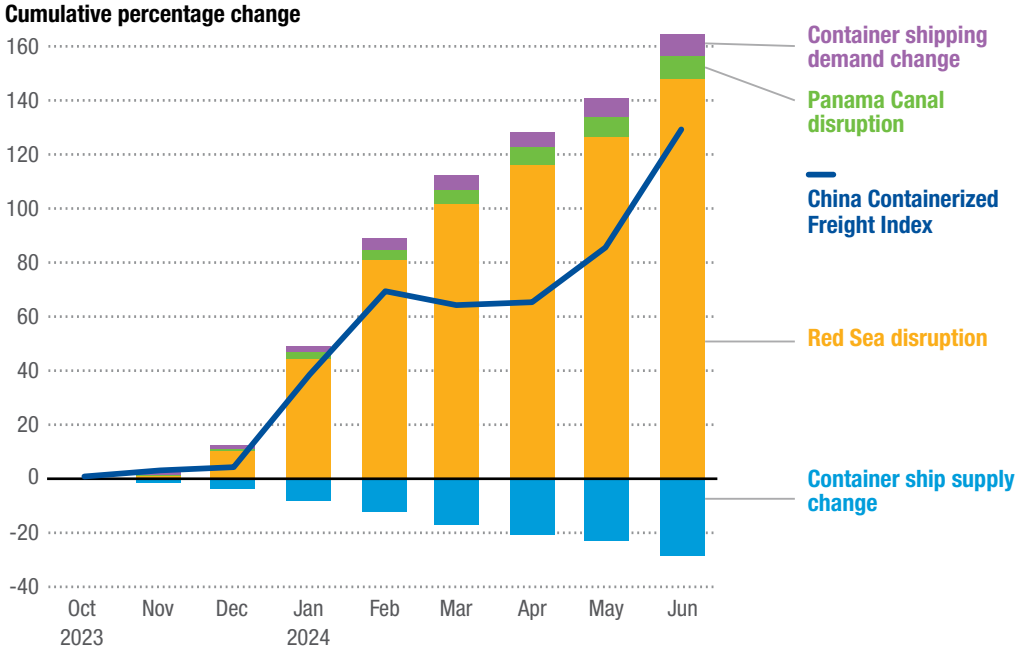
This section provides quantitative analysis of the underlying forces driving the recent freight rate increases due to disruptions in the Red Sea, Suez Canal and Panama Canal and simulates their impact on consumer prices and economic activity. As geopolitical- and climate-related disruptions may well be recurring issues, the present analysis will serve as a sound basis for predicting and forecasting future developments and formulating policy recommendations to mitigate the adverse impact of logistics disruptions on economies.

Evaluating key shocks causing maritime freight rate hikes in 2024

Red Sea disruption has significant impact on container shipping freight rates

As previously discussed in this chapter, freight rates, especially for container shipping, have been rising rapidly since the end of 2023.

Figure III. 7
China Containerized Freight Index and breakdown



Source: UNCTAD calculations, based on data provided by Clarksons Research Shipping Intelligence Network and Maritech Services Limited, Sea.
Notes: Cumulative changes from October 2023. Seasonally adjusted. The sum of the four presented components does not fully add up to the combined impact because "other" logistics shocks is not included in the figure. See technical note 1, for the estimation methodology.

The China Containerized Freight Index, a key indicator of freight rates for container shipping, grew approximately 120 per cent from October 2023 to June 2024.[2]

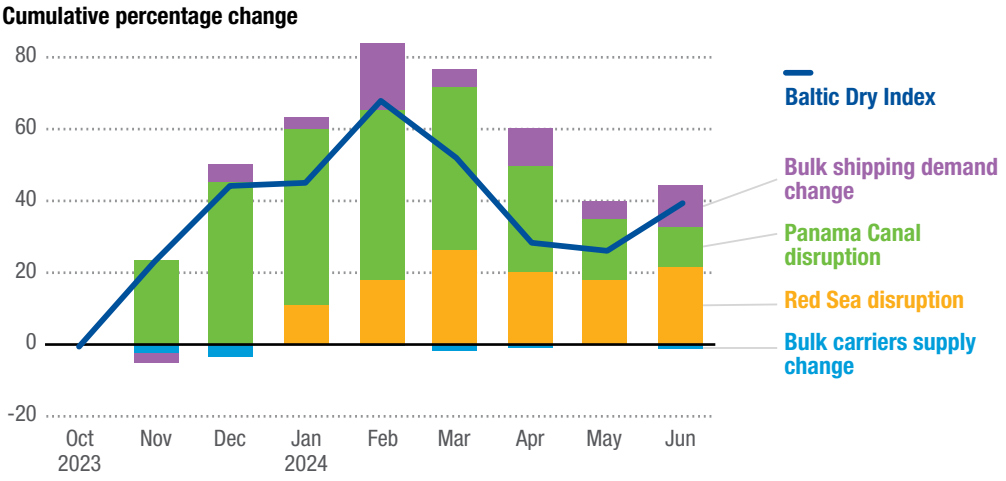
UNCTAD estimated the magnitude of several key shocks (factors) affecting container shipping freight rates, including the disruptions in the Red Sea, Suez Canal and Panama Canal, and an oversupplied ship capacity. It was found that the Red Sea crisis and disruptions to the Suez Canal was the most substantial factor, contributing 148-percentage points to the cumulative increase (120 per cent) in the China Containerized Freight Index (figure III.7). The Panama Canal disruption also contributed to the increase in the China Containerized Freight Index, but to a lesser extent, accounting for 9 percentage points. The impacts of these two shocks were partly offset by the growth in container ship supply capacity, which accelerated in 2023. When the demand for ships went up due to longer shipping routes caused by the Red Sea crisis, the market absorbed this by using available extra ship capacity (see section A. 2024 and beyond: Managing container fleet capacity and enhancing efficiency for a resilient future).

