RBB | Economics

The Impact of the CBER on Supply Chain Emissions

An evidence-based assessment of developments since 2008

RBB Economics, 20 July 2023

1 Introduction and summary

1 This paper has been prepared at the request of the World Shipping Council ("WSC"). It relates to the European Commission's Consortia Block Exemption Regulation ("CBER") and its impact on greenhouse gas emissions.

2 WSC considers that, by facilitating the formation of shipping consortia, the CBER has helped reduce greenhouse gas emissions in the liner shipping industry, and its broader supply chain. This is largely because consortia enable their members to operate appropriately-sized – often larger, more fuel-efficient – vessels.[1] Indeed, the European Commission ("EC") expressly identified this effect in its last evaluation of the CBER, stating that, for technological reasons, the use of larger vessels by consortia/alliances gives rise to, *inter alia*, environmental benefits.[2]

3 However, we understand that some stakeholders have challenged the notion that the CBER has had a positive impact on emissions overall. This theory, as we understand it, asserts that, while the CBER has led to reduced emissions in respect of deep-sea liner services, this may have been offset by increased emissions elsewhere in the supply chain.

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1 See for instance Notteboom, T.E., Vernimmen, B., The effect of high fuel costs on liner service configuration in container shipping, Journal of Transportation Geography (2008), Table 3, or Psaraftis, Harilaos N. and Kontovas, Christos A; CO2 Emission Statistics for the World Commercial Fleet, WMU Journal of Maritime Affairs, 2009; Table 2.

2 COMMISSION STAFF WORKING DOCUMENT EVALUATION of the Commission Regulation (EC) No 906/2009 of 28 September 2009 on the application of Article 81(3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia), p.32: "*For example, vessel sharing agreements have environmental benefits through reduced consumption and lower vessel emissions, and they bring technological benefits through newer, more efficient, more technically up-to-date modern ships and improved IT systems for container tracking to meet shipper demands.*"

4 It is contended that this offsetting effect also arises as a consequence of the CBER, because the formation of consortia and the use of larger vessels may result in a consolidation of cargoes across fewer routes meaning that loaded/discharged cargoes then have further to travel from their point of unloading before reaching their eventual destination and that such “hub” ports are subjected to increased levels of congestion.

5 In this paper, we assess the credibility of this concern, considering various pieces of evidence in this regard. We first unpack the mechanism through which the CBER is assumed to have resulted in increased emissions (Section 2). To do so, we set out the factual elements that must be verified for the concern that the CBER has resulted in an increase in emissions to hold. Specifically, it must be true that:

- there has been a consolidation of volumes amongst a relatively small number of “hub” ports as a result of the CBER;
- this consolidation has led to an increased usage of other transport modes, such as road and short-sea, due to volumes being loaded/discharged further away from their point of origin/final destination;
- the increased usage of road, short-sea and inland waterways transport has increased emissions from these modes of transport; and
- the increased emissions from these transportation modes have outweighed the reduction in emissions that has arisen from vessel-sharing facilitated by the CBER, leading to a net positive increase in emissions from the supply chain.

6 Importantly, each of the above would need to hold true for the concern that the CBER has had the unintended consequence of increasing greenhouse gas emissions to be valid. In the remainder of this paper, we analyse the available evidence to assess whether it supports this concern. Importantly, we do not consider each and every aspect of the above (for example, we do not consider the issue of causation), but this is unnecessary since the elements that we do consider already show that the concern is unlikely to be a valid one.

7 The paper’s structure and its conclusions are as follows:

- We start with an assessment of available evidence on ultimate outcomes in terms of emissions levels (Section 3). The evidence presented here does not provide any obvious support to the theory that, even if cargo consolidation has occurred, emissions from other forms of transport (such as road freight) have increased (either as a result of cargo consolidation or otherwise). Indeed, the data do not even suggest a strong correlation between such emissions and overall cargo volumes transiting through main ports (irrespective of whether that has been due to consolidation or simply increasing volumes in the sector as a whole).
- We then examine the evidence on the usage of road, short-sea and inland waterway transport, in order to assess whether these modes of transport have become relatively more heavily used as compared to deep-sea liner transport (Section 4). The data indicate that there has been no increase in the relative usage of these other modes of freight. This

is entirely the opposite of what one would expect if the CBER had resulted in an increased usage of other transport modes (and in turn increased emissions from them).

- Finally, we assess whether there is any evidence of a consolidation of cargoes over a smaller set of "hub" ports at all (Section 5). To do so, we analyse various pieces of evidence relating to ports and port usage.
  - The distribution of volumes across EU ports does not provide any evidence that volumes have become more concentrated amongst certain ports since 2008. Instead, various metrics all point in the same direction, namely that concentration amongst ports in the EU has remained low and stable between 2008 and 2021. Moreover, there is no evidence that large ports are growing faster than smaller ports, with many smaller ports in fact growing at faster rates that their larger counterparts.
  - There have been a number of new services and port calls added to existing sailings by carriers. This is again at odds with the notion that carriers are focusing their services on a limited number of port "hubs".
  - There is also no evidence that smaller ports are becoming less well-connected over time, either in absolute terms or relative to a select few port "hubs". This is borne out by the fact that the port liner shipping connectivity index ("PLSCI") of the 20 largest EU ports is growing at a similar rate as that for the rest of the ports in the EU. The fact that the PLSCI is growing for smaller ports also indicates that such ports are becoming better-connected over time.

8 In short therefore, the available evidence does not support, and is in many cases directly at odds with, the concern that the CBER has led to increased emissions from modes of transport other than deep-sea shipping. As such, the only demonstrable effect of the CBER on emissions remains a positive one, as has been acknowledged by the EC and as is supported by the available data.

2 Analytical framework

9 At the outset, it is worth reiterating that the CBER has a *prima facie* positive environmental effect through the reduction of greenhouse gas emissions from liner shipping. Indeed, as highlighted below in Figure 1, average greenhouse gas emissions per twenty-foot equivalent unit (TEU) are decreasing over time, and it has previously been acknowledged by the EC that "*vessel sharing agreements have environmental benefits through reduced [fuel] consumption and lower vessel emissions"*.[3]

10 Therefore, the theoretical concern that the CBER has resulted in an overall increase in greenhouse gas emissions in other areas of the supply chain relies upon a number of elements

[3] COMMISSION STAFF WORKING DOCUMENT EVALUATION of the Commission Regulation (EC) No 906/2009 of 28 September 2009 on the application of Article 81(3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia), p.32.

that should be assessed individually. All such elements would need to be true for this theoretical concern to be a genuine concern in reality.

- The first element / assertion is that there has been a consolidation of cargoes across a smaller number of ports (major "hubs") over time, and that this has arisen as a consequence of (i.e., been caused by) the CBER.
- The second element is that this has given rise to increased emissions through one or more of the following mechanisms:
  - increased use of road transport, as a consequence of cargoes being loaded/discharged from vessels further away from their point of origin/final destination; and/or
  - increased use of onward short-sea and/or inland waterway transport in order to bridge the gap between the major "hubs" and the actual shipment origin/destination.
- The third element is that the increases in emissions arising as a consequence of the above mechanisms are sufficiently large to outweigh the emissions-reducing impact of cargoes being shipped on larger vessels as a consequence of the CBER.

