



**UNIVERSITY OF GOTHENBURG**  
**SCHOOL OF BUSINESS, ECONOMICS AND LAW**

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**International container shipping through the Covid-19 pandemic**  
**- Disruptions from a Swedish perspective**

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## Disruptions in international container shipping during the Covid-19 pandemic from a Swedish perspective

### **Abstract:**

At the onset of the pandemic in spring 2020, the Swedish shipping sector was first affected by border closures preventing passengers to use RoPax shipping and cruise ferries. There were some blank sailings but in general they kept operating to foster intra-European trade by trucks despite the missing revenues from passengers. Shipping in general was affected by port disruptions and complicated crew changes. Eventually, however, it was clear that the most dramatic disruptions on a global scale were experienced in the container segment. General media reported on delayed goods, high freight rates and, however not related to the pandemic, the Ever Given blocking the Suez Canal for a week in March 2021.

Currently, there are few reports of supply chains and shipping suffering from disruptions and capacity constraints related to the pandemic. The peak in freight rates was rather replaced by depressed rates and there is a certain risk that some logisticians and supply chain managers regard the pandemic as a once-in-a-lifetime event and just want to get back to a previous behaviour seeing container shipping as a commodity with indefinite capacity at a reasonable price. Nevertheless, the war in Ukraine, the drought in the Panama Canal and the attacks by the Houthi rebels in the Red Sea create other problems for container shipping. Freight rates increase significantly, but from very low levels.

The purpose of the report is to describe and analyse how international container shipping was affected by the Covid-19 pandemic and other disruptions. The analysis takes a Swedish perspective on disruptions and tries to go beyond the anecdotal reporting and capture what happened and why.

Container shipping is put into a context of economy, consumption, world trade, supply chains and logistics. The pandemic and more current events affecting container shipping market are described together with how shipping lines responded. A series of interviews with Swedish actors revealed how they perceived the disruptions and what countermeasures the actors have applied to mitigate the effects, their organisational learning and how they prepare for future disruptions.

**Keywords:** Covid-19, pandemic, container shipping, resilience, disruption

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## Executive summary

Traditionally, passenger traffic and infrastructure projects are covered on the news pages of newspapers, while freight issues are at best "hidden away" on the economy pages or mostly covered in the industry press. But during the pandemic, the public was widely exposed to freight transport in general media, as goods not arriving on time or container shipping rates being extremely expensive attracted the attention of a larger audience. Covering that time, this report is based on media documents, scientific publications and a series of interviews, and the study aims at going beyond the anecdotal reporting and capture what happened and why.

### **Malfunctioning container shipping**

Container shipping, by tradition, has a peak season early fall to replenish stores ahead of Black Friday and Christmas shopping, and another in January so factories in Europe and North America can buffer components ahead of China shutting down for its New Year. But in 2020, Chinese factories did not open after the New Year and there was no supply of goods to ship. Then the pandemic hit the rest of the world with closed warehouses and factories, limiting the demand for ocean freight services. The shipping companies responded by cancelling departures and holding back ships from trading and even scrapped some vessels. Later, when governments stimulated the economy, demand increased unexpectedly quickly, not least when consumers ordered consumer goods made in Asia as they could not spend their money on travelling or dining. There was also a shortage of containers when they were stuck in ports or at warehouses and factories that were closed with no personnel to empty them.

Shipping lines, but also ports and inland transports had difficulty scaling up in line with demand. Seafarers, port workers and truck drivers also got infected. Due to the surge of Asian product orders by American consumers, ships had to wait for weeks in San Pedro Bay outside the ports of Los Angeles and Long Beach, causing significant congestion. Major retailers such as IKEA, Walmart and Home Depot chartered container vessels to get their goods through smaller ports.

The highest attention was given to the blockage of Suez Canal when Ever Given stood sideways for a week. In normal times container shipping would have come into a balance rather quickly, but it had severe effects this time as the transport system was already working at full capacity. At the start of the war in Ukraine in February 2022, containers bound for Russia were left standing in ports and the alternatives by air and rail between Asia and Europe were stopped. Other conflicts, like the attacks on commercial shipping transiting the Red Sea starting at the end of 2023, have forced shipping lines to reroute their services via the Cape of Good Hope.

### **Unprecedented container freight rates**

The spot market for shipping services is an auction and freight rates vary dramatically depending on supply and demand. At the peak, container freight rates were about ten times higher than in the years before the pandemic and they returned to that level or even below early in 2023. Rapid and dramatic changes in freight rates are normal for tank and dry bulk but this time a similar trend was observed in liner shipping. However, high prices only applied to shipments from Asia; for Swedish exports shipping was still cheap but it was difficult to get onto the ships that rushed back to Asia to pick up higher-paying goods. In addition, only part of the transport capacity was traded on the spot market, up to 70% of the capacity belonged to the flows under period contracts with fixed prices. Recent problems to pass the Suez and Panama canals have caused a shift upwards, but from very low levels.

## **Effects for shipping lines and shippers**

The interviews with representatives for shipping companies, ports and shippers revealed tensions when the shipping companies prioritised the lucrative spot market before period contracts and desperate customers had to book the same cargo with several shipping companies. Overall, however, it seemed that shippers and shipping lines tried to solve the problems together. In an international comparison, the Swedish ports did not really suffer from capacity problems for freight handling but had to adapt to disruptions in other parts of the transport chains. In a previous study of the labour union conflict in APM Terminals in Port of Gothenburg, it emerged that development projects in sustainability and Information and Communication Technology (ICT) were postponed, but the pandemic rather induced intensification of such projects.

The disruptions were truly costly, and an interviewed shipping company estimated that they had to deploy 25% more vessel capacity to compensate for disruptions in ports and in hinterland logistics. The high freight rates resulted in extreme profits for the shipping companies. Maersk, for example, made a profit of SEK 320 billion in 2022 with a profit margin of 47%. It is also noteworthy that several shipping companies broadened their service range with air freight, inland transport, and logistics services instead of buying other shipping companies or ships with these large profits.

## **Preparing for coming crises**

In hindsight, the globalised society and comparatively stable economic period has resulted in fragile supply chains, but it would be incredibly expensive to build logistics systems that can withstand such major disruptions as a global pandemic. In fact, transport chains worked remarkably well and few products ran out completely.

There are many good reasons to keep inventory at low levels, but experiences from shortages during the pandemic will probably lead to safety stocks and willingness to pay for reliable freight transport. Negotiations are now as much about delivery capacity as it is about price.

Another effect of the pandemic is increasing regionalisation with separate supply chains for each of the major economic regions of Europe, North America and Asia, however not for all types of products. One reason of this strategy is reduced exposure to transport disruptions, but geopolitics with trade barriers and sanctions are more decisive for such dramatic changes. Nevertheless, global trade has significant advantages, not least for Sweden, so the economy is not striving backwards to small self-sufficient villages. On the other hand, it is not risk-free to position supply chain members in production stages more and more far from each other.

## Sammanfattning

Traditionellt bevakas persontransporter och infrastrukturprojekt på tidningarnas nyhetsidor, medan godstransporter i bästa fall "göms undan" på ekonomisidorna men mest bevakas av branschpressen. Men under pandemin exponerades allmänheten för godstransporter i allmänna medier, även om det mest handlade om att varor inte kom fram eller att containerfrakten var dyr. Denna rapport är baserad på mediedokument, vetenskapliga publikationer och en serie intervjuer och studien syftar till att gå bortom den anekdotiska rapporteringen och fånga vad som hände och varför.

### Containertransporter som fungerade dåligt

Containersjöfarten har en högsäsong i början av hösten för att fylla på förråden inför Black Friday och julhandeln, och ytterligare en i januari så att fabriker i Europa och Nordamerika kan buffra komponenter inför Kinas nedstängning inför det kinesiska nyåret. Men 2020 öppnade inte kinesiska fabriker efter nyår och det fanns mycket lite varor att skicka. Sedan slog pandemin till i resten av världen med stängda lager och fabriker som begränsade efterfrågan på sjötransporter. Rederierna svarade med att ställa in avgångar. Senare, när regeringarna stimulerade ekonomin, ökade efterfrågan oväntat snabbt, inte minst när konsumtionsvaror tillverkade i Asien beställdes hem eftersom allmänheten inte kunde använda sina pengar för att resa eller äta ute. Det var också brist på containrar när de satt fast i hamnar eller vid stängda lager och fabriker utan personal som kunde tömma containrarna.

Rederier, men även hamnar och landtransporter hade svårt att skala upp i takt med efterfrågan. Och naturligtvis blev även ombordpersonal, hamnarbetare och lastbilschaufförer smittade. Amerikanska konsumenter beställde stora mängder asiatiska produkter, och fartyg låg och väntade i veckor i San Pedro Bay utanför hamnarna i Los Angeles och Long Beach. Stora detaljhandelskedjor som IKEA, Walmart och Home Depot chartrade containerfartyg för att få in sina varor i USA via mindre hamnar.

Mest uppmärksamhet fick stoppet i Suezkanalen där Ever Given stod i sidled i en vecka. Det fick allvarliga konsekvenser eftersom transportsystemet gick för fullt, men i normala fall skulle containersjöfarten ha kommit i balans ganska snabbt. Det fruktansvärda kriget i Ukraina påverkade också när containrar på väg till Ryssland blev stående i hamnarna och alternativen med flyg och tåg mellan Asien och Europa stoppades. Andra konflikter, som attackerna mot kommersiell sjöfart som passerar Röda havet, har tvingat rederier att omdirigera sina tjänster via Godahoppsudden.

### Oöverträffade fraktpriser för containrar

Spotmarknaden för sjötransporter är en auktion och frakterna varierar dramatiskt beroende på utbud och efterfrågan. Som mest var priserna för containerfrakt ungefär tio gånger högre än under åren före pandemin men de har nu återgått till den nivån eller till och med därunder. Snabba och dramatiska förändringar i fraktpriser är normalt för tank och torrbulk, men den här gången gällde det linjesjöfart. Men de höga priserna avsåg bara frakterna från Asien, för svensk export var det fortfarande billigt även om det var svårt att få plats ombord på fartygen som skyndade tillbaka till Asien för att hämta mer högbetalande varor. Dessutom handlas endast en del av transportkapaciteten på spotmarknaden, uppemot 70 % är flöden enligt periodkontrakt med fasta priser. Problem att passera kanalerna i Suez och Panama påverkar fraktpriserna uppåt, men från mycket låga nivåer.

## Effekter för rederier och speditörer

Intervjuerna med representanter för rederier, hamnar och speditörer visade på spänningar när rederierna prioriterade den lukrativa spotmarknaden framför tidsbundna kontrakt och att desperata kunder bokade samma gods hos flera rederier. På det hela taget verkade det dock som att speditörer och rederier försökte lösa problemen tillsammans. I en internationell jämförelse drabbades de svenska hamnarna egentligen inte av direkta kapacitetsproblem men fick anpassa sig till störningar i andra delar av transportkedjorna. I en tidigare studie av den fackliga konflikten i APM Terminals i Göteborgs Hamn framkom det att utvecklingsprojekt inom hållbarhet och digitalisering sköts på framtiden, men pandemin ledde snarare till att sådana projekt intensifierades.

Störningarna var verkligen kostsamma, och ett intervjuat rederi uppskattade att de var tvungna att sätta in 25 % mer fartygskapacitet för att kompensera för störningar i hamnar och i inlandslogistik. De höga fraktratena gav ändå extrema vinster för rederierna, Maersk gjorde till exempel en vinst på 320 miljarder kronor 2022 med en vinstmarginal på 47%. Det är också anmärkningsvärt att flera rederier breddade sitt tjänsteutbud med flygfrakt, landtransporter och logistiktjänster snarare än att köpa andra rederier eller fartyg för de stora vinsterna.

## Förberedelser inför kommande kriser

Med facit i hand har det globaliserade samhället och den relativt stabila ekonomiska perioden resulterat i bräckliga leveranskedjor, men det skulle bli oerhört dyrt att bygga logistiksystem som klarar så stora störningar som en global pandemi. Det är faktiskt lite förvånande att transportkedjorna fungerade så bra och att få produkter tog slut helt i butikshyllorna.