Dry bulk freight rates were affected by the Panama Canal disruption; limited effect of the Red Sea and Panama Canal disruptions on tanker freight rates

Using a similar approach, UNCTAD estimated the impacts on dry bulk and tanker freight rates, captured by the Baltic Dry Index and the Baltic Dirty Tanker Index.

In the dry bulk shipping market, the effect of the Panama Canal disruption became clear starting in November 2023 (figure III.8), when the Canal authority cut back on ship passages. The impact reached its peak in January 2024, contributing 49 percentage points to the cumulative 45 per cent increase in the Baltic Dry Index over this period.

Figure III. 8
Baltic Dry Index and breakdown



Source: UNCTAD calculations, based on data provided by Clarksons Research Shipping Intelligence Network, and Maritech Services Limited, Sea.
Notes: Cumulative changes from October 2023. Seasonally adjusted. The sum of the four presented components does not fully add up to the combined impact because "other" logistic shocks is not included in the figure. See technical note 1, for the estimation methodology.

[2] For the purpose of this analysis, all time series data in this section have been seasonally adjusted by UNCTAD.

However, the rise in shipping rates slowed significantly from April 2024 to June 2024, as restrictions on canal sailings gradually eased.

The impact of the Red Sea crisis and the Suez Canal disruption was more modest than the Panama Canal disruption, with a peak impact of 26 percentage points on the Baltic Dry Index increase by March 2024, indicating a different pattern compared to container shipping freight rates. One reason for this difference is that container cargo could be transported using the landbridge in North America to circumvent the Panama Canal, but this is less feasible for dry bulk cargo, such as coal or grain. It is not as efficient or cost-effective to transport large quantities of bulk materials by land compared to shipping them by sea. Similarly, the Suez Canal accounts for a higher share of container shipping compared to dry bulk cargo. However, the impact of the Red Sea and Suez Canal crisis worsened in June 2024, becoming the main reason for the increase in dry bulk shipping rates.

In the case of the crude tanker shipping market, the Baltic Dirty Tanker Index was on the rise again from October 2023, mainly driven by strong oil shipping demand and increased ton-miles (see section A. Tanker freight rates: 2023 volatility and 2024 highs amid strong demand and disruptions). The impact of the two chokepoint disruptions on the crude oil tanker market was less significant than their impact on container and dry bulk shipping sectors.[3]

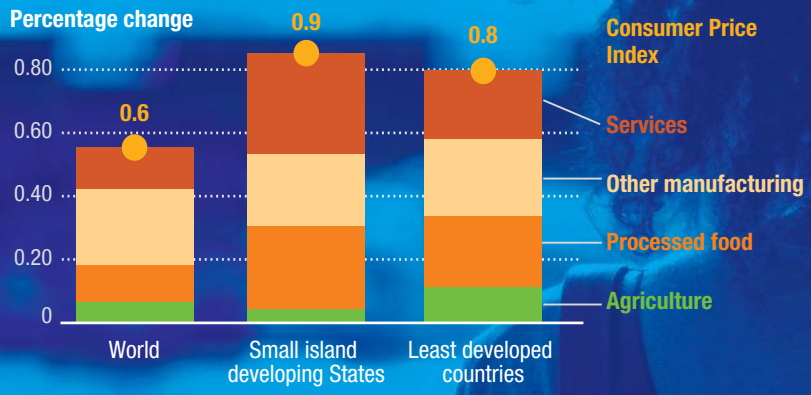
Simulating economic impact of freight rate increases: Higher impact on consumer prices and on gross domestic product in small island developing States

A simulation exercise was conducted to assess the impact of the freight rate increases (from October 2023–June 2024) on prices and economic activity. The simulation concluded that global consumer price levels will increase by 0.6 per cent by around the end of 2025 due to the Red Sea crisis and the Panama Canal disruption

[3] Crude oil tanker routes passing through the Suez Canal and the Panama Canal are not included in the Baltic Dirty Tanker Index (Baltic Exchange, 2024).