11 Evidently, if any of the above elements do not match the market reality, then the concern that the CBER has resulted in increased emissions will not hold.

12 In this paper we do not consider each aspect of the above in detail. Instead, we focus on assessing the validity of certain of the above elements. We do so in three different ways.

- First, we examine whether the available data in terms of direct effects lend support to the concern that has been raised – e.g., if emissions from the freight industry have increased, this would be consistent with the theory described above.
- Second, we consider whether the available evidence indicates that cargoes are being transported an increasing amount/distance via other complementary transport modes such as road (i.e., in metric ton-km terms) relative to cargo transported via deep-sea.
- Third, we assess whether there is evidence of a significant consolidation of cargoes over a reduced number of routes over time. As indicated above, this is a necessary element for the broader concern to be a valid one. To do so, we analyse data on port volumes and growth, addition of services and ports to existing services, and port connectivity indices.

3 Emissions from freight and the supply-chain

13 This section aims to assess overall emission levels in the transport sector, as compared to shipping volumes since 2008. That is, it assesses whether or not there is evidence that emissions levels for various modes of transport have been increasing, and how any such trends compare to trends in shipping volumes.

14 In this regard, Figure 1 below presents the trends in annual greenhouse gas emissions in the EU, arising from each of the international shipping and goods transport sectors (the latter is proxied for by the relevant data for the transport sector excluding passenger cars and motorcycles). Alongside this, the figure also presents the annual volumes of cargo handled by "main" ports in the EU.[4]

15 The figure demonstrates that, since 2008, emissions from the international shipping and goods transport supply chains have been either broadly stable or declining. This arises against a background of a steady increase in the volume of cargo transported, which grew by 35% between 2008 and 2021, from 63 to 85 million TEUs. In other words, although the amount of cargo being transported has increased substantially, the emissions associated with its transportation have not, and have in fact decreased overall.

16 More specifically, the figure shows a clear decline in international shipping emissions, consistent with the EC's previous findings in respect of the impact of the CBER. Emissions from international shipping were around 170 million metric tons in 2008, while they had fallen to 129 million metric tons in 2021 (a reduction of 24%). The figure also shows no obvious increase in transport emissions – the transport supply chain emitted 522 million metric tons of emissions in 2008 against 460 in 2021 (an overall reduction of 12%).

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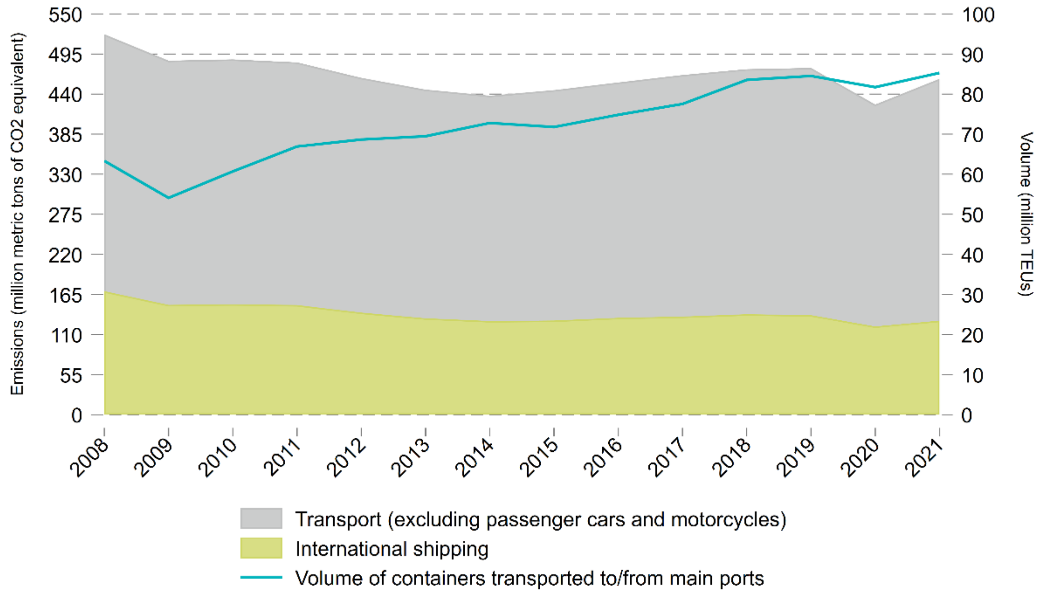
4 "Main" ports are defined by Eurostat as per the Directive 2009/42/EC. "Main" ports are those ports "*handling more than 1 million tonnes [metric tons] of goods or 200 000 passengers annually.*" However, "*additional data may also be included by countries for smaller ports on a voluntary basis" and "because of normal fluctuations in port activity, the thresholds are not automatically applied on a yearly basis to maintain the consistency of the series over time*." See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Main_ports

Figure 1: Annual greenhouse gas emissions in the EU for transport and international shipping sector, 2008-2021



Source: European Environment Agency (EEA). See https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer and Eurostat, see https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go.mar_go_qm_cont&display=list&sort=category&extractionId=MAR_TP_GO

Notes: Emissions from the transport sector include emissions from road transportation (cars, light duty trucks, heavy duty vehicles and buses, motorcycles and "other" road transportation), railways, domestic navigation and "other" transportation. To control for passenger traffic, we deduct emissions from cars and motorcycles from the total transport figure as these figures are unlikely to relate to freight. We use the "International navigation" sector from the EEA data to plot international shipping.

17 The figure of course does not control for any steps taken to use less pollutive technologies, but nevertheless provides no obvious support for the theory that the reduction in emissions from shipping has come at the cost of increased emissions from other modes of transport.