Det finns många goda skäl att hålla låga lagernivåer, men erfarenheter från brister under pandemin kommer sannolikt att leda till säkerhetslager och en betalningsvilja för pålitliga godstransporter. Förhandlingarna handlar nu lika mycket om leveranssäkerhet som om pris.

En annan effekt av pandemin är ökad regionalisering med separata leveranskedjor för var och en av de stora ekonomiska regionerna i Europa, Nordamerika och Asien, dock inte för alla typer av produkter. En faktor är minskad exponering för transportstörningar, men geopolitik med handelshinder och sanktioner är mer avgörande för sådana dramatiska förändringar. Den globala handeln har dock betydande fördelar, inte minst för Sverige, så ekonomin strävar inte bakåt mot små självförsörjande byar. Men lite sunt förnuft har ändå smugit sig in eftersom det inte är riskfritt att stycka upp leveranskedjor i allt fler produktionsled långt ifrån varandra.

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## Abbreviations and terminology

Feeder service	A service connecting hub ports with smaller ports, mainly in the container segment.
Less-than-container-load (LCL)	A consolidation service for shipments smaller than the capacity of a container.
Regionalisation	In the context of supply chains, a way of using suppliers, locate manufacturing and serve customers within the same major economic or political region.
RoPax	Roll-on-Roll-off/Passengers – vessels moving a combination of rolling freight units and passenger and the related shipping segment. Also referred to as ferries.
RoRo	Roll-on-Roll-off – a transshipment technique relying on rolling cargo on and off vessels, but also denoting the shipping segment moving rolling cargo
Short sea shipping	Shipping within a major economic region, not crossing oceans. In this report interpreted as intra-European shipping.
TEU	Twenty-foot equivalent unit – a volume measurement on container shipping equal to a standard 20-foot container. FEU, accordingly, relates to forty-foot containers.

# 1 Introduction

## 1.1 Background

At the onset of the pandemic in spring 2020, the Swedish shipping sector was first affected by border closures preventing passengers to use RoPax shipping and cruise ferries. There were some blank sailings but in general they kept operating to foster intra-European trade by trucks despite the missing revenues from passengers. Shipping in general was affected by port disruptions and complicated crew changes. Eventually, however, it was clear that the most dramatic disruptions on a global scale were experienced in the container segment. General media reported on delayed goods, high freight rates and, however not related to the pandemic, the Ever Given blocking the Suez Canal for a week in March 2021.

Currently, there are few reports of supply chains and shipping suffering from disruptions and capacity constraints related to the pandemic. The peak in freight rates was rather replaced by a period of low rates and there is a certain risk that some logisticians and supply chain managers regard the pandemic as a once-in-a-lifetime event and just want to get back to a previous behaviour seeing container shipping as a commodity with indefinite capacity at a reasonable price. Nevertheless, the war in Ukraine, the drought in the Panama Canal and attacks by the Houthi rebels in the Red Sea create significant problems for container shipping. Freight rates do increase, but from very low levels.

The pandemic triggered a wide set of research projects on the effects on supply, logistics and transport chains. One example is the project *The role of liner shipping for robust supply chains (Linjesjöfartens roll för robusta försörjningskedjor)* funded by the Swedish Transport Administration, and other examples are the smaller Lighthouse pre-study projects *Shipping post-covid (Sjöfarten post-corona)* and *Regionalised supply chains and the effects on shipping (Regionaliserade försörjningskedjor och påverkan på sjöfarten)*. In addition, University of Gothenburg and Chalmers have funded the work through the joint Strategic Research Area Transport.

A first report, *The effects of the coronavirus pandemic on the Swedish shipping industry and its resilience capabilities (Altuntas Vural et al., 2021)*, covering the acute phase from March 2020 to May 2021 was published in 2021. This report is intended for a wider audience and adds to the preliminary findings in that report and constitutes another part of the results of the research projects. The research projects also produce scientific journal articles, which are more narrowly focused and primarily written for an academic audience.

## 1.2 Purpose

The purpose of the report is to describe and analyse how international container shipping was affected by the Covid-19 pandemic and other disruptions. The analysis takes a Swedish perspective on disruptions and tries to go beyond the anecdotal reporting and capture what happened and why.

## 1.3 Methodology

The description and the analysis in the first part of the report are based on documents in the public and business press, statistics and published research. The second part on disruptions as perceived by Swedish actors and the countermeasures applied is based on about 30 interviews with representatives for firms based in Sweden. The interviews were recorded, transcribed and then coded for analysis using the software NVivo.

## **1.4 Scope**

The projects take a maritime transport perspective, but disruptions to supply chains have various causes for different cargoes and at different geographical scopes. The attempt is to describe and analyse the effects for global supply chains dependent on trans-ocean container shipping.

## **1.5 Report outline**

The demand for freight transport is a derived demand, which means that this demand is dependent on the demand for commodities, components or products that are located in another part of the world. To understand how and why container shipping malfunctioned during the pandemic, it needs to be put into a context of economy, consumption, world trade, supply chains and logistics. The main events connected to the pandemic itself are assumed to be well known. Chapter 2 addresses the global phenomena in the economic environment that had consequences for container shipping whereas Chapter 3 focuses on international container shipping itself. Chapter 4 depicts how Swedish actors perceived the disruptions and chapter 5 focuses on the countermeasures the actors have applied to mitigate the effects. Chapter 6 then takes the perspective of organisational learning and preparing for future disruptions. Chapter 7 concludes the report.

## 2 The economy, trade, and supply chains through the pandemic

Explaining the development of container shipping during the pandemic and how it has affected Swedish actors requires some background about the general economic development, consumption, world trade, supply chains and freight transport in general.

### 2.1 A pandemic timeline

Describing the general character of the pandemic including infection rates and government measures is beyond the scope of this report. To capture the effects on supply chains and container shipping, some facts about the pandemic are however required. Figure 1 provides such a timeline from the first cases were identified in Wuhan to when pandemic restrictions were lifted in Sweden.

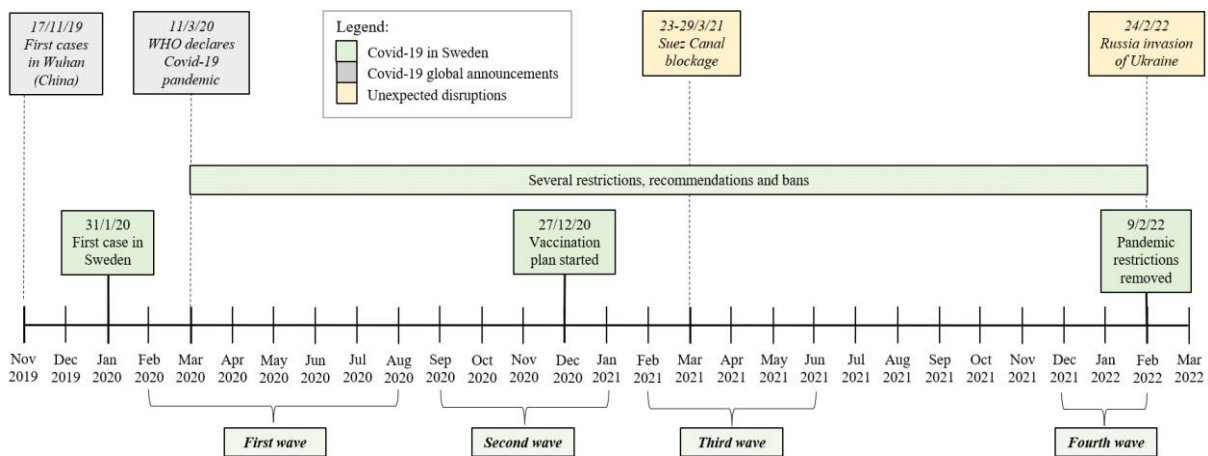


Figure 1. Timeline over the pandemic including non-pandemic disruptions affecting maritime transport. Source: Own elaboration based on official reports.

### 2.2 Economic development and consumption

The lockdowns of societies or at least strong recommendations to stay at home caused severe disruptions of daily life and would have led to almost a halt in the economy unless governments acted.

#### 2.2.1 Economic stimulation from governments

Trying to avoid the dire consequences across the society experienced during the financial crisis of 2008-2009, governments took rapid and drastic economic countermeasures. One way of stimulating the economy was that central banks lowered interest rates, bought government bonds and even shares of listed companies. To keep firms afloat and assist workers, governments also implemented wage subsidy schemes or made already existing ones more generous (Pope and Hourston, 2020). To stimulate consumer demand, countries such as the USA implemented “Helicopter money” (McCombie, 2022) for households to spend.

#### 2.2.2 Consumption

The government stimulations kept the economy going and salaries were paid. Lacking possibilities of travelling, dining and buying other services requiring physical contact, consumers sat at home ordering physical products over the internet, products often produced in Asia. People on leave compensated by the government also had time to decorate homes, improve gardens and build patios. Furthermore, people working from home adapted their residences into working

spaces. This obviously triggered physical goods flows and, accordingly, government stimulus also stimulated trans-ocean container shipping. Adding to the turbulence of supply chains, consumers perceiving a risk of products running out in shops or feared to be infected by Covid-19 while shopping started to hoard (Roos *et al.*, 2023).

### *2.2.3 Material and component shortages*

An economy with stimulated demand, channelled to consumption of physical products, in combination with production systems affected by lockdowns and part of the workforce infected and absent, and transport systems struggling to serve the supply chains, led to shortages of raw material and components. Lack of microchips was particularly highlighted in media, but there was also frequent shortage of components more likely to be moved by container shipping.

### *2.2.4 Inflation and high interest rates*

The government stimulation boosted the demand and the disrupted supply chains limited the supply, leading to staggering inflation, high above the 2 % central banks typically aim for. To curb the inflation, central banks have increased the interest rates significantly after a long period of extremely low or even negative funds interest rate.

## **2.3 World trade and supply chains**

According to Business Sweden (2023) and UNCTAD (2020), global supply chains and world trade suffered from geo-political tensions and related shifts in globalisation patterns before the pandemic. The tariff escalation and trade tensions between China and the USA triggered the expectations of a slow-down in globalisation rate and a shift in supply chain flows. In addition, the geopolitical crisis between Iran and western nations created bottlenecks in global oil trade flows particularly due to the military blockage at the Strait of Hormuz. Hence, disruptions were not entirely new when Covid-19 pandemic hit at the beginning of 2020. However, the speed and scale of the impact were incomparable to the previous crises. By March 2020, the projected decline in global trade was between 13-32% (World Trade Organization, 2020). The size of the percentages and the interval underlines the degree of uncertainty that was prevalent in the markets when the ripple effects of the pandemic were observed internationally.

Container shipping has a peak season early fall to replenish stores ahead of Black Friday and Christmas shopping, and another in January so factories in Europe and North America can buffer components ahead of China shutting down for its New Year. But in 2020, Chinese factories remained closed after New Year causing a supply disruption. China's share in global exports was 13.2% in 2019 and Jensen (2020) found that over 200 of Fortune 500 firms had a direct presence in Wuhan and over 900 of Fortune 1000 had tier 1 or tier 2 suppliers in this region from where Covid-19 virus started to spread. China is the primary buyer of raw materials, and producer of components and sub-assemblies to many global supply chains. The lockdowns and factory closures in China created ripple effects in the supply chains dependent on continuous supply from this region.

While China started to reopen towards the beginning of March 2020, the effects of the virus became more prevalent in the rest of the world. Country lockdowns and factory closures followed in Europe and the USA. This created a big demand shock in markets due to fast increasing unemployment, declining demand for service industries and commercial products. Monitoring these trends suggests that projections on global trade were clearly negative, and no quick recovery was expected.