Figure III. 9
Impact of increased shipping rates due to disruptions in the Red Sea and Panama Canal on consumer price levels and real gross domestic product

(a) Impact on consumer price index and its breakdown



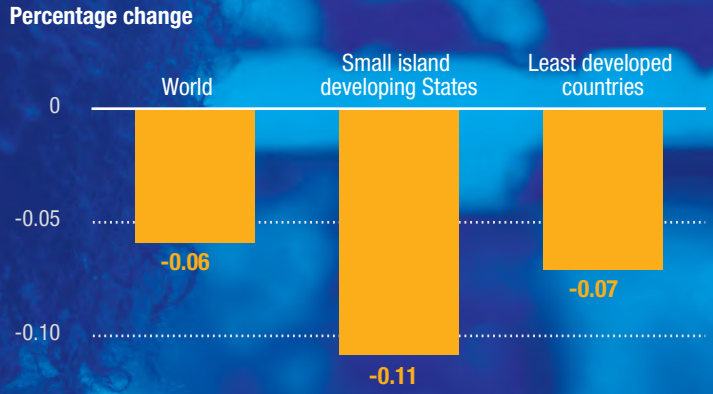
(figure III.9, panel (a)).[4] The simulation assumes that the combined impact of the two chokepoint disruptions on the freight rates, that is, 157-percentage points and 33-percentage points contributions to the China Containerized Freight Index and the Baltic Dry Index, respectively between October 2023 and June 2024, will be sustained over the simulation period. This is a conservative assumption as freight rates already continued to climb in June 2024. If freight rates were to increase beyond the current assumption, their impact on global consumer prices would be greater than projected in this analysis, with a possibility of reaching a 1.5 per cent increase, as simulated in chapter 3 of the *Review of Maritime Transport 2021* (UNCTAD, 2021).

In this simulation, SIDS would be the most affected economic group, with a simulated consumer price impact of 0.9 per cent, due to their heavy reliance on maritime shipping for their economic activities. Specifically, processed food prices are expected to rise by 1.3 per cent in SIDS, contributing 0.26 percentage points to the overall consumer price increase, as SIDS depend heavily on processed food imports by sea. LDCs are expected to face a 0.8 per cent rise in consumer prices, a higher impact than the world average. Of this total increase, food prices alone will add 0.34 percentage points. This result highlights the significant food security risk in SIDS and LDCs from the global chokepoint disruptions.

The simulation also shows that real GDP will be reduced by 0.06 per cent globally (figure III.9, panel (b)). The negative impact on SIDS is double the world average, underscoring their heavy economic reliance on seaborne trade and their limited ability to replace imported goods with domestic production.

The negative economic impact on SIDS **is double the world average**

[4] The simulation was conducted using the standard Global Trade Analysis Project (GTAP), version 7 model (Corong et al., 2017) and the GTAP version 11 database (Aguiar et al., 2023). The simulation result compares changes from an initial equilibrium to a new equilibrium (see technical note 1, for details of the methodology). To specify a time horizon for these changes, an estimation result reported in UNCTAD, 2021, and indicating a one-year lag for the passthrough from freight rates to consumer prices, was used.



(b) Impact on real gross domestic product

Source: UNCTAD calculations, based on the GTAP version 11 Data Base and other data provided by Clarksons Research Shipping Intelligence Network and Maritech Services Limited, Sea.
Notes: Median of the impact across economies in respective economic group. See technical note 1, for the simulation methodology.

C. Impact of transport infrastructure on maritime costs: Insights from the Trade-and-Transport Dataset

LDCs experienced 30–70% higher transport costs for their imported goods than other groups

Maritime freight rates have been vulnerable to logistical disruptions caused by pandemics, geopolitical tensions and climate-related factors. However, the impact of these factors on maritime transport costs can be alleviated with a robust and resilient transportation infrastructure.

For a thorough investigation of transport costs and their determinant factors, UNCTAD and the World Bank developed the Trade-and-Transport Dataset.[5] The following summarized analysis of trends in the Trade-and-Transport Dataset focuses on maritime transport costs across four major economic groups: developed economies, developing economies (excluding SIDS and LDCs), SIDS and LDCs. SIDS and LDCs face high maritime transport costs.

- From 2016 to 2021, developed economies enjoyed the lowest maritime transport costs, which averaged 8.1 per cent of the FOB value (the costs of goods plus shipping to the departure port) and $86 per ton (figure III.10).
- Developing economies, excluding SIDS and LDCs, faced higher maritime transport costs averaging 10.6 per cent of the FOB value and $89 per ton.
- SIDS bore transport costs that were 15–20 per cent higher per ton ($103 per ton) compared to other regions. However their transport costs as a percentage of the FOB value (9.8 per cent) were slightly lower than other developing economies. This can be explained by the fact that SIDS import more containerized goods, which are worth more per ton, making the percentage of transport costs lower in comparison to the high value of these goods.
- LDCs experienced 30–70 per cent higher transport costs for their imported goods than other groups, averaging a substantial 13.7 per cent of the FOB value. Eight of the top ten economies with the highest transport costs in the world are LDCs, including Mozambique, Sierra Leone and Togo.

This data underscores the significant economic burden of transport costs on these particularly vulnerable economies.