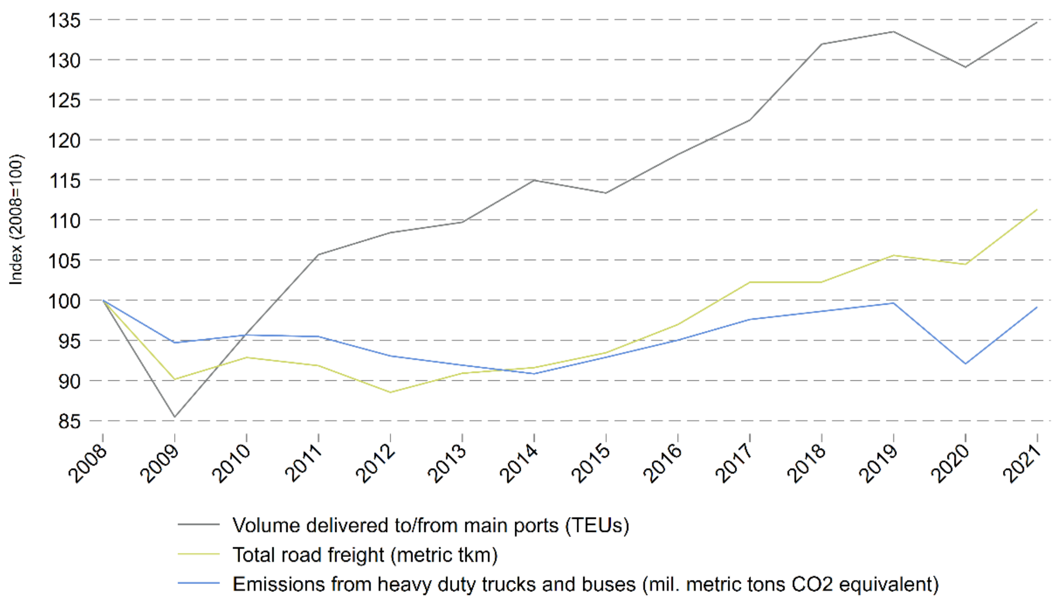
18 This is further confirmed by Figure 2 below, which focuses more specifically on road freight. Specifically, the figure presents indices for the total volume of cargo delivered to and from the main EU ports, the total volume-distance covered by road freight and the emissions from heavy-duty vehicles (including container trucks) in the EU between 2008 and 2021. The indices are set to 100 for each series' 2008 value, to allow for easier comparison and analysis of trends.[5]

19 Consistent with Figure 1, Figure 2 indicates that emissions from heavy-duty vehicles, i.e., the vehicles typically used for road freight including container trucks, while experiencing variation over time, have not increased substantially since 2008. In contrast, over the same period, there has been a substantial increase (over 35% since 2008) in the total volume delivered to and from main EU ports.

[5] Indices are numerical representations used to track the performance or changes of data over time. They provide a standardized way to compare and analyse trends, focusing on relative changes rather than absolute values. Using indices simplifies visualization, facilitates comparisons, and enables long-term trend analysis by eliminating the influence of differing scales or units of measurement.

20 There has also been an increase in total road freight in the EU, but this has notably been considerably more modest (+11% since 2008). The fact that this increase has been more modest than the trend in volumes of cargo transiting through main ports is also, on its face, at odds with any suggestion that there has been a disproportionate increase in road freight due to cargoes being consolidated across fewer routes/ports, although we examine this in more detail below.

Figure 2: Trends in volume transported to/from main EU ports, total road freight and emissions from heavy duty trucks and buses in the EU - 2008-2021 – Index 2008 = 100



Source: *Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go.mar_go_qm_cont&display=list&sort=category&extractionId=MAR_TP_GO and https://ec.europa.eu/eurostat/databrowser/view/ROAD_GO_TA_TG__custom_6629509/default/table?lang=en. European Environmental Agency Data. See https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer*

Notes: *When using Eurostat data, the domain used is "European Union – 27 countries (from 2020)"*

21 Accordingly, the figure highlights that there is no clear correlation between volumes handled by the main EU ports, total road freight and overall levels of emissions coming from heavy duty road freight vehicles. Again, this does not provide any clear support for the notion that increases in the volumes of cargo transiting through main ports has led to an increase of emissions from road transportation.[6]

22 In short, therefore, the data that focus directly on the relationship between cargo volumes transiting through the main EU ports and emissions levels do not provide any obvious support to the theory that emissions from other forms of transport (such as road freight) have increased as a consequence of increased cargo consolidation facilitated by the CBER. Indeed, the data do not even suggest a strong correlation with overall cargo volumes transiting through the

[6] This is even before one considers that an increase in volumes of freight delivered to main ports does not imply an increased consolidation of volumes amongst such ports (which we assess below). In particular, even in a situation without such consolidation, if overall demand for sea freight is increasing, and such growth is experienced proportionally across all ports, main ports' cargo volumes would increase.

main EU ports (irrespective of whether that has come as a result of consolidation rather than simply increasing volumes in the sector as a whole).

4 Share of complementary transport modes

23 Notwithstanding the absence of evidence on rising levels of emissions, we have also considered other types of evidence to assess whether there is any support for the concern that CBER has led to an increase in emissions. Specifically, we consider:

- the distribution of freight volumes over the various transportation modes used for moving cargoes; and
- the split of maritime transport as between deep- and short-sea shipping.

24 In particular, we assess whether there has been an increase in road freight, inland waterway transport and/or short-sea shipping since 2008. We do so because, as noted above, central to the notion that the CBER has led to increased emissions is that it has resulted in cargoes being loaded/discharged further away from their point of origin/ultimate destination, thus ultimately requiring greater use of these complementary forms of transport.

25 We focus in particular on the share of cargo volumes (or more specifically, volume multiplied by distance) transported by different forms of transport (rather than volume levels), since this controls for changes in overall demand. If it is correct that the CBER has led to cargoes being initially loaded/discharged further from their ultimate origin/destination, this would mean relatively greater use of transport modes that take cargoes to/from the main port at which they are loaded/discharged would be necessary.

26 However, this is not supported by the evidence presented in Figure 3 below.

27 Specifically, the figure depicts the proportion of total freight transport in the EU that is accounted for by each transport mode, amongst air, maritime, railway, road and inland waterway, from 2008 to 2021, based on metric ton-km.[7]

28 The figure indicates that, contrary to what one would expect if the overarching concern discussed above in Section 2 were correct, the relative use of road, rail and inland waterway transport has not significantly increased over time (i.e., as a proportion of total freight), relative to the situation in 2008. Indeed, there has generally been limited variation in the relative importance of different modes of freight transportation.

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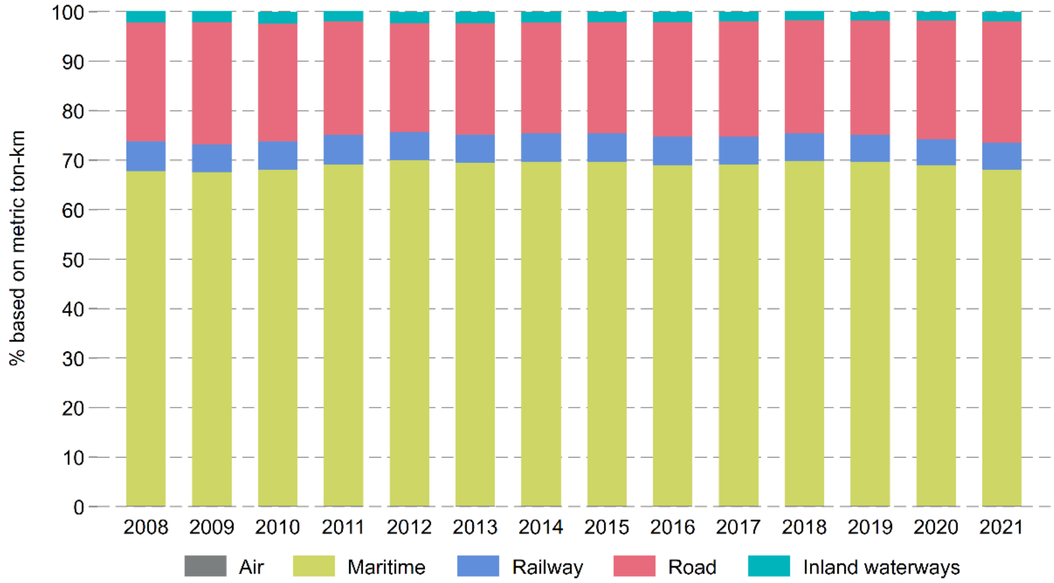
7 As explained in the associated metadata (https://ec.europa.eu/eurostat/cache/metadata/en/tran_hv_ms_esms.htm and https://ec.europa.eu/eurostat/cache/metadata/EN/mar_tp_esms.htm), these data are based on a "territorialisation" methodology developed by Eurostat, based on collected data expressed in metric tons. These data are presented along a breakdown for maritime freight which does not identify short- and deep-sea.