The initial collapse in global freight trade between regions caused production capacity reductions, which were due to component and labour shortages in factories. Some factories were entirely shut down which caused further ripple effects later when the markets recovered. Lack of supplies and reduced production capacity forced business customers to pressure their suppliers for prioritisation. Governments realised the importance of keeping up freight flows, particularly for essential goods. However, it was difficult to get the orders fulfilled on promised delivery schedules.

Consumer markets, on the other hand, were pressuring supply chains for basic goods such as long-lasting good items and hygiene products. Crisis-induced buyer behaviour such as stockpiling and hoarding was triggering a bullwhip effect in supply chains and leaving retailer shelves empty (Roos et al., 2023). Larger order sizes were pushed through upstream in the supply chains which caused volatile production schedules.

During the second half of 2020, there was an unexpectedly fast recovery in demand markets as people adapted to new distant working conditions and transport chains functioned well, particularly for online purchases. Demand for certain goods such as consumer electronics, home decoration, furniture and food increased. This rapid recovery was accompanied by partial openings in several markets. This created a peak in demand which was difficult to be followed by production and transport capacity.

By October 2020, the projected decline in global trade was revised backwards to 9.2%. At the end of the year, statistics by the World Trade Organization (2022) revealed that the decline was lower than this projection; world merchandise trade volume decreased by 5.2% and global GDP contracted by 3.4% as shown in Figure 2.

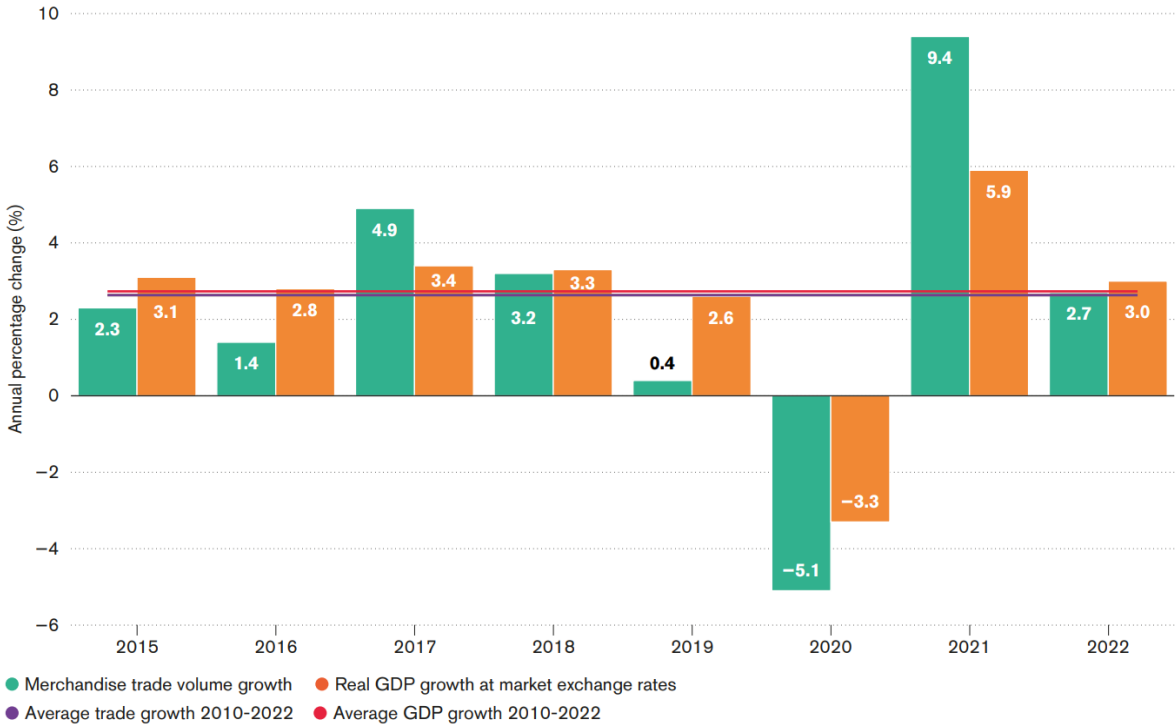


Figure 2. World merchandise trade volume and real GDP growth, 2015-22. Source: (World Trade Organization, 2023b), p. 30, referring to WTO for trade, consensus estimates for GDP.

2021 was a much better year in terms of recovery and global trade but it was also a year, in which there were new bottlenecks related to global logistics and transport chains, which led to



general price increases in goods and services. The upward trend in world trade did not last long and in 2022, the markets were shocked by Russia's invasion of Ukraine and the consecutive energy crisis. By October 2023, the global merchandise trade projections were reduced to 0.8% for 2023 and 3.3% for 2024 (World Trade Organization, 2023a). The actualised numbers during the last quarter of 2022 indicate further revisions to these numbers towards the lower end. The reason behind the current outlook is the energy crisis, the ongoing war and high inflation rates in major world economies which disrupt demand significantly.

## **2.4 Logistics and transport chains**

Early in the pandemic, international organisations and governments took a timely and early decision to keep freight flows running, especially for essential material. This enabled logistics channels to remain open. However, there were many problems for different traffic modes and transport infrastructure.

Road transport operators needed to tackle with long queues at the intra-European borders due to different regulations imposed by different countries. The drivers were under high risk of getting infected and they were asked to wait for health controls, rapid tests, and later, vaccination certificates, which caused a lot of delays for road transport. The blockages at the borders caused reduced hinterland transport capacity for container shipping. This had a negative impact particularly on repositioning of much needed empty containers but also effective flows of inland transport. In addition, special requirements for drivers on board of RoRo and RoPax vessels created problems and disruptions for land transport.

Rail freight operators benefited from the advantages of cancelled passenger trains, which enabled freight trains to run faster and more reliably. In addition, cross-border rail transport became the alternative for inter-continental shipping particularly from Asia to Europe. Recently introduced rail bridge services from East Asia to Europe were highly utilised due to port closures and port congestion in Asia, but also due to lack of air freight capacity.

Air transport was the most affected mode due to minimised passenger mobility and border lockdowns. This created massive layoffs at the airports and airline companies, which is still causing ripple effects on service quality and reliability levels in air transport. During the acute phase of the pandemic, passenger planes were used for freight only services in certain cases compensating for a lack of air freight capacity.

Urban logistics was one of the most active branches because of consumer lockdowns and a significant increase in e-commerce activity. Due to lockdowns, consumers used online shopping channels more than ever. This put a pressure on existing urban logistics infrastructure and service providers. New actors emerged such as voluntary organisations, NGOs, churches, neighbours who took the shopping orders from high-risk groups and delivered them. Many urban logistics innovations were introduced and tried out which enabled contactless deliveries, use of non-human deliveries, digital signatures, and the like.

The increase in e-commerce volumes created a pressure on distribution centres and warehouses. Some product groups were no longer sold at their former pace (e.g., textiles and wearing apparel) so they incurred very high inventory holding costs at warehouses and distribution centres. Providers of some other products enjoyed very high demand, such as for consumer electronics or home decoration products and they blocked available warehouse or urban depot space, because logistics could not keep up with the pace of orders. In the end, the inventory holding costs and storage costs increased significantly.

### 3 Container shipping through the pandemic

Container shipping was severely strained by several aspects of the pandemic crisis, which was frequently covered by general media. The very short story is that container shipping suffered from Chinese factories staying closed after the Chinese New Year in 2020 and there was no supply of goods to ship. Then the pandemic hit the rest of the world with closed warehouses and factories, creating a lack of demand for freight transport. The shipping companies responded by cancelling departures, so called blank sailings, and holding back ships from trading. When the demand increased unexpectedly fast, container shipping in a wide sense was not able to catch up and a series of disruptive events and a general lack of capacity haunted world trade for much of the duration of the pandemic. For a timeline over the pandemic including non-pandemic disruptions affecting maritime transport, see Figure 1.

This chapter focuses on how trans-ocean container shipping was affected by the pandemic, trying to give the broader picture, and going beyond the anecdotes covered in media.

#### 3.1 Disruptions in ports and hinterlands

The beginning of the pandemic marked a downturn in total port calls due to container shipping lines announcement of immediate blank sailings to adjust to expected volume declines. In 2020, the cargo vessel calls fell by 5.1 percent when compared with the previous year and most of this fall was realised during the first three quarters of the year (UNCTAD, 2022). The share of container vessel calls, however, was not as large as expected because blank sailings decreased after the third quarter of 2020, when container volumes began speeding up. The total reduction of port calls was more related to the breakbulk and RoRo/RoPax segments.

Ports tried to manage the crisis with measures such as sanitary protocols, reduced number of dockworkers per shift, social distancing, enhanced cleaning, and sanitising routines for operational equipment, longer shift changeover, the use of digital tools for in-person processes such as ship surveys. Country lockdowns created severe problems for crews, not least how to arrange for crew exchanges. The variance between country regulations also created delays in port calls or port operations. One of the biggest problems was the zero-Covid policy in China which caused long-lasting port closures at the busiest ports of East Asia. This created long delays and forced cut and runs, that is leaving a port before all the planned cargo exchange is ready, or route changes for many container lines.

The hinterland connections were disrupted as well and triggered an empty container shortage for the shipping lines. At the beginning of the pandemic, empty containers were distributed between various inland locations around the world. With the reduced frequency of vessels during the first two quarters of 2020, the repositioning of those containers was delayed. When the volumes picked up again during summer 2020, there was a significant empty container shortage at large ports and main trade lanes. Lack of hinterland transport capacity and factory or country lockdowns exacerbated the problem. The route with the highest willingness to pay was Trans-Pacific, particularly during the second half of 2020 and all of 2021. All available containers were repositioned to the Trans-Pacific routes, which caused a big problem for the other locations that struggled with finding empty containers. This became one of the reasons behind increasing container freight rates. Some shipping lines engaged sweeper ships, that is a special-purpose service for repositioning empty containers, to balance the supply and demand of empty containers.

Port closures due to infections or lockdowns created a knock-on effect for port congestion and reliability of container vessel schedules. Combined with the rapid volume increase in 2021, port congestion became a big problem particularly in US West Coast ports such as Los Angeles and Long Beach. The vessel queues outside the ports and the long delays in hinterland distribution created price increases at the retail level. This was followed by the announcement of The Ocean Shipping Reform Act (OSRA-22) which was introduced by the USA to protect US consumers and producers. Many forwarders and shippers filed claims at US courts against container shipping lines following this act.

Container port throughput took a dive at the onset of the pandemic, but not much lower than usually during the Chinese New Year. The difference was rather that it was slower to catch up again. Figure 3 shows that the port throughput varied considerably from November 2020 to November 2023, but most remarkable is that the common February dips were much less pertinent in 2021 and 2022. The ports have been busier than before the pandemic (January 2019 = Index 100 in the figure) over the full period.