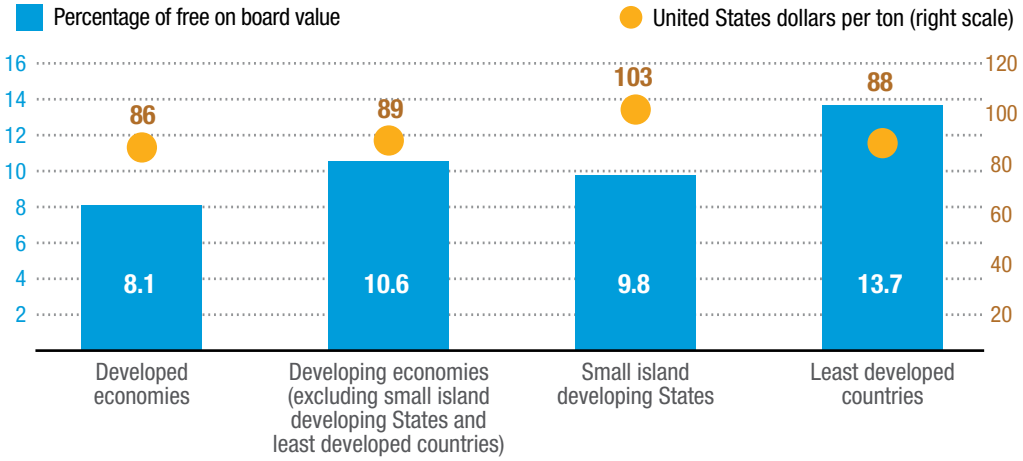
Transport infrastructure has a critical role in reducing maritime transport costs. Maritime transport costs are influenced by many factors including geographic distance,[6] the number of transits between origin and destination, the absence of economies of scale, trade imbalances and, critically, the quality of transport infrastructure. It is well established that efficient transport infrastructure is key to reducing these costs and facilitating streamlined trade.

[5] This detailed dataset breaks down transport costs by type of goods, using a specific identifying code (known as the "Harmonized System code" or "HS code"). This dataset is more comprehensive than a previous 2021 dataset on transport costs, the Global Transport Costs Dataset for International Trade. Transport costs are measured as the difference between "cost, insurance and freight" values (which include the cost of the goods, insurance, and shipping to the destination port) and "free on board" (FOB) values (the cost of the goods and shipping up to the departure port only, not insurance or shipping to the final destination). As of July 2024, the data published cover the years 2016–2021. While the Trade-and-Transport Dataset includes transport costs for four modes of transport (air, sea, rail and road), the current analysis focuses on sea transport.

[6] As a related point, developing economies must exert more transport work than developed countries to move their imports and exports by sea per dollar of maritime trade (see chapter I).

Figure III. 10

Median maritime transport costs for imported goods by economic group, 2016–2021: Least developed countries pay the most



Source: UNCTAD and the World Bank, Trade-and-Transport Dataset.
Note: Transport costs (percentage of free on board value and United States dollars per ton) are calculated by the following two steps: (a) transport costs for each destination economy in a specific year are calculated by weighted average across all commodities and all trading partners (origin economies); (b) transport costs are aggregated by taking medians across all years and destination economies within respective economic groups.

As such, UNCTAD analysed the impact of investment in maritime transport infrastructure on maritime transport costs using a panel structure of the new Trade-and-Transport Dataset,[7] while controlling for various other factors.

The finding reveals that investments in maritime infrastructure significantly reduce transport costs. Specifically, if a country's investment-to-export ratio in maritime transport infrastructure were to improve from the bottom 20th percentile group in the world (that is around 0.09 per cent of exports) to the 20th–40th percentile group in the world (that is about 0.19 per cent of exports), maritime transport costs would decrease by 4.7 per cent (figure III.11). Furthermore, increasing the investment-to-export ratio to the 60th–80th percentile group (that is around 0.60 per cent of exports) would reduce maritime transport costs by 11.6 per cent. In simple terms, spending more on improving ports and shipping facilities leads to lower shipping costs.

In other words, if a country's initial level of transport costs was 10.6 per cent of the FOB value (a typical figure for developing economies, excluding SIDS or LDCs), increasing its maritime transport infrastructure investment-to-export ratio from the lowest 20th percentile range to the 60–80th percentile range would reduce the transport costs by 1.2 percentage points. So instead of paying 10.6 per cent of the value of the goods for shipping, the costs would drop to 9.4 per cent.

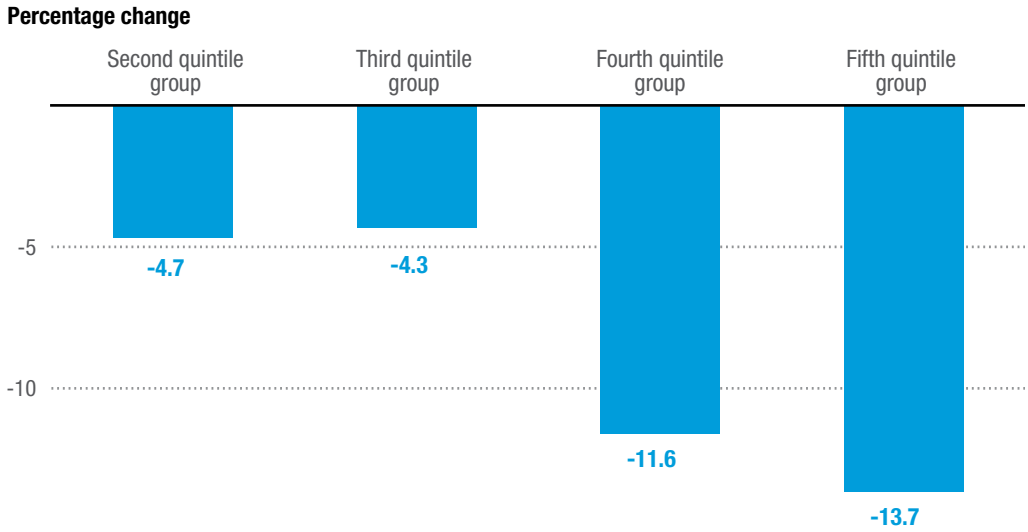
The finding reveals that **investments in maritime infrastructure significantly reduce transport costs**

[7] Due to the limitation of data availability, impact of exporter's investment was analysed (see technical note 2, for details of the methodology).