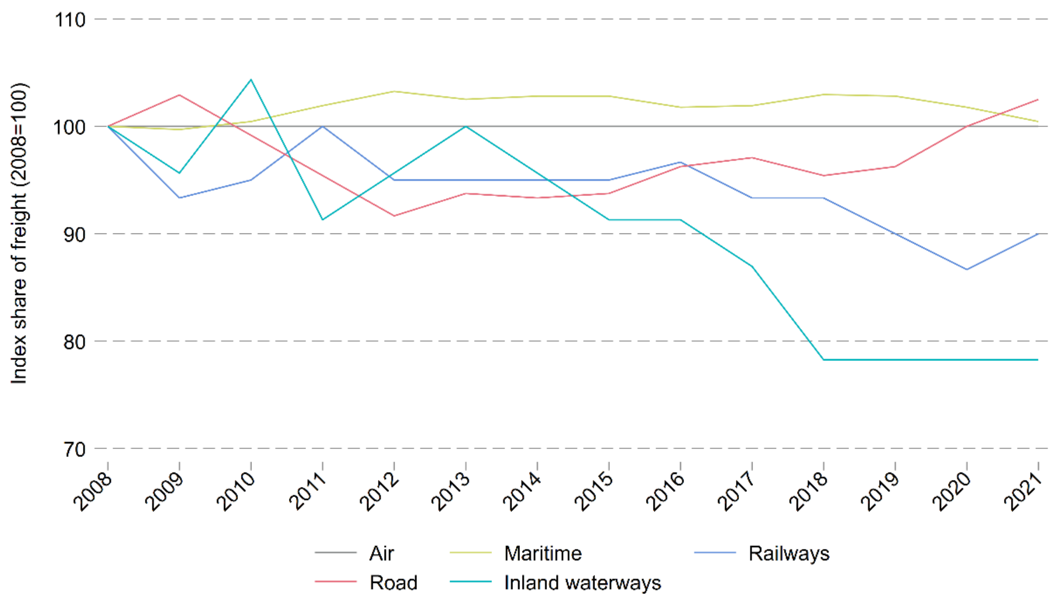
Figure 3: **Modal split of total freight in the EU, 2008-2021**



Source: Eurostat. See https://ec.europa.eu/eurostat/databrowser/view/tran_hv_ms_frmod/default/table?lang=en
Notes: When using Eurostat data, the domain used is "European Union – 27 countries (from 2020)"

29 In order to improve readability on the trends followed by the share of each transport mode, the same data are presented in Figure 4 below, where the shares are presented in indices, set at 100 for 2008. This figure confirms that, with the exception of declines in the relative importance of railway freight and inland waterways in recent years, there are no clear trends. There is certainly no evidence of the relative distances travelled by road increasing as compared to those travelled by sea (indeed while road's share varies over time, its share in 2020 was the same as in 2008, and its share in 2021 was only marginally higher, and approximately the same as in 2009). The data thus do not support the theory outlined in Section 2.

Figure 4: Indexed share of each mode of freight in the EU, 2008-2021



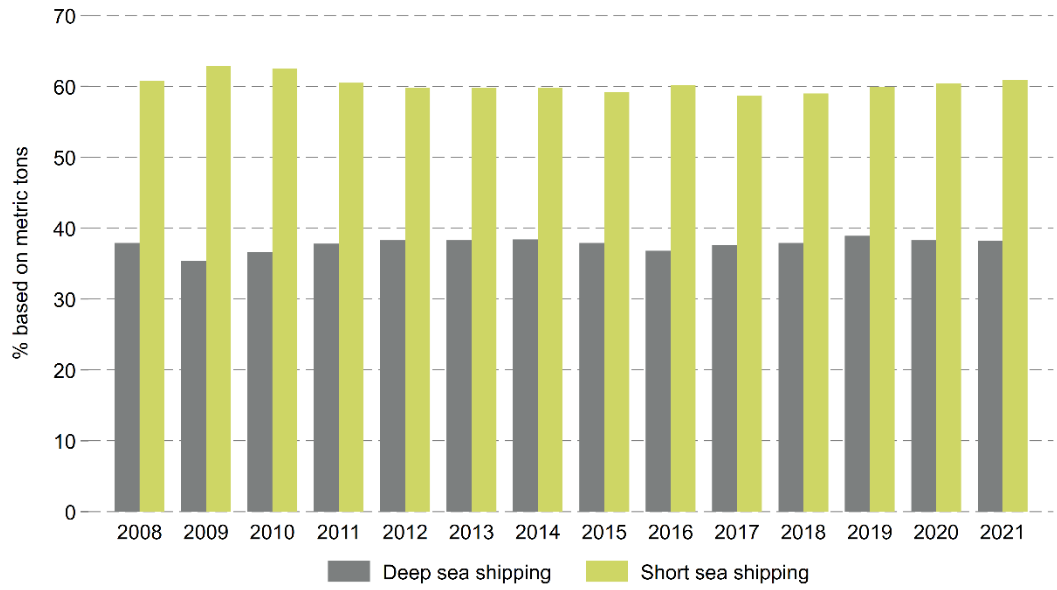
Source: Eurostat. See https://ec.europa.eu/eurostat/databrowser/view/tran_hv_ms_frmod/default/table?lang=en
Notes: When using Eurostat data, the domain used is "European Union – 27 countries (from 2020)"

30 Finally, if sea cargoes were being consolidated at port "hubs", with the remaining distance not covered by either road or inland waterways (as demonstrated from Figure 3 and Figure 4 above), one would expect to observe a relative increase in the volume of cargoes transported via short-sea shipping within the maritime transport category, as compared to deep-sea shipping.[8] However, as Figure 5 shows, the volume of goods transported by short-sea shipping has not increased as a proportion of total goods transported by sea.

31 Specifically, the figure presents the share of cargo volume (in metric tons) accounted for each of short- and deep-sea shipping, within sea transport in the EU, for each year from 2008 to 2021. It shows that the share of total cargo volumes transported via short-sea shipping has remained relatively constant, at around 60%. This share follows no clear trend and provides no factual support to the idea that international liner shipping has focused on a few main routes connecting major "hubs" on average further away from cargoes points of origin and destination, thus requiring an increased use of short-sea shipping.