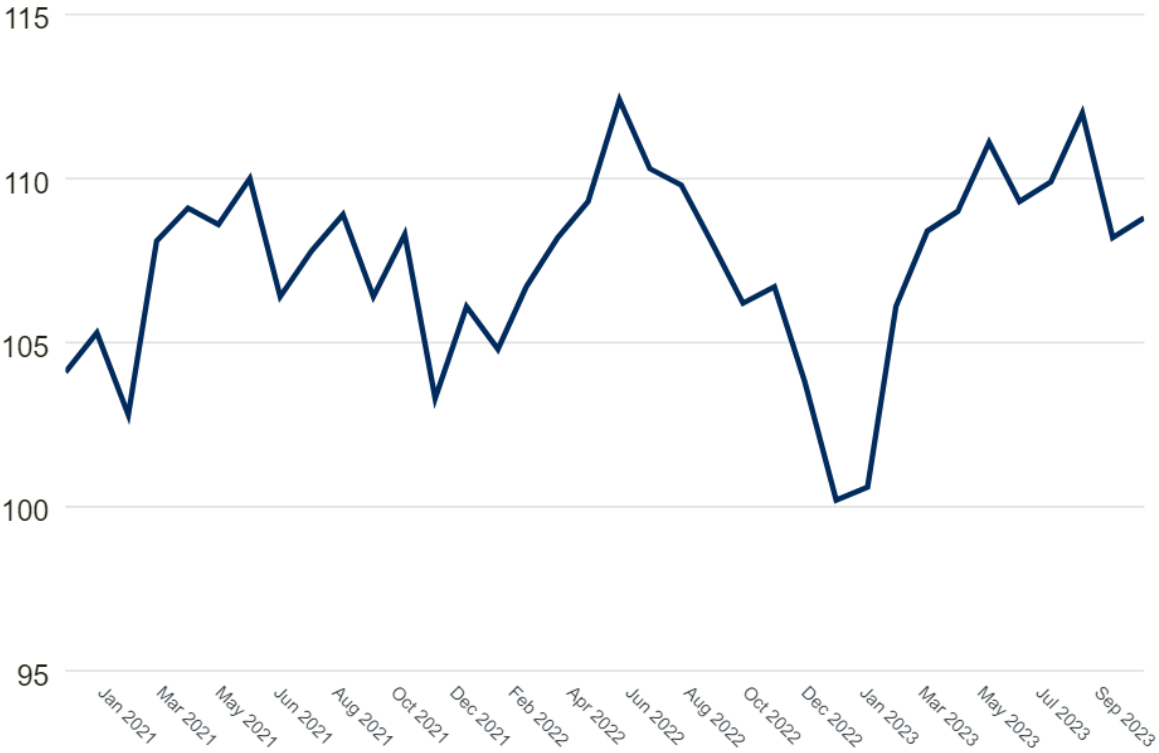


Figure 3. Drewry Global Container Port Throughput Index – January 2021 to December 2023. Jan 2019 = 100, calendar adjusted. Source: Drewry, 2023: <https://www.drewry.co.uk/maritime-research/maritime-research-related-content/port-throughput-indices>

The severe congestion in the San Pedro Bay ports of Los Angeles and Long Beach meant that large shippers such as IKEA, Walmart and Home Depot responded by chartering somewhat smaller container vessels to get products into the USA through smaller ports in California. The Biden administration pressured California ports and unions to work around the clock. It was a clear sign of how serious the situation was perceived as it is not common that the US government sets out to micromanage ports. To keep up capacity, shipping lines also moved ships to the Pacific Ocean and creating a shortage of vessels at other routes.

### 3.2 Disruptions at sea

Container shipping during the pandemic was marked with capacity shortages in all aspects. Chartered vessels went off hire at the beginning due to volume contraction expectancies, blank sailings reduced weekly capacities at ports, empty containers were not available where they were needed the most, and labour shortages hampered both ports and vessels due to crew change crisis. All these problems in combination impacted reliability of liner shipping significantly. It could take several months to move a container from East Asia to Central USA, which used to take 45 days on average before. The congested ports on the US West Coast and in China tied up significant vessel capacity. The shipping lines responded by relocating vessel capacity to the Trans-Pacific route with the highest willingness to pay, affecting routes worldwide. One of the major shipping lines reported that they needed to deploy some 25% extra capacity to uphold freight flows during the midst of the pandemic.

The large volatility in transit times, combined with heavy consumer demand at the retail and online commerce end created a so called bullwhip effect (Forrester, 1961), which in short, explains how disturbances propagate in several stages of a supply chain which overreact to demand signals with a lack of proper consumption information. The time pressure from the shippers forced shipping lines to let go of slow steaming targets and the usual year-by-year reductions of CO<sub>2</sub> emissions was replaced by an increase. This is explained by Maersk:

*“Compared to emissions in 2020, we did not continue our downwards trajectory towards the EEOI target in 2021, as we saw an increase in our emissions intensity/EEOI of 6.9%. The increase is related to global supply chain disruptions, as vessels sailed at maximum speed to make up for lost time, and reefer containers ran overtime to protect delayed foods and perishables.” (Maersk, 2022), p. 20.*

In essence, many shipping lines just speeded up at sea to join the queue at anchoring areas outside the ports, while struggling to keep their promised transit times during the pandemic. More positively though, the shipping lines continued and often even intensified their commitment to curb emissions in the future by ordering vessels for fossil free fuels or at least prepared for using such fuels.

### 3.3 Freight rates

The reduced capacity combined with very quickly recovering demand caused a significant increase of container freight rates. According to Drewry’s World Container Index, the average freight rate for a 40-foot container shipment from Shanghai to Los Angeles, which was between 2 000 and 3 000 USD for many years before the pandemic, raised above the 12 000 USD level by the end of 2021. Lack of space on vessels, port congestion, lack of empty containers, increased demand for available capacity and other bottlenecks such as the Suez Canal blockage created this sharp increase. 2020 and 2021 were years when orderbooks for container vessels were meagre and little capacity was delivered, which exacerbated the capacity situation. Figure 4 shows how the supply and demand of container shipping have developed since 2007.

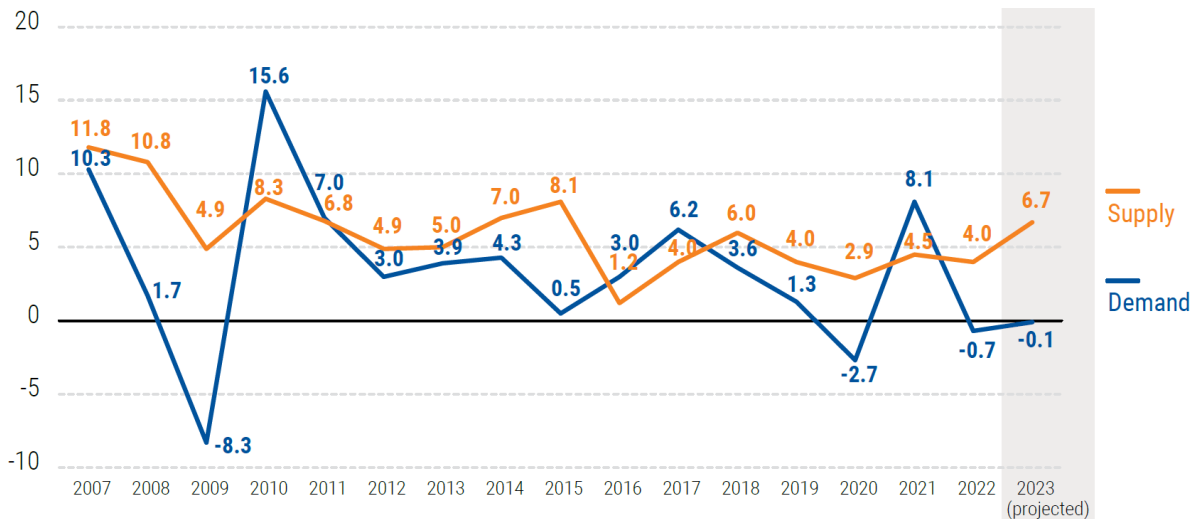


Figure 4. Growth of demand and supply in container shipping, percentage change, 2007–2023. Source: UNCTAD (2023), p. 44.

Note that the volatility of the demand was much more significant during the financial crises 2008-2009 and its aftermath than during the pandemic.

The freight rates in Figure 5 relate to the spot market prices. Shippers and shipping lines also sign period contracts with a set price up to a certain volume and these were affected first when the periods expired. During the most turbulent time, however, it was very difficult to strike deals over medium periods as both parties were exposed to significant risk and preferred either spot market prices or very long contracts less dependent on temporary fluctuations. Furthermore, the price hike only applied to export out of China – observe how the freight rate on the balancing leg to China kept low throughout the pandemic. This was obviously favourable for Swedish export to Asia.

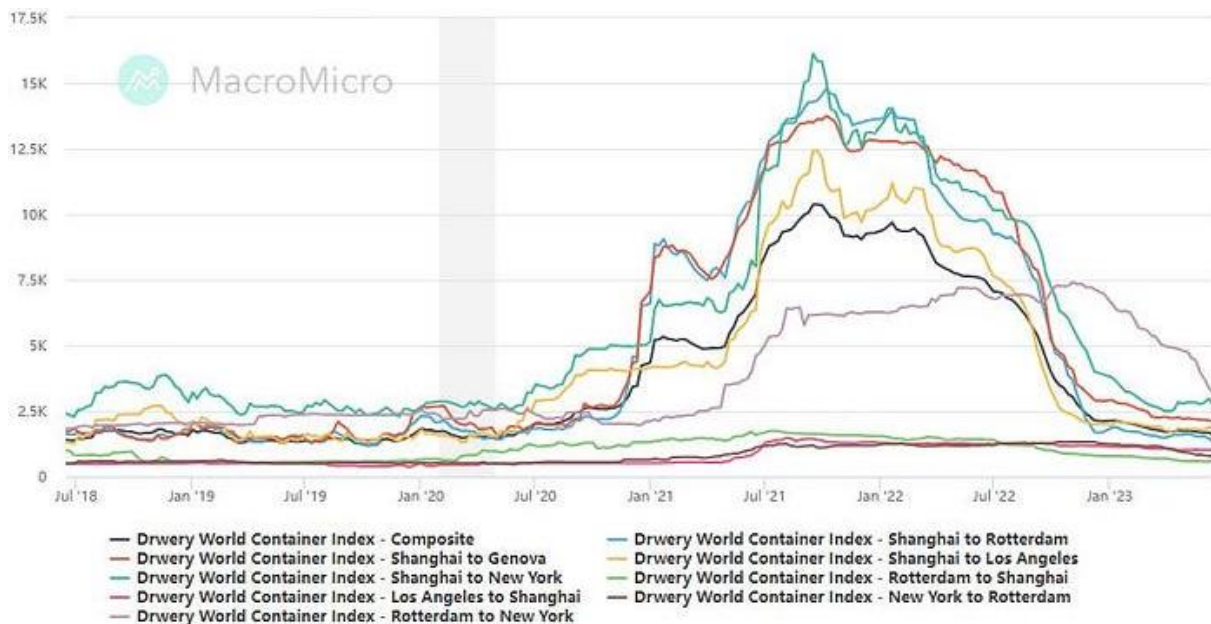


Figure 5. The Drewry World Container Index July 2018 to July 2023. Source: Medium, 2023: <https://medium.com/@dillbe/container-freight-rates-stabilize-returning-to-pre-covid-levels-3cbe1d9189b4>.

By the end of 2021, the troubled conditions in liner shipping markets forced many large shippers to opt for alternative solutions such as chartering ships to transport their own cargo, leasing their own containers (e.g. IKEA, Walmart and Lidl), insourcing logistics for better control, switching to alternative modes of transport such as long-haul cross-border rail (China-St. Petersburg service) or moving inland freight in bulk or breakbulk due to lack of empty containers in hinterland locations.

Freight transport is a derived demand based on that the value of a product is higher in another location, and the difference is larger than price of the transport service. The extremely high freight rates thus constituted a specific type of disruption to many shippers as the price difference was lower than the transport cost. It simply did not make economic sense to transport between continents.

Although it was a tough period for supply chain managers and shipping lines that struggled with keeping up the service levels, financially it was one of the best periods ever for many liner shipping companies. Container shipping lines followed different strategies in response to this rate increase. Some went for spot market rates and booked every available capacity unit at the spot market rate instead of filling the space with containers under period contracts with customers. Some others kept honouring the period contract rates which were significantly below the spot market prices. This built trust among shippers and allowed these shipping lines to sign new long-term contracts at the beginning of 2021 at high rates compared to spot market rates, which started to decrease in 2022 and has continued so during 2023.

Despite that shipping lines suffered from significantly increased costs, their profits mirror the freight rates boom during the pandemic. After many years of modest returns, the large container shipping lines reported profits of 364 billion USD for 2021 and 2022 (Murray and Patel, 2023) with profit margins above 50% as shown in Figure 6. Such dramatic volatility is common in tramp shipping, but virtually unprecedented in container liner shipping.