These results underscore that better investment in ports and shipping facilities can lead to noticeable savings in transport costs. This could be done through various channels, such as investing in efficient cargo handling and for ports to accommodate larger vessels, but also enabling a higher frequency of shipping services at ports.

Additional analysis shows that investment in road infrastructure can also lower maritime transport costs, highlighting how spillover effects from better hinterland transport – land areas including countries connected to the port – can positively impact port operations (see technical note 2, for analysis of how road infrastructure investment affects maritime transport costs).

Figure III. 11
How investing in maritime infrastructure affects maritime transport costs



Source: UNCTAD and the World Bank, Trade-and-Transport Dataset and the International Transport Forum, Transport infrastructure investment and maintenance spending.
Notes: Y-axis indicates impact of increasing investment/export ratio from the first quintile group (0–20 per cent) to the respective quintile groups in x-axis on maritime transport costs for goods exported. The impacts are represented in terms of percentage changes (not percentage point changes). Imputed values in the Trade-and-Transport Dataset are removed in the estimation. Due to the limitation in data availability, the estimation mainly covers developed economies and developing economies with relatively large economic sizes. See technical note 2, for the details of the methodology.

D. Policy considerations

Main issues

Freight rates in 2023 and the first half of 2024 were characterized by significant volatility and fluctuations, influenced by a variety of factors including supply and demand dynamics, geopolitical tensions, climate-related events and environmental regulations.

The persistent supply–demand imbalance across all segments has a direct impact on how freight rates are developing.

Congestion at major ports, exacerbated by the disruptions and increased demand, also contributed to higher freight rates and charges. Additionally, the shortage of empty containers is becoming a challenge.

Economic and trade uncertainties, geopolitical factors, changes in trade patterns, trends in the supply of ship carrying capacity along with the ongoing shift to cleaner energy and the rise of environmental regulations, will continue to significantly influence future shipping freight rates.

In addition, new environmental regulations, such as IMO CII as well as the European Union ETS, are expected to raise operating costs for shipping companies and affect future freight rates dynamics and pushing rates higher.

Analysis by UNCTAD shows that the Red Sea crisis is the main driver of the current rise in container freight rates, and its impact has increased from November 2023. The disruption of the Panama Canal due to low water levels had a significant impact on dry bulk freight rates between November 2023 and March 2024, but the effect of the drought in driving up rates had diminished by June 2024. However, in the absence of the two chokepoint disruptions, an increasing supply of container ships would have outstripped demand, leading to lower container freight rates and pointing to a potential overcapacity in the container shipping market. In addition, these shocks disrupting chokepoints could raise global consumer price levels by 0.6 per cent by around the end of 2025, with the risk of higher impacts. SIDS and LDCs could face higher food price increases due to their heavy dependence on maritime transport, which is a food security risk. Global real GDP is projected to be negatively impacted, with SIDS being the most affected.

The new Trade-and-Transport Dataset shows that developing economies, particularly SIDS and LDCs, experience higher transport costs compared to developed economies. However, investment in transport infrastructure, both at ports and in their hinterland, can reduce maritime transport costs.

Policy recommendations:

1. **Monitor and collect data on freight rates and disruptions**. International organizations and agencies, such as UNCTAD and IMO, and stakeholders in the shipping industry, including the International Chamber of Shipping (ICS) and policymakers, should engage in continuous monitoring, data collection and analysis to anticipate and mitigate the impact of disruptions on freight rates.
2. **Enhance capacity management**. Shipping companies should closely monitor market developments and manage ship carrying capacity to address the supply–demand imbalance. This includes strategic vessel recycling and optimizing fleet composition to align with market needs.
3. **Improve port efficiency**. Improving port operations including through upgraded port infrastructure and the adoption of new and green technologies can help reduce congestion and improve overall supply chain efficiency. This is key for mitigating the impact of disruptions on freight rates and reducing additional charges.
4. **Support the green transition**. Policymakers should implement clear and consistent regulations to address the impact of environmental standards on freight rates. Providing incentives for energy-efficient technologies and green vessels will encourage compliance and promote sustainability in the shipping industry, which will also influence market dynamics and freight rates.
5. **Assistance**. As deemed appropriate, technical assistance and support (financing, guarantees, etc.) should be provided to assist developing economies, specifically SIDS and LDCs, in enhancing maritime transport sector and help implementing measures to mitigate the impacts of global logistics shocks on their economies and people.

Technical notes

Technical note 1
Methodology to assess the impact of the Red Sea and Panama Canal disruptions on freight rates, consumer prices and gross domestic product (section B)

The analysis in section B estimated and simulated the impact of the Red Sea and the Panama Canal disruptions on freight rates, consumer prices, and real GDP at the global level, and in SIDS and LDCs. The estimation process is divided into four steps:

1. Estimating the impact on number of ship passages in the Suez Canal and the Panama Canal.
2. Estimating the impact on freight rates.
3. Converting the impact on freight rates into maritime transport costs.
4. Simulating the impacts on consumer prices and GDP.