[8] We understand that the maritime category comprises all "sea-going vessels" thus comprising short- and deep-sea shipping. See https://ec.europa.eu/eurostat/cache/metadata/en/tran_hv_ms_esms.htm

Figure 5: Short- and deep-sea shipping as a proportion of total sea transport in the EU, 2008-2021[9]



Source: Eurostat. See https://ec.europa.eu/eurostat/databrowser/view/mar_sg_am_cw/default/table?lang=en; https://ec.europa.eu/eurostat/databrowser/view/MAR_SG_AM_CW__custom_6710276/default/table?lang=en

Notes: When using Eurostat data, the domain used is "European Union – 27 countries (from 2020)"

32 As demonstrated above, the empirical evidence therefore provides no obvious support for the theory that the CBER, while leading to reduced emissions from deep-sea transport, has given rise to increased emissions from other forms of transport. Moreover, this evidence also does not provide any support for the notion that the CBER has resulted in proportionately greater use of these other forms of transport (be it road, inland waterways or short-sea shipping) as a consequence of cargoes having to be loaded/discharged further away from their ultimate point of origin/destination. In fact, it suggests that there has been no such shift, and the CBER's only effect on greenhouse gas emissions would be limited to the demonstrable decrease in emissions from international shipping.

5 Evidence on cargo consolidation, port growth and connectivity

33 As indicated above, the question of whether the CBER has resulted in the consolidation of cargoes across fewer routes/ports is central to the theoretical concern that the CBER has, overall, resulted in higher (rather than lower) emissions. If it has not, then this is already sufficient to dismiss the theory set out in Section 2 as a realistic concern.

34 In this regard, it is important to appreciate from the outset that the CBER cannot be assumed to result in this kind of consolidation *a priori*. That is, it does not follow as a matter of logic that

[9] Short-sea shipping is defined by Eurostat as the "*maritime transport of goods over relatively short distances, as opposed to the intercontinental cross-ocean deep sea shipping. In the context of EU transport statistics, it is defined as maritime transport of goods between ports in the EU (sometimes also including candidate countries and EFTA countries) on one hand, and ports situated in geographical Europe, on the Mediterranean and Black Seas on the other hand.*" See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Short_sea_shipping_(SSS).

the CBER will have resulted in deep-sea shipping lines operating fewer routes and/or loading and discharging larger cargoes at fewer ports, as opposed to simply enabling shipping lines to operate the same routes and visit the same ports but using a smaller number of larger vessels and/or operating those services at a higher frequency.

35 There are reasons to believe that the CBER has allowed carriers to call at ports that they would not have been able to serve on an individual basis for lack of sufficient demand. Indeed, as highlighted in Section 3.2 of the RBB report dated 3 October 2022, it is recognised by the EC that "*[c]onsortia can lead to economies of scale and better utilisation of the space of the vessels. In principle, a fair share of the benefits resulting from these efficiencies can be passed on to users of the shipping services in terms of <u>better coverage of ports (improvement in the frequency of sailings and port calls)</u> and better services (improvement in scheduling, better or personalised services through the use of more modern vessels, equipment and port facilities)"*.[10]

36 Therefore, whether deep-sea freight has focused on a lower number of services and/or ports must be assessed empirically (and not assumed). In this section, we seek to do so via the following pieces of evidence:

- First, we analyse data on the distribution of volumes across ports.
- Second, we consider the available evidence on the introduction of new services and the addition of ports to existing services.
- Third, we compare connectivity indices for large and smaller ports, and assess the extent to which these have changed over time.

5.1 Distribution of volumes across ports

37 If the mechanism described in Section 2 holds true, one would expect to see cargoes becoming increasingly concentrated across a smaller set of major "hubs". That is, one would expect to observe not only cargo volumes transported through major "hub" ports increasing, but also other smaller ports handling a decreasing volumes of cargo, either in absolute terms or as a share of the overall volume of cargo transiting through ports.

38 In this regard, Figure 6 and Figure 7 illustrate the share of total cargo handled through ports in the EU of different levels of sizes, for each of 2008 and 2021 respectively. In these figures, ports are first ranked according to cargo volumes handled in 2008 and then divided into four groups (i.e., quartiles), each containing a quarter of the total number of 302 ports as of 2008.[11] The charts then represent the volume handled by each of these groups of ports as a share of

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11 Data was available for 452 unique ports over the period 2008 to 2021, however in 2008, data on only 302 ports were available. We define quartiles on this basis and only consider these 302 ports over the whole period. However, the sample size in a given year may be less, given that not all ports for which a quartile was defined in 2008 have data in every year. For instance, the sample size in 2021 was 254 ports.

the total volume.[12] For example, Figure 6 below indicates that the smallest 25% of ports in the EU accounted for 2% of the volumes handled amongst all ports in the EU in 2008.

Figure 6: Volume handled by ports in the EU – quartiles by size – 2008

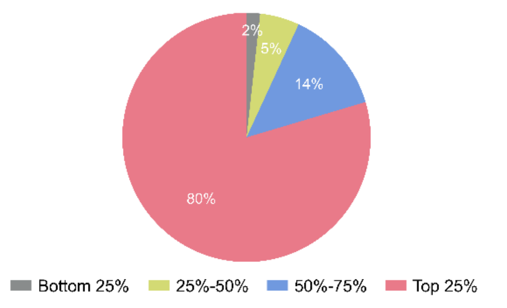
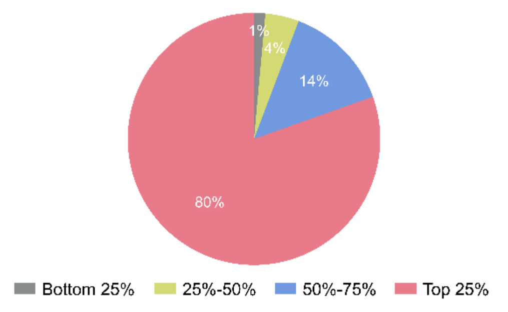


Figure 7: Volume handled by ports in the EU – quartiles by size - 2021



Source: Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go&display=list&sort=category

Notes: Quartiles are defined based on the total (i.e., combination of inwards and outwards freight) gross weight in thousands of metric tons transported to/from main ports in each EU member state in 2008.
Eurostat does not have data available for Austria, Czechia, Hungary, Luxembourg or Slovakia.

39 While it is evident from the figures that the largest 25% of ports handle a very significant portion of all shipped volumes, this share has not increased between 2008 and 2021. Specifically, the share of all volumes handled by the largest 25% of ports remains unchanged, at 80% in both 2008 and 2021. The same is true for the quartile containing the next largest 25% of ports, which had a share of 14% of all volumes shipped in both 2008 and 2021.

40 This is evidently not consistent with the notion that cargoes have been increasingly consolidated across fewer "hub" ports.