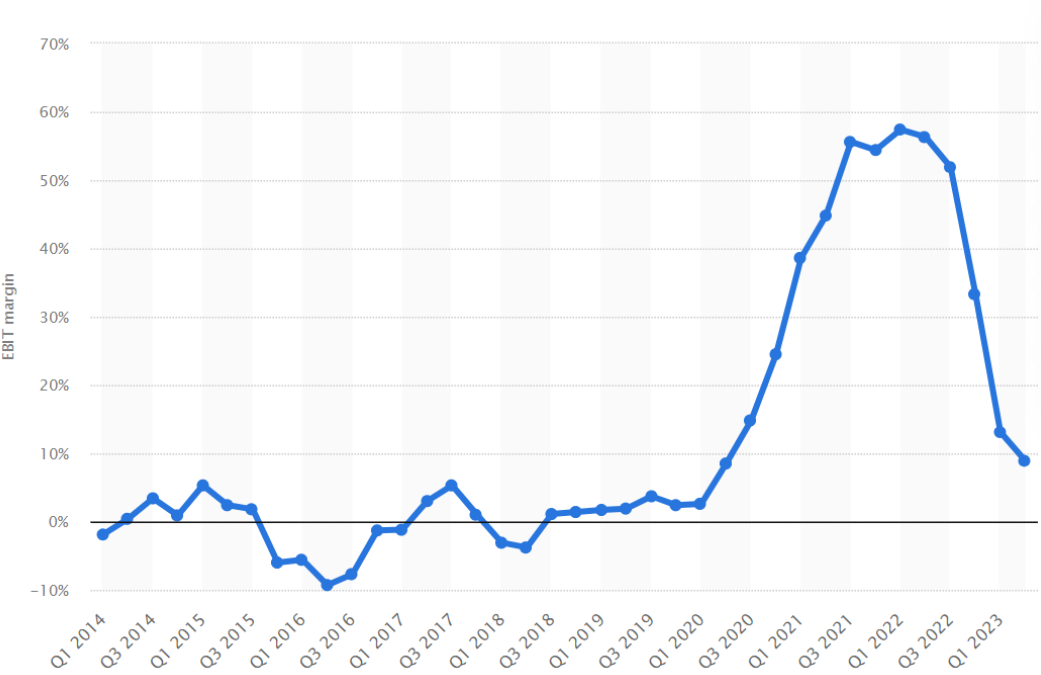


Figure 6. Average Earnings Before Interest and Taxes (EBIT) margins of main container shipping lines from the first quarter of 2014 to the second quarter of 2023. Source: Statista, 2023: <https://www-statista.com/statistics/1263780/ebit-margins-of-container-carriers-by-quarter/>.

Especially in the US, voices were raised for regulation or at least to curb the over-profits of shipping companies. However, it testifies to ignorance of the shipping market and a certain lack of history. Shipping markets have always gone up and down, but the short-term highs are often followed by “seven difficult years” and as recently as 2017 Hanjin, the world’s then seventh largest container shipping company, went bankrupt. As a steady supply of shipping services is needed for world trade, governments can not only regulate away the highest freight rates, but also need to protect shipping lines in bad times. Stable access to container shipping at reasonably predictable prices was in fact the reason why container shipping for a very long time enjoyed exemptions from the tough competition laws in both the EU and the US. However, it is doubtful if it would have helped if the shipping companies had been allowed to continue coordinating capacity and prices within so-called liner conferences during the pandemic. Moreover, the problems were rather in the ports and inland transport this time.

The high profits made by container shipping lines during 2021 and 2022 are now, although prospects for 2023 and forward are far less positive, visible in new investments. The usual pattern is that temporarily high profits in the maritime sector are used for buying competitors or ordering new vessels, often strengthened by banks and private capital willing to lend. The time lag to deliveries is the normal reason for freight rate collapses. This time, however, the market concentration implies that further horizontal integration is likely to violate competition laws.

Particularly MSC follows its tradition of organic growth and has ordered new vessels, signed long-term charter contracts and bought second-hand vessels to gain economies of scale (Li, 2023). At the end of 2023, the container vessel orderbook is the largest ever and corresponds to 32% of the current fleet (Janson, 2023), but Maersk and some other large container shipping lines rather integrate vertically by investing in forwarding as well as road and air transport operations to cover a larger scope of the transport chains. They also invest in inland terminals and logistics infrastructure. Some of them increased investments in digitalisation, tracking and connectivity equipment in particular (Raza *et al.*, 2023). All these show signs for an increased control over the end-to-end transport chain by container shipping lines. In a comparison of the strategies of MSC and Maersk, The Economist (2023) finds that MSC goes for scale while Maersk aims for scope by integrated services, precision and flexibility by use of big data. With different strategies and increased size, they have decided to break up the 2M alliance trying to avoid further commoditisation of container shipping.

The composite container freight index was depressed in the autumn of 2023, even below 1 400 USD, but the attacks in the Red Sea and that shipping lines choose to go around the Cape of Good Hope has induced a steep increase to 4 000 USD, as is shown in Figure 7. By 24 January 2024, the container freight rate index from Shanghai to Rotterdam is at 5 000 USD per 40-foot container.

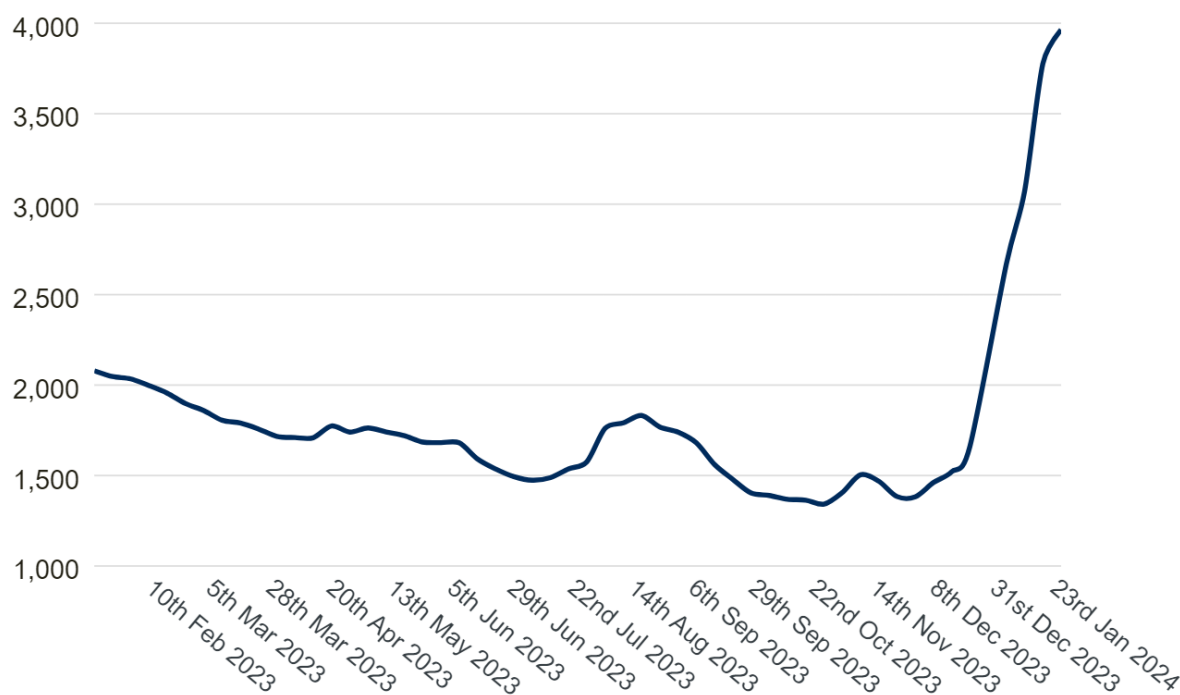


Figure 7. Drewry World Container Index (WCI) 10 February 2023– 24 January 2024 (US\$/40ft). Source: Drewry, 2024: <https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise/world-container-index-assessed-by-drewry>.

The current hike in freight rates reflects problems on the supply of shipping, the demand is expected to be low in the foreseeable future. Many financial institutions and other experts expect a trough scenario for container shipping the coming years (see, e.g., Janson (2023)), i.e., just the opposite of what shippers experienced during the immediate aftermath of the pandemic. The current high inflation rates and recession expectations in major world economies are also attributed to long-lasting depressed container freight demand. The freight rates are also affected by increased capacity with new incoming vessels and newly built empty containers.

### 3.4 Non-pandemic disruptions

Also, other events affecting container shipping added to the disruptions caused by the pandemic.

#### 3.4.1 Suez Canal blockage in March 2021

The blockage of the Suez Canal was an unexpected incident which exacerbated the problems in liner shipping. On average 80-90 ships pass Suez Canal every day. The container vessel Ever Given ran aground on 23 March 2021 at Suez Canal and the blockage lasted for six days. The blockage caused long vessel queues on both ends of the canal. By the end of the third day, some vessels were diverting to the longer route around Cape of Good Hope. The alternative route had a longer distance and added ten days to a regular sailing via the Suez Canal.

The canal blockage caused disruptions to all cargo flows including containers, crude oil, dry bulk, LNG, and even of livestock. The blockage caused an immediate increase of oil prices due to uncertainty, inventory problems for a large variety of consumer goods and manufacturing components. The blockage made the conditions for empty container availability worse as many of the vessels in the queue were positioning empty containers.



The vessel was salvaged after almost a week but kept in custody until 7 July until a financial settlement was reached, and the vessel could leave the canal area, after 100 days of delay. It was dramatic and had major effects as the transport system worked at full capacity, but in normal times it would have come into a balance rather quickly. It's like a puncture at a city road that goes unnoticed on a weekend night, but in rush hour traffic, it's all the more noticeable.

The legal aftermath is truly complex due to the truly international character of shipping implying that several jurisdictions are involved. In the case of Ever Given, it was:

- owned by Japanese Shoei Kisen Kaisha,
- chartered and commercially operated by Taiwanese Evergreen,
- operationally managed (ship management) by German Bernhard Schulte,
- crewed by Indian seafarers,
- registered/flagged in Panama,
- certified by the classification society American Bureau of Shipping,
- insured by UK P&I Club, and
- carrying goods for forwarders and shippers from many countries.

To shipping, probably the largest effect of the Suez Canal closure was that the sector was highlighted in the public media explaining that the convenience of daily life in the western world depends on smooth container shipping.

#### *3.4.2 The Russia – Ukraine War*

Aside the terrible suffering on the personal level, massive material destruction and the violation of international law, Russia's invasion of Ukraine also affected container shipping. The war started just weeks after the last Covid-19 restrictions were lifted in Sweden, and container shipping was still affected by the imbalances caused by the pandemic. Among effects were that Ukraine ports could no longer be called and that a significant number of containers destined for Russia was offloaded and clogged Western European ports (Bergqvist, 2022) and sanctions against Russia has complicated trade. In the longer run, however, it is likely that the largest effect on container shipping is that it adds to the geopolitical tensions reshaping global supply chains.

#### *3.4.3 Low water level in the Rhine during summer 2022*

The environment also affects container shipping and the dry weather in Continental Europe resulted in low water levels in the Rhine during summer 2022. It mostly affected bulk segments, but the barges serving the hinterlands of Rotterdam and Antwerp suffered from capacity constraints as barges could not be fully loaded. The effects on Swedish actors were limited, though.

#### *3.4.4 Low water level in the Panama Canal from autumn 2023*

Swedish shipping companies are, however, affected by the drought in Panama significantly reducing the capacity of the Panama Canal from the autumn of 2023. Too little rain feeds into the Gatun Lake limiting the depth of the seaway, but the lake also feeds the canal's locks and provides drinking water in the region. To save water, the capacity is announced to be halved over the winter season 2023-24. Climate change is likely to cause more frequent drought problems

for the Panama canal, which incentivises plans for alternatives to pass between the Atlantic and the Pacific, mainly land-bridge services by rail (The Economist, 2024).