First step: Impacts on number of ship passages in the Suez Canal and Panama Canal

The first step is the estimation of the impact of the Red Sea crisis and the Panama Canal disruptions on the number of ship passages in these "chokepoints". UNCTAD has estimated the following Poisson regression models in the event study-design using Poisson Pseudo-Maximum Likelihood estimator:[8]

$$y_{ilt} = \exp\left(\sum_{\substack{k=-5 \\ k\neq -1}}^{7} \delta_k z_{il,t-k} + \delta_{-6}^{terminal} z_{il,t+6}^{terminal} + \alpha_{il} + \alpha_t + q_{ilt}\psi + \epsilon_{ilt}\right),$$

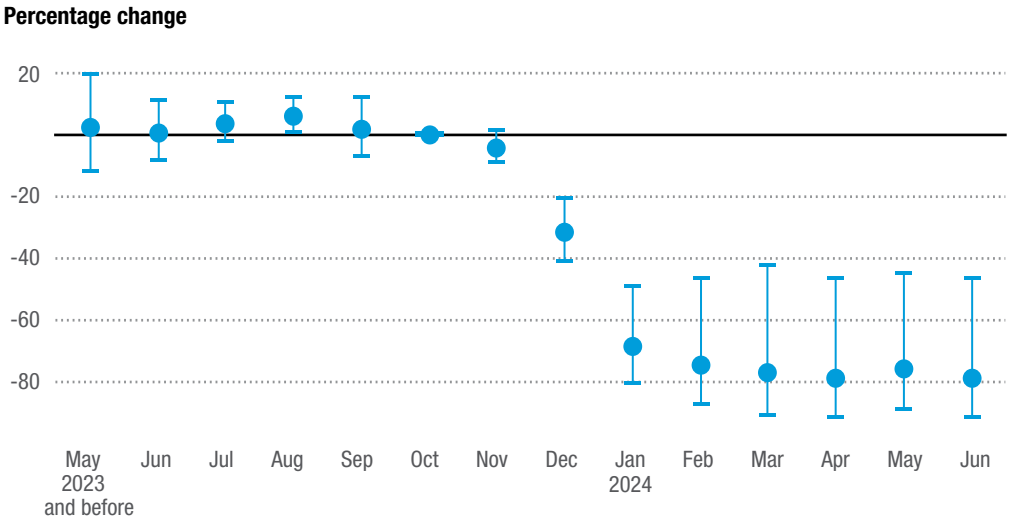
where y_{ilt} is the number of ship passages for vessel type i (such as intermediate size container ship and neo-Panamax container ship) at location l in time t, $z_{il,t}$ is the treatment variable that takes 1 in November 2023 in the Suez Canal (in June 2023 in the Panama Canal for Panama Canal regression) and 0 otherwise, and $z_{il,t+6}^{terminal}$ is the terminal treatment variable that takes 1 in May 2023 and before in the Suez Canal (in December 2022 and before in the Panama Canal for Panama Canal regression). Consequently, the terms $\sum_{\substack{k=-5 \\ k\neq -1}}^{7} \delta_k z_{il,t-k} + \delta_{-6}^{terminal} z_{il,t+6}^{terminal}$ capture the dynamic effects of the Red Sea crisis and the Panama Canal drought on the ship passages. Further, α_{il} means fixed effects for vessel type i and location l, α_t is a time fixed effect, q_{ilt} indicates other controls (different time trends were used in regressions for dry bulk ships), and ϵ_{ilt} is error term.

Six versions of the above regressions were estimated to separately assess the impacts of the Red Sea crisis and the Panama Canal drought on container ships, dry bulk ships and tankers. For instance, the estimated result for the impact of the Red Sea crisis on the container ship passages is indicated in figure 1. It indicates that the parallel trend assumption is mostly satisfied, implying that the result can be interpreted as a causal impact.

[8] The explanation follows Freyaldenhoven et al. (2021), but some notations are adjusted.

Figure 1

Event study estimation result for the impact of the Red Sea disruption on the number of container ship passages



Source: UNCTAD calculations, based on data provided by Maritech Services Limited, Sea.
Notes: The estimation result is originally represented in logarithmic scale. It is converted into percentage change in this figure. The vertical lines indicate 95 per cent confidence intervals. The confidence intervals are based on standard errors clustered at location and vessel type.