41 An examination of absolute port volumes paints a similar picture. Again, as noted above, if the mechanism outlined in Section 2 holds, we would expect to see growth in larger ports only, while smaller ports would have experienced decreasing volumes (in either absolute terms or relative to larger ports). However, Figure 8 and Figure 9 below indicate that this has not been the case.

42 Specifically, Figure 8 and Figure 9 plot the rate at which the volumes handled by each EU port grew between 2008 and 2021, against its size in terms of handled volumes as of 2021.[13] Figure 8 presents this information for ports where the volume of cargo handled has increased, while Figure 9 includes all ports. In both figures, the more to the left a port is along the x-axis, the smaller its size, in terms of total handled cargo as of 2021. The higher it is up the y-axis in the graph, the higher the growth rate it has experienced between 2008 and 2021.

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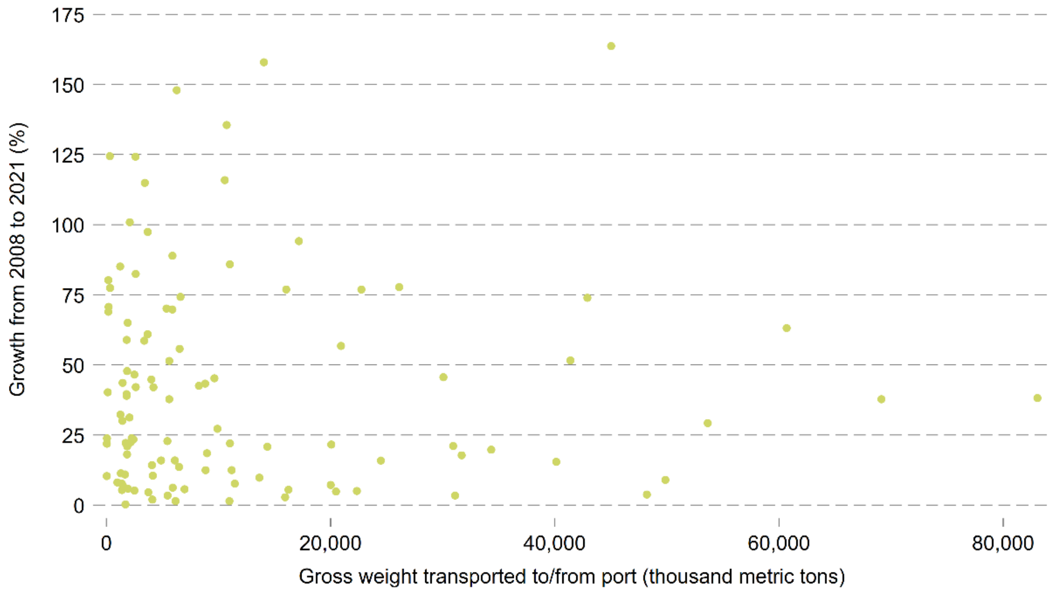
12 The total volume handled by the 25% largest ports as of 2008 is represented in red, the volume handled by the 25% smallest ports is represented in grey, while the green and grey areas represent the volumes handled by the ports which lie in the middle half of the distribution (blue for ports that fall in the second largest 25%, and grey for ports which lie in the second lowest 25%).

13 These figures exclude outliers in terms of port size and growth rates, for ease of reading:
- Two ports with a total gross weight handled of over 200 thousand metric tons have been excluded. These ports are Antwerp and Rotterdam with growth rates of 26% and 13%, respectively.
- Three ports with a growth rate over 200% have been excluded. These are Catania, Piraeus and Wangerooge, which have handled volumes of 6,656; 46,951; and 147 thousand metric tons respectively in 2021.

43 The figures indicate that there is significant variation in the extent to which different ports' volumes have increased, and the respective sizes of these ports. However, most importantly, there is no clear correlation between a port's size and the rate at which its volumes have grown. That is, larger ports do not appear to have grown at a faster rate than smaller ports.

44 Indeed, many of the ports that have achieved significant growth since 2008 are smaller ports. On average, the ports that have grown the fastest are significantly smaller than the ports with which grew at a lower rate.[14] By the same token, while some small ports have seen declining volumes, so too have some larger ports. This is therefore again inconsistent with the notion that cargoes have become increasingly consolidated across larger ports.

Figure 8: Port size (volume handled in 2021) and volume growth (between 2008 and 2021) – EU Ports with an increase in handled volumes between 2008 and 2021

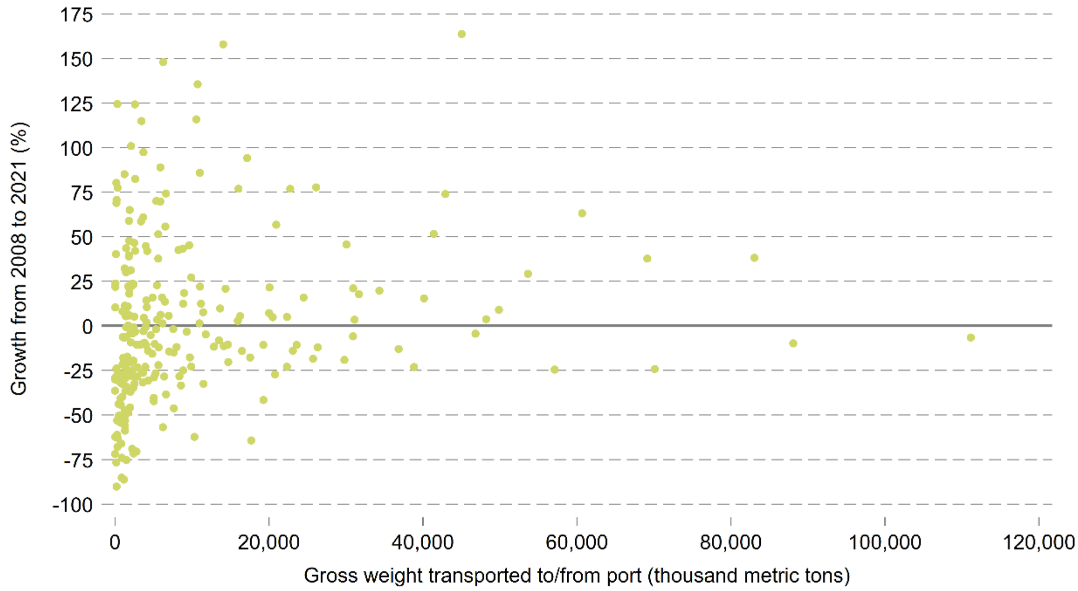


Source: *Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go&display=list&sort=category*

Notes: *This figure only considers 109 ports that grew their total handled volumes between 2008 and 2021. Gross weight is plotted as per 2021 figures.*

14 The median growth rate of ports with a positive growth rate is 30%. Ports which grew by more than 30% between 2008 and 2021 handled on average 12,324 thousand metric tons in 2021, compared to an average of 22,818 thousand metric tons handled by the ports which achieved a growth rate lower than 29%.