The delays to pass the Panama canal are much longer than those caused by Ever Given in the Suez Canal and although it ties up vessel capacity, it is only marginally affecting container liner shipping connecting Sweden. Shipping segments serving the oil and automotive sectors are more affected. If it would have happened during the peak of capacity constraints, however, it would have seriously affected also container shipping serving Swedish shippers.

#### *3.4.5 Attacks in the Red Sea from Houthi rebels in Yemen from December 2023*

In mid-December, Houthi rebels intensified attacks on vessels passing the Bab al-Mandab Strait, connecting the Red Sea and the Arabian Sea as a reaction to the situation in Gaza. Initially, they attacked vessels with Israeli owner interests, but then extended to vessels they believed would call Israeli ports and eventually hitting shipping indiscriminately. The situation is different than during the Ever Given incident as there is not only a delay at stake; there is an actual risk of a total loss of crews, vessels and cargo as well as contaminating water and beaches. In addition, it is not a definite stop and there is no estimate of the duration. Hence the shipping lines need to undertake very difficult risk assessments.

Major container shipping lines, such as Maersk, MSC, CMA CGM and Hapag-Lloyd, first ordered their vessels to stop, and later ordered them to take the significant detour around Cape of Good Hope. The delay depends on the ship's location when deciding to detour but it implies roughly two weeks of delays. There is an option to speed up to regain some lost time, but it is not likely with a market situation with excessive vessel capacity. Somewhat contradictory, the stocks of the listed container shipping lines increased significantly upon the news (Miller, 2023), but it is logical as the detour ties up some of the excessive capacity and freight rates are pushed upwards. The detour obviously increases operational costs, mainly bunker costs, but shipping lines avoid the Suez Canal fee and save on insurance war zone premiums.

## 4 Pandemic disruptions as perceived by Swedish actors

The announcement of the Covid-19 pandemic from the World Health Organization (WHO) in March 2020 gave rise to global world trade uncertainty and unexpected effects for logisticians and transport operators. In the case of Sweden, supply chain actors, such as exporters, importers, and freight forwarders, have been negatively affected by lockdowns, lack of empty containers, high container freight rates, and insufficient port capacity. Also shipping lines suffered from port congestion, insufficient service levels and troublesome crew changes but of course prospered from high freight rates. Although previous disruptions like the 2008 financial crisis and the 2017 port conflict in Gothenburg disrupted the supply chains, the pandemic brought additional unforeseen difficulties like the Suez Canal blockage and soaring freight rates, provoking the perfect storm for supply chain actors.

These effects are presented from four perspectives: global trade and supply chains; logistics and transport freight consequences; pandemic repercussions on the container shipping sector; evaluation of non-pandemic disruptions. This chapter departs from the global situation pictured in the above chapters, interprets it from a Swedish perspective based on interviews with representatives from firms based in Sweden.

### 4.1 World trade and supply chains

During the acute phase of the pandemic, the global supply chain management system suffered from unpredicted delays, high freight rates, and a lack of performance.

Enforced lockdowns in China constrained the workforce, resulting in limited production and decreased productivity. Government restrictions and safety measures reduced port dockers' operations. Lower port rotation induced port delays and uncertainty about delivery accuracy. This resulted in missed seasons for retailers and time windows for event managers, and lack of a dependable transport capacity.

Container port delays affected feeder services, and specifically the intracontinental feeder leg of long-haul transport between continents. The biggest European ports, i.e., Rotterdam, Antwerp, and Hamburg with extensive hinterland demand and high terminal efficiency, prioritised direct shipping-line connections over feeder services. Asian ports with high transshipment traffic, in comparison, protected feeder services. Consequently, feeder companies suffered longer waiting times and delays, and customers in Sweden experienced uncertainty and frustration due to their dependency on feeder services. As an example, in December 2022, a feeder vessel could wait nine days in Rotterdam after being rejected in Hamburg due to a lack of space in the terminal. In parallel, due to government restrictions and lockdowns, RoPax traffic disappeared on some routes, like Finland-Sweden, and has reduced vessel capacity on specific routes. This also affected the container segment as some containers are moved by RoRo and RoPax services.

The increase in lead time and lack of capacity caused a decrease in schedule reliability from 80–90% in 2019 to 20% during the pandemic and an increase in vessel rotation time by one to two weeks on the route between Europe and Asia. As a result, shipping line performance decreased, provoking uncertainty about delivery accuracy and problems with freight distribution.

Due to port delays, vessel speed increased in parallel with the increase of oil prices and freight rates during the summer of 2020. Charter costs tripled, and other freight transport services in Europe, like rail transport and short sea shipping, suffered from increased prices too. Initially, customers complained about the increase in freight rates, and even after accepting this global

situation, they were more concerned about the lack of performance in terms of lead time and called for better service. According to a freight forwarder, customers were paying six times the price for a product that was ten times worse than before the pandemic. In fact, since the beginning of the pandemic, the service reliability performance decreased from 70% to 20–30% when it was the worst, mainly due to unreliable information about delivery accuracy. In this regard, the delivery on-time precision from shipping lines decreased by 30–35%, and Swedish customers suffered extra costs for the distribution and unloading of containers.

Furthermore, shipping lines began renegotiating their contract agreements to handle the extra cost of high charter rates and oil prices. The shipping lines had more market power to negotiate the conditions than shippers had, and agreeing on specific volumes in the contracts was difficult. Due to the complexity and uncertainty, negotiations between shipping lines and shippers focused more on regional markets than globally.

During the autumn of 2020, global production increased in response to a higher consumer demand. Feeder transport services experienced an increase of 25% in tonnage, and the share of import grew because of the success of retail companies. However, world trade suffered from port delays, lockdowns, and a lack of vessels, resulting in a performance setback. Thanks to increased volumes and freight rates, shipping lines experienced increased profit margins, but negatively affecting the end customers, who needed to absorb the higher costs.

Based on previous disruptions, some companies initially compared the pandemic situation to the 2008 financial crisis. However, the effects of the lack of port capacity and high freight rates differed from those of the previous crisis. Furthermore, the solution of rerouting vessels to small or new ports during the port disruption, was not feasible during the Covid-19 pandemic because lower port rotation limited the number of ports available to shipping companies.

## **4.2 Logistics and freight transport in general**

Due to unreliable information, lower service performance, and higher costs during the pandemic, the interviewed companies improved their communication with customers and invested in warehouse storage capacity.

On the one hand, the increase in freight rates and the decrease in performance led to difficulties for freight forwarders when negotiating capacity and agreeing on rates with importers and exporters. This situation caused a rise in workload. Companies adapted their management processes with more flexible and precise procedures, new strategies, and an enhanced flow of information to and communication with their customers. Furthermore, shipping companies recruited new staff for customer service and ICT development, and while working remotely reduced daily physical interactions and changed routines, employees worked harder and more efficiently to deal with the challenging situation.

On the other hand, the problem of inaccurate information led to complexities in the planning process and the tracking-and-tracing of goods. Consequently, the warehouse storage and distribution process suffered further delays. To deal with this situation, companies needed more space to store their goods due to an increase in volume and unstable delivery of containers. Thus, they started to build new warehouses, which increased their capital costs.

## **4.3 Container shipping**

During the pandemic, lockdowns and decreased productivity prompted port delays, uncertain delivery accuracy, and a lack of port and vessel capacity. Companies suffered from a lack of container availability and reliable information.

The insufficient space in ports and longer lead times meant many empty containers and caused a container shortage. Some shipping lines could not load their cargo on a vessel, and consequently, they suffered from an accumulation of approximately 5–10% of the total number of containers in their facilities.

This situation affected the export process, warehouse capacity, and freight distribution. Shipping lines and freight forwarders faced difficulties in controlling the flow of containers, planning, and finding available capacity. To handle this situation, they improved and intensified the dialogue between customers, terminal operators as well as port authorities and shifted their cargo to other traffic modes. For instance, in Gothenburg the container shortage shifted 80–90% of freight from road to rail delivery. At the same time, some retailers used a combination of two ports, Norrköping and Gothenburg, to facilitate and manage their cargo and warehouse capacity.

#### **4.4 Non-pandemic disruptions**

Due to port service delays and a lack of vessel capacity during the Covid-19 pandemic, several shipping lines operated old ships, which had a harmful environmental impact. Also, from a transport perspective, the lack of truck drivers and rail wagons caused severe consequences for the reliability of the flow of goods. During the pandemic and specifically through the predominance of the Omicron variant from November 2021 (Fourth wave in Figure 1), the shortage of truck drivers was quite problematic. The rail wagon shortage added to longer lead times and additional business management efforts to handle the need to procure wagons to move cargo.

Swedish container supply chain actors have faced additional challenging situations during the pandemic. First, the Suez Canal blockage in March 2021 caused operational chaos and uncertainty in maritime transport. This disruption was not directly related to the pandemic, but indeed produced additional damage for actors in the supply chain since there was no slack in the system to sort out the imbalances caused by the blockage of the canal. Second, the current high inflation rates involve a long-term economic risk for feeder companies because they will deal with higher costs, which could lead to financial losses.

Third, Swedish supply chain actors suggested that the industry, mainly the transport providers, must deal with future challenges. On the one hand, that means high expenditures on green technology. New maritime environmental regulations, such as including maritime transport in the EU Emission Trading System, and technological innovations require substantial investments. Examples are rebuilding vessels, installing new batteries or preparing engines for alternative energy carriers for operating vessels. On the other hand, from a land-transport perspective, the new labour regulations and salary conditions for truck drivers will make it even more difficult to find available truck drivers in Continental Europe and Sweden in the future. It is also critical to create a stable supply of locomotive drivers because Sweden's industry is highly dependent on rail freight.

# 5 Countermeasures and recovery from disruptions

There were different countermeasures undertaken by Swedish maritime supply chain actors to mitigate the consequences of these effects. These countermeasures were observed in 2021 when the actors tried to recover from acute pandemic-related disruptions while still tackling with new disruptions such as the Suez Canal incident, lack of empty containers, soaring freight rates and, just after removing the last restrictions, the Russia-Ukraine War. It was only during Q3 and Q4 of 2022 the freight rates started to decrease and as of May 2023, container freight rates went back to pre-pandemic levels and even lower.

Supply chain resilience, in very basic terms, depends on two fundamental strategies: flexibility and redundancy. The recovery measures that are mobilised during the disruptions are grouped under these two categories and one additional group, in which support measures are presented.

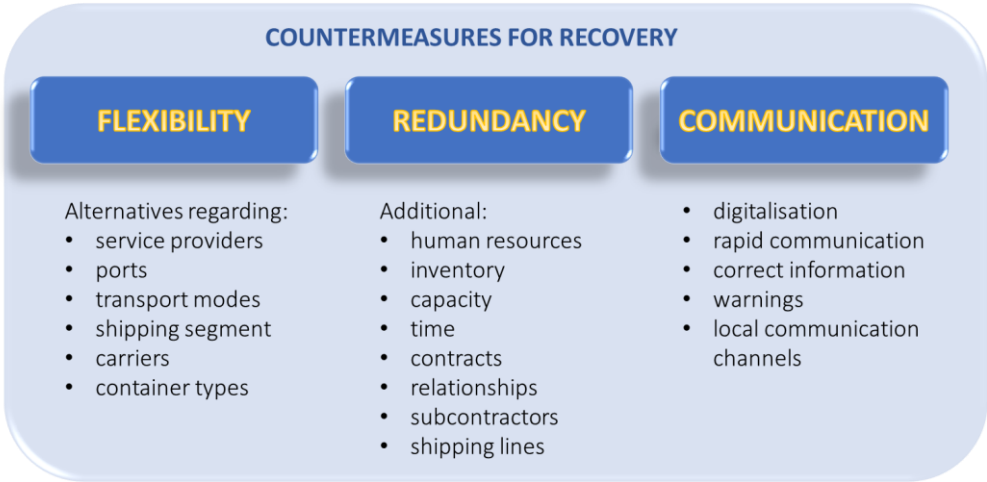


Figure 8: Overview of countermeasures for recovery. Source: Own elaboration

The findings in this section reflect the mitigation and recovery strategies applied by Swedish actors in supply chains involving container shipping such as exporters, importers, shipping lines and freight forwarders.