Second step: Impacts on freight rates

In the second step, UNCTAD has estimated Structural Vector Autoregression models, separately for container shipping, dry bulk shipping, and tanker shipping. These models are based on monthly data for $\Delta \ln z_t = (\Delta \ln fleet_t, \Delta \ln trade_t, \Delta \ln frate_t)'$, where $\Delta \ln fleet_t$ represents the first difference in natural logarithm of fleet supply after seasonal adjustment. $\Delta \ln trade_t$ and $\Delta \ln frate_t$ are similarly defined for shipping trade demand and freight rate. The external variables are $\Delta \ln x_t = \left(\Delta \ln x_t^{Red\ Sea}, \Delta \ln x_t^{Panama}\right)$, representing the difference in natural logarithm of the Red Sea shock and the Panama Canal shock estimated in the first step.[9] The Structural Vector Autoregression representation is given by:

$$A_0 \Delta \ln z_t = \alpha + \sum_{i=1}^{S} A_i \Delta \ln z_{t-i} + C \Delta \ln x_t + \epsilon_t,$$

where $\epsilon_t = \left(\epsilon_t^{fleet\ supply\ shock}, \epsilon_t^{shipping\ demand\ shock}, \epsilon_t^{other\ logistics\ shocks}\right)'$ denotes the vector of structural shocks. It is assumed that A_0 has a recursive structure, allowing the reduced form errors e_t to be decomposed as follows:

$$e_t \overset{\text{def}}{=} \begin{pmatrix} e_t^{\Delta \ln fleet} \\ e_t^{\Delta \ln trade} \\ e_t^{\Delta \ln frate} \end{pmatrix} = \underbrace{\begin{pmatrix} b_{11} & 0 & 0 \\ b_{21} & b_{22} & 0 \\ b_{31} & b_{32} & b_{33} \end{pmatrix}}_{B = A_0^{-1}} \epsilon_t,$$

After estimating the above Structural Vector Autoregression models, historical decomposition was conducted to break down the freight rate changes into the three structural shocks and the two external variables. The contributions of these two external variables represent the impacts of the Red Sea shock and the Panama Canal shock on the freight rates.

[9] The methodology is similar to the one used in an early version of Kilian (2009), but the two chokepoint shocks are treated as exogenous variables rather than as endogenous variables.

The contribution of the other logistics shocks is intentionally omitted in figure III.7 and figure III.8 as the interpretation of the shocks is not straightforward and it is not a focus of the analysis. The decomposition result, in terms of first differences of natural logarithms, was converted to cumulative percentage changes for the visualization purpose.

Third step: Converting impacts on freight rates into transport costs

In the third step, the impacts of the Red Sea shock and the Panama Canal shock on freight rates were transformed into changes in maritime transport costs based on the following regression model:

$$\Delta \ln tcost_{cdt} = \beta \Delta \ln frate_t + \alpha_c + \alpha_d + u_{ilt},$$

where $\Delta \ln tcost_{cdt}$ is maritime transport cost for commodity c and destination economy d in year t, $\Delta \ln frate_t = \left(\Delta \ln frate_t^{container}, \Delta \ln frate_t^{dry\ bulk}, \Delta \ln frate_t^{tanker}\right)$ is the vector of freight rates (in terms of first difference of natural logarithm) for container shipping, dry bulk shipping and crude oil tanker shipping sectors, and the α's are respective fixed effects.[10] Data for the maritime transport costs are derived from the Trade-and-Transport Dataset from UNCTAD and the World Bank. After estimating the regression model, the freight rate shocks due to the Red Sea crisis and the Panama Canal drought, estimated in the second step, were incorporated into $\Delta \ln frate_t$ to form predictions for $\Delta \ln tcost_{cdt}$. The predicted values for $\Delta \ln tcost_{cdt}$ were converted to percentage changes and used as inputs in the fourth step below.

Fourth step: Impacts on consumer prices and GDP

The final step used the GTAP version 7 model (Corong et al., 2017) and the GTAP version 11 Data Base (Aguiar et al., 2023) to simulate the impacts of the Red Sea crisis and the Panama Canal disruption on consumer prices and GDP. The simulation was based on a standard closure of the GTAP model, except a change to allow for an exogenous change in transport costs. The endogenous variable for transport costs ($ptrans$) was swapped with an exogenous variable for maritime shipping technology ($atall("wtp", COMM, REG, REG)$). The predicted values for maritime transport costs ($\Delta \ln tcost_{cdt}$) in the third step, after being converted into percentage changes, were used as shocks to the transport costs in the GTAP model (the variable $ptrans$).

The magnitude of the shocks is too large for the GTAP simulation to converge. To address this problem, the original shocks are scaled down by some factor and the simulated impacts are scaled back. It is confirmed that any scaling numbers can produce almost identical simulation impacts as long as the model simulation converges.

[10] In the actual conversion, tanker freight rate was omitted as it was not statistically significant.

Technical note 2
Methodology to assess the impact of transport infrastructure investment on maritime transport costs (section C)

A baseline regression for the analysis in section C is the following fixed-effects model:

$$\ln y_{odct} = \beta \ln z_{ot} + \gamma \ln x_{odct} + \alpha_{odc} + \alpha_{ct} + \epsilon_{odct} ,$$

where y_{odct} is maritime transport costs (in terms of percentage of the FOB value) for origin-destination-commodity pair (odc) at time t, z_{ot} is investment/export ratio in maritime transport infrastructure (a variable of interest) in origin economy o at time t, x_{odct} is a vector of control variables for origin-destination-commodity pair (odc) at time t (some control variables are observed only at origin or destination level), α_{odc} means fixed effects for origin-destination-commodity pair (odc), α_{ct} is fixed effects for commodity (c) at time t, and ϵ_{odct} is an error term. The vector of control variables (x_{odct}) include GDP, value of total imports, unit value of commodity, and trade imbalances. Further, the fixed effects control for any fixed features of all origin-destination-commodity pairs and commodity-wide time effects. There are 63,654 fixed effect dummies for α_{odc} and 6,711 dummies for α_{ct}. The number of observations used in the estimation is 162,606.