Figure 9: **Port size (volume handled in 2021) and volume growth (between 2008 and 2021) – all EU ports**



Source: *Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go&display=list&sort=category*

Notes: *This figure considers 249 ports for which data was available in both 2008 and 2021. Gross weight is plotted as per 2021 figures.*

45 This is further illustrated through the data presented in Figure 10 below. Specifically, the figure presents various metrics regarding the concentration of cargo volumes handled by EU ports, namely: the share of volume held by the largest port, the 5 largest ports and the 10 largest ports in the EU, as well as the HHI across all EU ports, for the period 2008-2021.[15]

46 The figure shows that the concentration of volumes across EU ports is and has remained low, according to all relevant metrics:

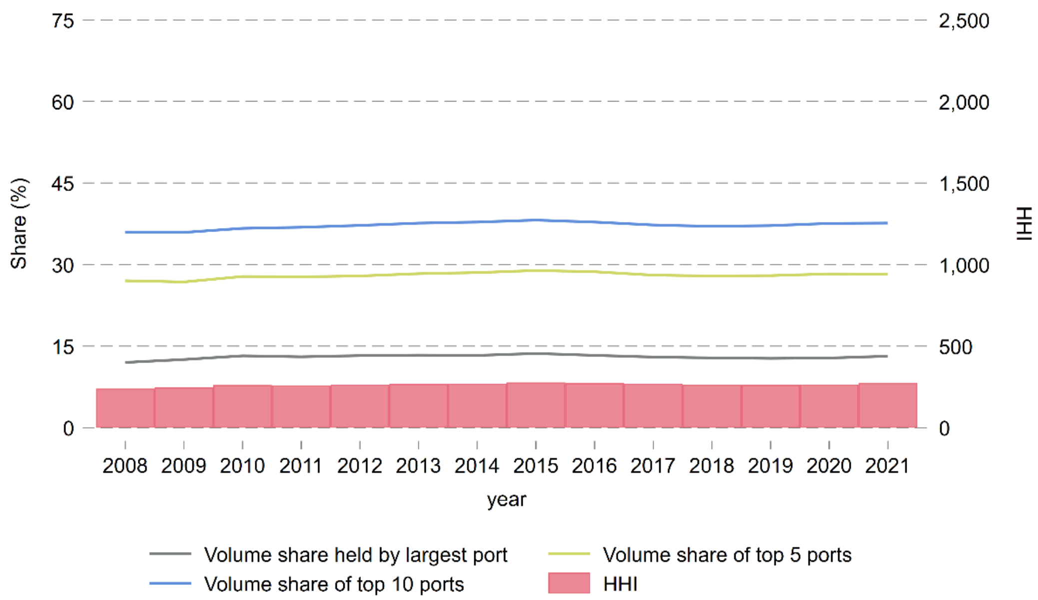
- The HHI remained stable, exhibiting only a very modest increase, from 240 in 2008 to 274 in 2021. Moreover, the level of concentration remained very low over the period, including during the pandemic.

- The volume share handled by the largest individual EU port is low and stable. It has never exceeded 14%, from 12% in 2008.

[15] The top 5 and 10 ports are identified for each relevant year. The full sample of top 10 ports across the period comprises 16 unique ports, 8 of which are consistently present in the top 10 throughout the period. Over the analysed period, Rotterdam, Antwerp, Hamburg and Amsterdam always constitute the 4 largest EU ports, and the fifth largest port is always either Algeciras or Marseille. Le Havre and Valencia are systematically ranked between the 6th and 10th position by size between 2008 and 2021. Overall, the data does not display any significant shifting of volumes from some ports to others. That said, even if there was such a shift (*quod non*), that would not provide any support to the concern that the CBER may have led to increased emissions throughout the supply-chain. For such an effect to occur, it must be that, as a result of the CBER, volumes were shifted from ports which necessitated less road, inland waterways or short-sea complementary freight, to ports which necessitate an increased usage of these alternative transportation modes and that such shift led to an increase in emissions that more than offset the well recognised decrease in emissions in deep sea shipping facilitated by the CBER. However, as explained in Section 4, there is no evidence of such an increased usage of other transport modes.

- The share held by the 5 largest EU ports has remained stable and limited, at around 28%. This implies that the 5 largest EU ports each hold a share lower than 6% each on average.
- The share held by the 10 largest EU ports has similarly been stable. These ports have jointly handled a share of around 37% over the period. This corresponds to an average share of 3.7% per individual top 10 EU port, or an average share of less than 2% for ports ranked 6th to 10th.[16]

Figure 10: Volume share held by the largest port; the largest 5 ports and the largest 10 ports, plus volume HHI across all EU ports - 2008-2021



Source: *Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go&display=list&sort=category*

Notes: *These results are based on Eurostat data for the total (i.e., combination of inwards and outwards freight) gross weight transported to/from main ports in each EU member state, in thousands of metric tons. Eurostat does not have data available for Austria, Czechia, Hungary, Luxembourg or Slovakia. In total, these data relate to 302 ports in 2008 and 326 ports in 2021.*

47 In short, a range of metrics all indicate that there has not been any significant consolidation of cargoes across EU ports since the CBER was first implemented. As noted above, this would be a necessary feature for the theory set out in Section 2 to be plausible, i.e., because such consolidation must have occurred if, controlling for overall demand, there were to have been a greater burden placed on other transport modes to take cargoes between major ports and shipments' points of origin/destination.

5.2 New services and port additions

48 To the extent that cargoes were being consolidated across a smaller number of major "hubs", one would also expect this to materialise in a decreasing number of different services operated by liners, and/or these services calling at a smaller number of different ports (i.e., to focus on

[16] With the top 5 ports handling 28% of all volumes, and the top 10 handling 37%, this means ports ranked 6th to 10th jointly handle 9% of volumes, i.e., 1.8% each on average.

these major “hubs”). However, to the contrary, carriers appear to have regularly introduced new services and improved existing ones by adding ports to their sailings.

49 This was illustrated in Table 9 of the RBB report dated 3 October 2022 (section 3.4, page 22). The table presented instances of new and improved services with additional port calls in European routes in 2021 and 2022, from both consortia and individual carriers. We have updated this exercise exhaustively for spring 2023 and provide the results in Table 1 and Table 2 below.

Table 1: New services between 29 March 2023 and 13 June 2023

Carriers	Service	Port rotation
Spliethoff	North Europe – USEC conro	Antwerp, Southampton or Bristol, Baltimore, Camden, Morehead City, Antwerp.
MSC	Far East – North Europe ‘Swan’	Qingdao, Ningbo, Yantian, Tanjung Pelepas, Antwerp, Gdynia, Gdansk, Klaipeda, King Abdullah Port, Singapore, Qingdao.
Unimed	Greece Turkey shuttle	Piraeus, Istanbul (Haydarpasa), Gebze, Gemlik, Piraeus.
X-Press	Greece – Libya shuttle ‘LBX’	Piraeus, Misurata, Piraeus.
Medkon Lines	Bulgaria – Romania shuttle ‘BRO’	Istanbul (Ambarli), Gebze, Varna, Constanta, Istanbul (Ambarli).
Global Feeder Shipping (GFS)	Spain – Portugal – Morocco (‘SPM’)	Valencia, Barcelona, Casablanca, Algeciras, Tanger Med, Leixoes, Vigo, Lisbon, Tanger Med, Algeciras, Casablanca, Valencia.
Unifeeder	Intra Baltic Service	Klaipeda, Gdynia, Szczecin, Helsingborg, Aarhus, Klaipeda.
Ellerman City Liners	Poland – UK service (‘Poland to UK Express’)	Gdynia, Teesport, Tilbury, Gdynia.