## 5.1 Flexibility measures for recovery

Organisational flexibility is by Dubey *et al.* (2021) defined as “the ability of organisations to deploy resources quickly, efficiently and effectively in response to sudden changes in the market conditions”. During the acute phase but also during the later stages of the pandemic, organisations tried to mitigate the effects by adding and deploying alternative service providers, alternative ports, alternative transport services such as shifting to air, break-bulk, rail or RoRo shipping, alternative shipping lines and even alternative container types when it was difficult to find a certain type.

Flexibility was achieved by switching between these alternatives when needed, changing routes, adapting pre-carriage and on-carriage based on these changes to keep the flows ongoing. All these alternatives enabled the companies to spread their risk. Some of these flexibility measures remained in the market even after the pandemic as they depended on long-term contracts. A portion of containerised cargo is now lost to break-bulk for instance. Ocean-rail combinations were widely accepted in the market but were later hindered by the Russia-

Ukraine War. Self-chartered vessels resulted in some companies entering the shipping business, such as Lidl running its own shipping line, Tailwind, now.

One way of creating flexibility was through good relationships with maritime supply chain members. Some ports served as storage spaces for shippers who needed more warehouse capacity. Some end customers were convinced to adapt to a high variety in lead times which required them to introduce substitute products or additional waiting times for highly customised product deliveries.

Shipping lines increased their capacity to match the demand that kept on increasing after the acute phase of the pandemic and during the Russia-Ukraine War, but they also adapted it quickly to the lower demand in 2023. The main recovery action for shipping lines is exercising dynamic capacity management strategies. Examples are hiring on charter markets during demand peaks and slow steaming or scrapping during low demand periods.

When it was not possible to find the required space on vessels, shippers needed to settle for flexibility regarding the quantity of shipments. Less-than-container-loads (LCLs) became a safer option because they were on board on each sailing so flexibility in order sizes to fit into smaller shipments became one countermeasure for recovery, particularly during the capacity shortage. Flexibility in order size did not only result in LCL shipments but also in changes in order quantity in every sailing as this was a risk mitigation measure to avoid missing a vessel due to a large booking. Another way to tackle with this was the ability to change the order mix. During the recovery phase, customers started to mix and match the orders based on prioritisation of needs, which was highly dependent on demand data or point-of-sales data from the stores. Shipping lines were also dependent on this demand data, so they started asking for long-term booking forecasts from their customers to be able to predict demand and provide capacity. This resulted in elimination of some flexibility which was an accepted norm before the pandemic: book one vessel and if production cannot make it then you roll onto the next vessel. During the later stages of the pandemic, some shipping lines introduced no-show fees and started to exercise the minimum quantity commitments in period contracts more strictly than before. This eliminated some degree of flexibility but allowed for better predictability.

Long-term period contracts normally represent a lack of flexibility in shipping operations because they have a lock-in effect with shipping lines and the volume commitments. However, during this period, contracts have been a mechanism of recovery through both assuring a degree of security but also enabling some degree of flexibility on the contract terms. Some shippers were secured against high peaks in freight rates because the shipping lines kept the contract rates, which at the time were considerably lower than the spot rates. Contract holders could get some share from the scarcely available capacity, so the contracts became a prioritisation mechanism, or in other words, they were used to prioritise customers. Some of the conditions of contracts were relieved mutually to create flexibility in the system. Hence, the number of customers that demanded to sign volume contracts increased both in 2021 and 2022 during the period of recovery and the contract durations got longer than normally observed in container shipping markets. This was a response to the experience of very high spot rates and shippers wanted to secure at least a base volume covered by contract rates, as some shipping lines limited the number of shipments offered to holders of period contracts and the remaining transport capacity was sold on the spot market.

## 5.2 Redundancy measures for recovery

Redundancy has been a key tool in tackling the disruptions and creating some buffer in the system. Redundancy was basically shaped around increasing the number or size of ships and port capacity. Additional human resources, inventory, capacity, time, contracts, relationships, subcontractors, shipping lines, all supported the ability to recover from the negative impacts.

The disruptions themselves revealed the need for skilled labour that can solve problems within a short time, take initiative during a time of crisis or build relationships to create alternatives during lack of capacity. Respondents from liner shipping companies stated that although it was a period when their business thrived in financial terms, it was also a period where a record number of problems occurred, and they needed to work more than ever to keep operations going smoothly. A similar situation was observed at the shipper end where additional skills were needed to solve logistics problems, monitor, plan and develop alternative solutions for the next bottleneck in the system.

On the other hand, to create redundancy in the system, one needs to have alternatives. During the container shipping crisis, however, there were not many alternatives for overseas shipments. Therefore, the shippers working on spot rates were obliged to make it to the contracted sailing, otherwise the rate agreements were changing. The shippers who were protected against these price changes were the ones who had period contracts with the shipping lines. Therefore, many shippers kept on signing long-term contracts even in 2022 to secure freight rates against market uncertainty.

One important recovery measure that stayed even after the pandemic is having buffer inventory and buffer warehouse space. However, it was almost impossible to find this storage space at Asian factories or warehouses which were already full due to lack of capacity on vessels. Therefore, extra storage capacity was created in Europe and in Sweden. The need was not only due to low reliability of ocean sailings but also high increases in market demand.

Buffers in planning horizons became a norm during the recovery phase as well. As the market became more used to lack of capacity, both shippers and freight forwarders tended to pull the planning horizons to earlier than regular dates and adapt to longer lead times. Time buffer enabled some security in bookings if good forecasting could have been done earlier than others who competed for the same space. Low levels of reliability resulted in new working practices in the maritime supply chain such as adding buffers to transit time offers.

## 5.3 Information and communication to facilitate recovery

Communication and managing relationships between maritime supply chain members have been one of the key recovery measures (Caballini *et al.*, 2022). During the labour market conflict at APM Terminals in Port of Gothenburg culminating in 2017, digitalisation and sustainability projects were postponed, while such projects were rather intensified during the pandemic (Rogerson *et al.*, 2024). New environmental regulations are introduced at a steady pace, and shipping lines cannot call or fax to customers when millions of containers are in the wrong place.

These measures facilitated the ability to both inject redundancy in the system and create some flexibility. Considering the number of problems that were handled every day during the time of crisis, building rapid communication channels and quick decision making was the key. Furthermore, an important aspect that was emphasised by almost all the respondents was getting the correct information or the warning about the possibility of a disruption, be it missing a



transshipment or being stuck during the Suez Canal blockage, as early as possible. Such knowledge supported the ability to create alternatives and mitigate the negative consequences of disruptions.

On the other hand, the crisis was global and so is the container shipping industry. The lack of capacity, high rates, lack of reliability were all global problems. Contracts, space allocations were signed at the headquarter offices, and communication is rather formal at that scale. Some respondents stated that Sweden is not the prioritised market when global volumes or rates are being negotiated centrally. Therefore, being local and managing local communication channels with shipping lines has been beneficial for some shippers and freight forwarders. Such local relationships facilitated decision making in favour of Swedish actors when there was flexibility in the system. Personal relationships then played an important role instead of digital communication channels or technological systems. Furthermore, there were situations when existing digital systems, for instance track and trace of containers within shipping lines and ports, were outdated or did not provide the correct information. This revealed the need for more effective digitalisation in the industry for better information output during the recovery period.

Also, some differences were observed between small and medium-sized companies and larger ones when it comes to communication demands. As the larger companies have more resources to follow the developments, it was easier for them to manage the crisis situations. Small and medium-sized companies needed more resources from other maritime supply chain actors such as freight forwarders and shipping lines to get access to the most up-to-date information. Different communication strategies were followed to handle these differences between companies. Closer communication procedures between maritime supply chain partners seem to remain after the pandemic as a business norm and as a contingency measure.

## 6 Preparing for future disruptions

The pandemic and the forthcoming crises over the horizon seem to have changed the way how maritime supply chain members work. A quote from one of the respondents clearly showed this: “... *And the pandemic has been a bit of a stress test, testing how we ... how do we solve things out of the ordinary, and be forced to do things*”. This chapter brings forward thoughts on how the pandemic and current crises might change supply chains in the future. The findings are still preliminary, though, as there are multiple avenues the development can take.

### 6.1 Increased stock levels

One big change is expected to happen in warehousing and inventory management. Respondents expect that most firms will keep more buffer inventory along the supply chains, and it will be easier to convince managers to hire and insource warehousing space for contingency plans. This has created a big change in the operations model which previously focused using subcontractor storage when needed and never investing in own warehouses. Considering the ongoing uncertainties in global markets, increased control and buffer inventory is expected to remain for a longer duration. On the negative side, though, is that high interest rates make stockkeeping very expensive.

### 6.2 Redundancy in transport chains

One negative consequence after the pandemic, and the container shipping crisis, has been the switch to other traffic modes. Lack of empty containers and the bottlenecks in regular container liner sailings resulted in many shippers switching to land transport services. Respondents do not expect that all this traffic will switch back to short sea shipping as the supply chain actors are more sensitive to disruptions now and they do not want to risk the lead times again.

On the other hand, together with other strategic drivers the increasing importance of logistics triggered some container shipping lines to vertically integrate further. They aim at controlling the shipments from door to door by providing the logistics and supply chain management services at the points they are needed. The container shipping lines moving into logistics service provision aspire to shape the future of long-distance logistics and they affect the positions of some actors such as freight forwarders currently dominating door-to-door transport chains that use container shipping for the main transport leg.

### 6.3 Redesigning supply chains - regionalisation

Flexible sourcing became another recovery measure where suppliers that are closely located, for example in Central or Eastern Europe, became preferred suppliers instead. Regionalisation became a buzzword after the pandemic (Pla-Barber *et al.*, 2021) and some of the respondents tended to develop supply networks closer than the former supply base in Asia. However, this remained mostly as a tendency or intention but significant action or change was not observed. It should be noted that most supply chains already are regional rather than global (Rugman *et al.*, 2009) and that disruption of transport chains and high freight rates are only part of the current regionalisation trend. The factor most frequently mentioned in a regionalisation context is geopolitical tensions leading to tariffs, sanctions or export restrictions.

Many supply chains are expected to become shorter due to regionalisation and some of the respondents accelerated the change after the pandemic. In turbulent times, Swedish purchasing organisations prefer European sourcing and even Swedish sourcing when possible. This results in a shortened supply chain on one hand. However, on the other hand, these suppliers are

most of the time dependent on Asian component suppliers to produce the final product. Hence, such a change does not change the structure of the supply chains entirely but redirects some legs.

What is observed so far is that multi-national firms can use their global presence to divide into regional supply chains with suppliers, manufacturing processes and customers located within one economic region. Smaller Swedish firms, dependent on Asian suppliers for products no longer produced in Europe or produced with inferior quality or deterring price, face significant problems to realign their supply chains. Schollin and Örtégren (2023) found that a furniture retailer and a wholesaler of office supplies faced significant barriers to replace suppliers from Asia with European ones. This is in line with Altman and Bastian (2023), who state that:

*“International flows have proven remarkably resilient through recent crises, strongly rebutting the notion that globalization has gone into reverse”.* Altman and Bastian (2023), p. 6.

Nevertheless, this trend is expected to influence some industries that require shorter lead times such as fast fashion or electronics, but some other industries will still be dependent on natural resources or efficient and competent labour force and the long and complex supply chains will continue to play a role. It is not as simple as that firms in western countries send blueprints and components to China for cheap assembly of products to be consumed in the west. Firms in the USA that changed to suppliers from Vietnam and Mexico to reduce the dependency on Chinese manufacturers experienced higher costs (Alfaro and Chor, 2023) and Chinese firms have crucial roles in supply chains, which cannot easily be replaced (Zhang *et al.*, 2024), as formulated by Xie (2023):

*“Trade data, corporate announcements and new academic research show that a large portion of the products shipped to the U.S. from places such as Southeast Asia and Mexico are being made in factories owned by Chinese companies [...] Many other goods finished in smaller countries are being made with key inputs from Chinese suppliers, meaning they wouldn’t get produced at all without Chinese involvement. Those realities underscore the challenge for policy makers and companies seeking to disentangle the U.S. from China’s colossal manufacturing machine. Far from decoupling, some supply chains connecting the U.S. and China have merely added another link or two, increasing the complexity and cost.”* Xie (2023), p. 3.