The maritime transport costs (y_{odct}) are based on the UNCTAD and the World Bank, Trade-and-Transport Dataset. As several data entries in the dataset are imputed values, these observations are removed for the estimation. Investment in maritime transport infrastructure is sourced from the International Transport Forum, Transport infrastructure investment and maintenance spending. It is converted to investment/export ratio by using export values in the Trade-and-Transport Dataset (export values are aggregated at origin economy level. As the investment is expressed in domestic currency, it is converted into United States dollars by using exchange rates). Control variables (x_{odct}) are calculated from the Trade-and-Transport Dataset, except real GDP data from the United Nations, National Accounts Main Aggregates Database.

For the visualization purpose in the main text, the variable of interest (z_{ot}) is replaced by its quintile group dummies (z_{ot}^{q}'s):

$$\ln y_{odct} = \sum_{q=2}^{5} \beta^{q} z_{ot}^{q} + \gamma \ln x_{odct} + \alpha_{odc} + \alpha_{ct} + \epsilon_{odct} ,$$

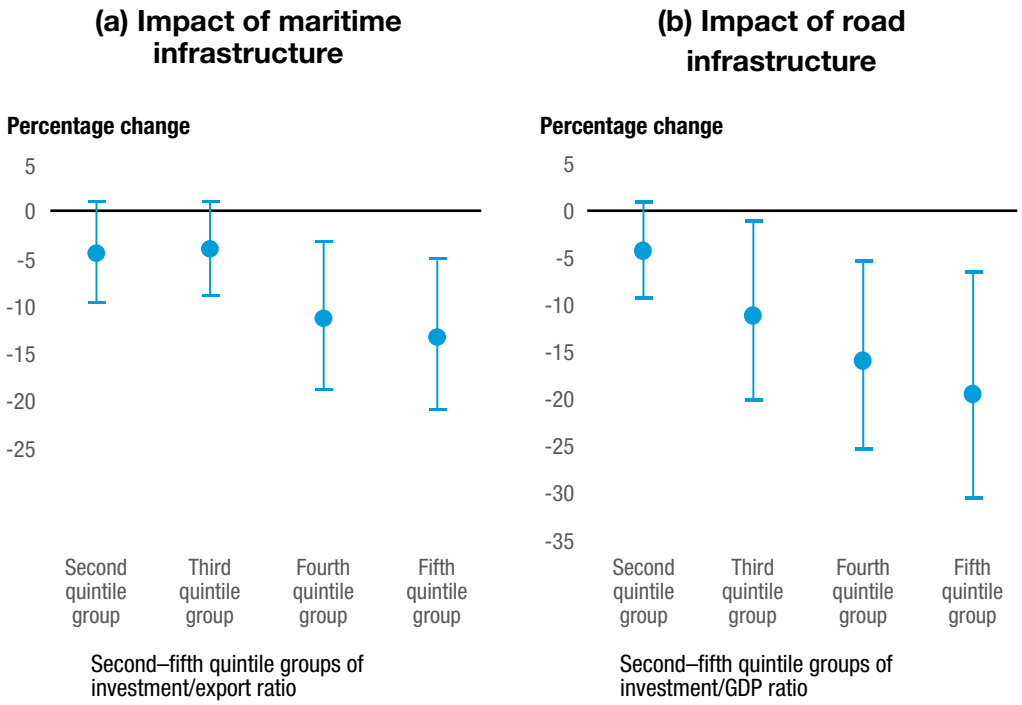
where z_{ot}^{q} is a q-th quintile group dummy for investment/export ratio in maritime transport infrastructure. The first quintile group dummy is omitted as it is set as a base category.

The coefficients on the quintile group dummies, β^{q}'s, indicate the impacts of improving the investment/export ratio from the first quintile group to the q-th quintile group in terms of log-differences. The estimated values of β^{q}'s are converted to percentage changes for the visualization purpose.

Additionally, impact of the road infrastructure investment was also estimated, by replacing z_{ot} and z_{ot}^{q}'s by its road version. For road infrastructure investment, investment/GDP ratio was used as a variable of interest, because it is more relevant for transport costs than investment/export ratio. The estimated impacts of maritime and road infrastructure investment on maritime transport costs are summarized in figure 2.

Figure 2

Impact of exporters' maritime and road transport infrastructure investment on maritime transport costs



Source: UNCTAD and the World Bank, Trade-and-Transport Dataset and the International Transport Forum, Transport infrastructure investment and maintenance spending.
Notes: Y-axis indicates impact of increasing investment/export (or investment/GDP) ratio from the first quintile group (0–20 per cent) to the respective quintile groups in x-axis on maritime transport costs for goods exported. The impacts are represented in terms of percentage changes (not percentage point changes). *Imputed* values in the Trade-and-Transport Dataset are removed in the estimation. Due to the limitation in data availability, the estimation mainly covers developed economies and developing economies with relatively large economic sizes. The vertical lines indicate 95 per cent confidence intervals. As the investment data are observed at origin economy level, the confidence intervals are based on standard errors clustered at origin economy level.

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