Global supply chains are not at the brink of extinction; the benefits of trading are simply too substantial for refraining from looking widely for good suppliers.

## 7 Conclusions

The disruptive effects of pandemic are no longer harming container shipping. Transport services cope with the demand and supply chains are getting back in balance, or rather an imbalance in the favour of shippers. Many logisticians and supply chain managers want to archive the experiences from the busy and troublesome years of the pandemic and look forward. Some might even think they can get back to the situation in 2019. This is obviously impossible, and it would be a mistake not to use the organisational learning that occurred, not least when the supply chains repeatedly face new disruptive events.

Negative consequences are hence due to lack of a clear recovery after the pandemic as the crises come in a concurrent nature where global supply chains needed to tackle with Russia's invasion of Ukraine, the energy crisis, higher inflation and interest rates, the economic recession, and the chain of effects from these incidents. More recently container shipping lines have also faced problems to pass the Panama and Suez canals. Hence, the maritime supply chain actors think that the markets are not going back to pre-pandemic volatility patterns, but a new pattern is emerging where unpredictability becomes the norm. The older pricing cycles no longer prevail, and the actors need to position themselves according to potential risks.

All maritime supply chain actors involved in this study were expecting the market to improve at least capacity-wise because they knew that the additional shipping capacity enters service in 2023 and onwards. However, they were very sure that the freight rates would not go back to pre-pandemic levels. Actually, they did and even passed in the downturn. As of late 2023, container freight rates are below their pre-pandemic levels. However, this did not change the propensity of shippers to secure their space and freight rates with long-term contracts. This also justifies the high degree of risk management in the industry during the pandemic aftermath.

One positive consequence of this period of crisis is the wider understanding of the importance of logistics and supply chain management in export and import organisations, among policy makers and the larger society. Understanding how critical the supply chain flows are, is expected to support the investments needed to improve logistics and supply chain processes. Some respondents emphasised that they expect policy makers and regulations to approach more rapidly and more positively to future logistics and supply chain problems.

It is said that a bridge builder who has seen a bridge collapse begins to build very robust bridges. But then a new generation of engineers and architects comes along and builds slimmer bridges in new materials and with tighter safety margins. During decades of fairly stable conditions, logistics students have been taught that tied-up capital is a bad thing and stocks should be as low as possible without stopping production and deliveries. There are many good reasons to have low inventory levels, but now today's logisticians have seen "a bridge collapse" and will probably size up the safety stocks and demand reliable freight transport. Negotiations are now as much about delivery capacity as it is about price.

There are also signs of regionalisation, i.e., designing separate supply chains for the major economic regions of Europe, North America and Asia. Reducing exposure to transport disruptions is a motive, but geopolitics and trade barriers also come into play. But it should not be forgotten that global trade has enormous advantages, not least for a small trade-dependent country like Sweden as well as for the hundreds of millions of Asians lifted from extreme poverty, so it is not a question of going back to small self-sufficient villages. But a little common sense has still reappeared because dividing supply chains into a large number of production stages far from each other does involve risk.

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## References

- Alfaro, L., Chor, D., 2023. Global Supply Chains: The Looming 'Great Reallocation', *Harvard Business School Working Paper, No. 24-012, in proceedings of Jackson Hole Symposium, August 2023*, Cambridge, MA.
- Altman, S.A., Bastian, C.R., 2023. DHL Global Connectedness Index 2022 - An in-depth report on the state of globalization, Bonn.
- Altuntas Vural, C., Gonzalez-Aregall, M., Woxenius, J., 2021. The effects of the coronavirus pandemic on the Swedish shipping industry and its resilience capabilities. Part 1 – the acute phase March 2020 – May 2021, *Lighthouse reports*. Lighthouse, Lighthouse reports, Gothenburg.
- Bergqvist, F., 2022. Europeiska hamnar korkas igen – ryskt gods tvingas skickas tillbaka, *Dagens Nyheter*, Stockholm.
- Business Sweden, 2023. Rewiring global supply chains - Executive Global Insight, September 2023, Stockholm, p. 20.
- Caballini, C., Ghiara, H., Persico, L., 2022. Analysis of the impacts of COVID-19 on selected categories of goods passing through the ports of Genoa and Savona, Italy. *Case Studies on Transport Policy*. <https://doi.org/10.1016/j.cstp.2022.03.002>
- Dubey, R., Gunasekaran, A., Childe, S.J., Fosso Wamba, S., Roubaud, D., Foropon, C., 2021. Empirical investigation of data analytics capability and organizational flexibility as complements to supply chain resilience. *International Journal of Production Research* 59(1), 110-128. 10.1080/00207543.2019.1582820
- Forrester, J.W., 1961. *Industrial Dynamics*. MIT Press, Cambridge.
- Janson, A., 2023. Vi har aldrig haft en så stor orderbok som nu (We have never experienced a larger orderbook than now), *Sjöfartstidningen*, Gothenburg, p. 43.
- Jensen, T.C., 2020. *The dependence on trade with China calls for a brand new digital supply chain model*, <https://www2.deloitte.com/dk/da/blog/blog-operational-excellence/2020/blog-tore-christian-jensen-digital-supply-chain-model.html> [Accessed 2024-01-13].
- Li, M., 2023. *MSC builds 1 million TEU lead over Maersk*, <https://container-news.com/msc-builds-1-million-teu-lead-over-maersk/> [Accessed 2024-01-14].
- Maersk, 2022. 2021 Sustainability Report, Copenhagen.
- McCombie, D.W., 2022. *When The 'Helicopter Money' Ends*, *Forbes*, <https://www.forbes.com/sites/davidwmccombie/2022/06/16/when-the-helicopter-money-runs-out/?sh=26889ad72f38> [Accessed 2023-12-03].
- Miller, G., 2023. *Why attacks on container ships caused container stocks to jump*, <https://www.freightwaves.com/news/why-attacks-on-container-ships-caused-container-stocks-to-jump> [Accessed 18 December 2023].
- Murray, B., Patel, T., 2023. The shipping industry's boom-and-bust cycle is so severe that carriers face going from bumper profits to losing money in the space of a few years: 'I'm certainly concerned', *Fortune*.
- Pla-Barber, J., Villar, C., Narula, R., 2021. Governance of global value chains after the Covid-19 pandemic: A new wave of regionalization? *BRQ Business Research Quarterly* 24(3), 204-213. 10.1177/23409444211020761
- Pope, T., Hourston, P., 2020. *Coronavirus: how countries supported wages during the pandemic*, *Institute for Government*.

- <https://www.instituteforgovernment.org.uk/article/explainer/coronavirus-how-countries-supported-wages-during-pandemic> [Accessed 2023-12-03].
- Raza, Z., Woxenius, J., Altuntas Vural, C., Lind, M., 2023. Digital transformation of maritime logistics: Exploring trends in the liner shipping segment. *Computers in Industry* 145(103811), 1-16. <https://doi.org/10.1016/j.compind.2022.103811>
- Rogerson, S., Svanberg, M., Altuntaş Vural, C., von Wieding, S., Woxenius, J., 2024. Comparing flexibility-based measures during different disruptions: evidence from maritime supply chains. *International Journal of Physical Distribution and Logistics Management* Accepted 8 January.
- Roos, J.M., Flodén, J., Woxenius, J., 2023. Grocery hoarding in Sweden during the COVID-19 pandemic and its consequences for logistics, *World Conference on Transport Research - WCTR 2023*, Montreal, 17-21 July, pp. 1-16.
- Rugman, A.M., Li, J., Hoon Oh, C., 2009. Are supply chains global or regional? *International Marketing Review* 26(4/5), 384-395. 10.1108/02651330910971940
- Schollin, E., Örtegren, O., 2023. Förflyttning av leverantörer från Asien till Europa - En kvalitativ studie av två företag om faktorer som påverkar beslutet vid byte av leverantörer mellan två regioner (Relocating suppliers from Asia to Europe - A qualitative study of two firms about factors affecting the decision of replacing suppliers between two regions), Department of Business Administration, University of Gothenburg, Gothenburg.
- The Economist, 2023. *How to stop the commoditisation of container shipping*, <https://www.economist.com/business/2023/03/09/how-to-stop-the-commoditisation-of-container-shipping> [Accessed 2024-01-14].
- The Economist, 2024. *The dwindling of the Panama Canal boosts rival trade routes*, <https://www.economist.com/the-americas/2024/01/09/the-dwindling-of-the-panama-canal-boosts-rival-trade-routes> [Accessed 2024-01-13].
- UNCTAD, 2020. Review of Maritime Transport 2020. UNCTAD, New York and Geneva, p. 159.
- UNCTAD, 2022. Covid-19 and Maritime Transport, Navigating the Crisis and Lessons Learned, New York and Geneva.
- UNCTAD, 2023. Review of Maritime Transport 2023 - Towards a green and just transition, New York and Geneva, p. 157.
- World Trade Organization, 2020. Trade set to plunge as COVID-19 pandemic upends global economy, Press Release, 8 April, Geneva.
- World Trade Organization, 2022. World Trade Statistical Review 2022. WTO, Geneva, p. 132.
- World Trade Organization, 2023a. Global Trade Outlook and Statistics, Update: October 2023, Geneva, p. 16.
- World Trade Organization, 2023b. World Trade Statistical Review 2023. WTO, Geneva, p. 138.
- Xie, S.Y., 2023. U.S. Companies Are Finding It Hard to Avoid China, *The Wall Street Journal*, New York.
- Zhang, X., Fan, X., He, M., 2024. Analysis on the effects of global supply chain reconfiguration on China's high-end equipment manufacturing industry. *International Journal of Physical Distribution & Logistics Management* 54(1), 1-39. 10.1108/IJPDLM-11-2022-0346

## Appendix 1: Example of interview guide – for shipping companies

### INTRODUCTION:

#### - *Short project presentation:*

We are interested in what effects the pandemic has had on your organisation, what measures you have taken as a consequence of the pandemic and why.

#### - *Information about the person interviewed:*

Tell us a little about yourself: title, role, how long have you been working in the company?

#### - *Information about the company:*

Size of the company, maritime segments, types of shipping services offered.

### FIRST PART

1. If we start from scratch, when did you experience problems related to the pandemic, and what happened?
2. What were the effects in your company? When was the situation most acute?
3. Did you experience some recovery?
4. Have there been setbacks?
5. What actions did you take? When did you take them? Why did you take them?
6. What is the situation today?
7. Did you cooperate with others (e.g., shipping companies) during this situation?

### FOLLOW-UP QUESTIONS

#### - *Effects*

8. When did the effects occur?
9. How long did the effects last?
10. Were there repeated effects?
11. Can you tell us what kind of cost you had related to the pandemic? Were any costs reduced?
12. Can you share any figures with us?
13. Were there any additional effects than those you have already mentioned?
14. Could you reflect on any particularities in your company characteristics that influenced how you were affected by the pandemic?

#### - *Actions*

15. When did you implement each action?
16. Were any measures temporary?
17. Is there anything else that you do differently that you haven't mentioned?
18. Why did you choose these particular measures?
19. Were there any measures you considered but did not implement?
20. How easy was it to implement the actions?
21. Were there any challenges in implementing actions?
22. How prepared were you for these consequences?

### OUTLOOK TO THE FUTURE

23. Do you act differently now after the experience with the pandemic compared to before?
24. Do you have measures in place to prevent similar effects in the future?
25. What could be done to reduce the effects of similar situations?
26. Could you have done something differently? (if you look in the rearview mirror)
27. In what way was the pandemic different to other serious disruptions?
28. Would you like to add anything else?