Source: *Alphaliner Newsletter no 14 – 2023: 29.03.2023 to 04.04.2023*
Alphaliner Newsletter no 15 – 2023: 05.04.2023 to 11.04.2023
Alphaliner Newsletter no 16 – 2023: 12.04.2023 to 18.04.2023
Alphaliner Newsletter no 17 – 2023: 19.04.2023 to 25.04.2023
Alphaliner Newsletter no 18 – 2023: 26.04.2023 to 02.05.2023
Alphaliner Newsletter no 19 – 2023: 03.05.2023 to 09.05.2023
Alphaliner Newsletter no 20 – 2023: 10.05.2023 to 16.05.2023
Alphaliner Newsletter no 21 – 2023: 17.05.2023 to 23.05.2023
Alphaliner Newsletter no 22 – 2023: 24.05.2023 to 30.05.2023
Alphaliner Newsletter no 23 – 2023: 31.05.2023 to 06.06.2023
Alphaliner Newsletter no 24 – 2023: 07.06.2023 to 13.06.2023

Table 2: New port destinations added to services between 29 March 2023 and 13 June 2023

Carriers	Port destinations added	Service
Hapag-Lloyd	St John (Canada)*	North Europe – ECNA – WCNA 'AL5'
ONE	Aalborg (Denmark),Halmstad (Sweden)	'Swedish Danish Service'
ZIM	Thessaloniki (Greece)	'Levant Black Sea Express'
ONE	Gdynia (Poland)	North Europe – Iberia 'IBC' loop
Containerships	Algeciras (Spain) and Bordeaux-Bassens (France)	NWC – UK – Iberia 'PGEC'
Diamond Lines	Vado Ligure (Italy), La Spezia (Italy)	'PNX' Greece – Italy – Turkey
2M	Antwerp (Belgium)**	'AE6 / Lion' Far East – Europe
CMA CGM	Dunkirk (France)	North Europe ISC 'EPIC'
Hapag-Lloyd	Manazanillo (Panama)*	Med – NCSA – WCSA 'MSW' loop
EMES and Evergreen	Valencia (Spain), Casablanca (Morocco)	Greece – North Africa – Spain (EMES: 'NAX', Evergreen: 'NAFR')
THE Alliance	Ningbo (China), Algeciras (Spain), Singapore (Singapore)*, Kaohsiung (Taiwan)*	Far East – North Europe 'FE3'
CMA CGM and Marfret	Zeebrugge (Belgium)***	North Europe – US East Coast – South Pacific – Australia / New Zealand (CMA CGM: Panama Direct Line 'PAD', Marfret: 'NASP')
Maersk	Port Elizabeth (South Africa)***	West Africa relay services - WAF 1 (Guinea Gulf + Angola)
MSC and CMA CGM	Ennore (India)	Europe-Mascareignes-Australia-Singapore-Colombo service (Australia Express / NEMO)
X-Press	Gdansk (Poland), Gdynia (Poland)	Intra Baltic X-Press ('IBX')

Source: *Alphaliner Newsletter no 14 – 2023: 29.03.2023 to 04.04.2023*
Alphaliner Newsletter no 15 – 2023: 05.04.2023 to 11.04.2023
Alphaliner Newsletter no 16 – 2023: 12.04.2023 to 18.04.2023
Alphaliner Newsletter no 17 – 2023: 19.04.2023 to 25.04.2023
Alphaliner Newsletter no 18 – 2023: 26.04.2023 to 02.05.2023
Alphaliner Newsletter no 19 – 2023: 03.05.2023 to 09.05.2023
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Alphaliner Newsletter no 23 – 2023: 31.05.2023 to 06.06.2023
Alphaliner Newsletter no 24 – 2023: 07.06.2023 to 13.06.2023

Notes: *The table does not include port additions which were added at the expense of other ports.*
** Added on only one leg of the journey (e.g., as a call on the eastbound leg).*
*** Added as the discharge and loading call.*
**** Seasonal call for fruit export.*

50 The tables show that, in less than three months, 8 new services were introduced on European routes, and 11 carriers included 15 additional EU port calls to their sailings. In contrast, only one service was discontinued, without the ports it served being instead included in other

services to maintain the connections.[17] Moreover, only 6 out of the 23 additional port calls in Table 2 are in one of the 50 largest ports in the world, with THE Alliance adding 4 of these large ports to one of its services.[18]

51 Thus, it appears clear that carriers are improving their services on various trade routes, and not only adding volumes to their existing services between the port "hubs" as suggested. Further, these additions clearly show that carriers are expanding their reach further than just the largest ports and continue to serve smaller ports as well.

52 The addition of new services and the inclusion of additional (smaller) ports on existing services over a prolonged period is evidently not consistent with the notion of consolidation of cargoes amongst a smaller number of ports.

5.3 Port connectivity

53 Finally, whether cargoes are being consolidated across fewer port "hubs" can be assessed using connectivity indices, such as the UNCTAD port liner shipping connectivity index ("PLSCI"). This index reflects each port's connectivity, based on scores for the following components for each port:[19]

1. the number of scheduled ship calls per week in the port;
2. deployed annual capacity in TEU;
3. the number or regular liner shipping services from and to the port;
4. the number of liner shipping companies that provide services from and to the port;
5. the average size (in TEU) of the ships deployed by the scheduled service with the largest average vessel size; and
6. the number of other ports that are connected to the port through direct liner shipping services.[20]

54 If the theory set out in Section 2 were correct, one would expect the following in respect of the connectivity of individual ports:

- For the major "hubs", the score of components 1 through 5 would increase with cargo consolidation, while the last component could potentially see its value decrease. Whether the PLSCI increases overall will depend upon the extent of these changes and the relative weightings of each component, and the net effect is therefore not possible to determine *a priori*.

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17 Kalypso's Med – USEC service 'Cristoforo Colombo' was closed. Additionally, there were seven service updates which included the closure of a service which was compensated by either new services or port additions to other services. This type of reshuffling is not included in Table 1 and Table 2.

18 See https://www.worldshipping.org/top-50-ports for a list of the 50 biggest container ports in the world. Only Algeciras (Spain), Antwerp (Belgium), Ningbo (China), Singapore (Singapore), and Kaohsiung (Taiwan) in Table 2 appear on the top 50 largest ports list.

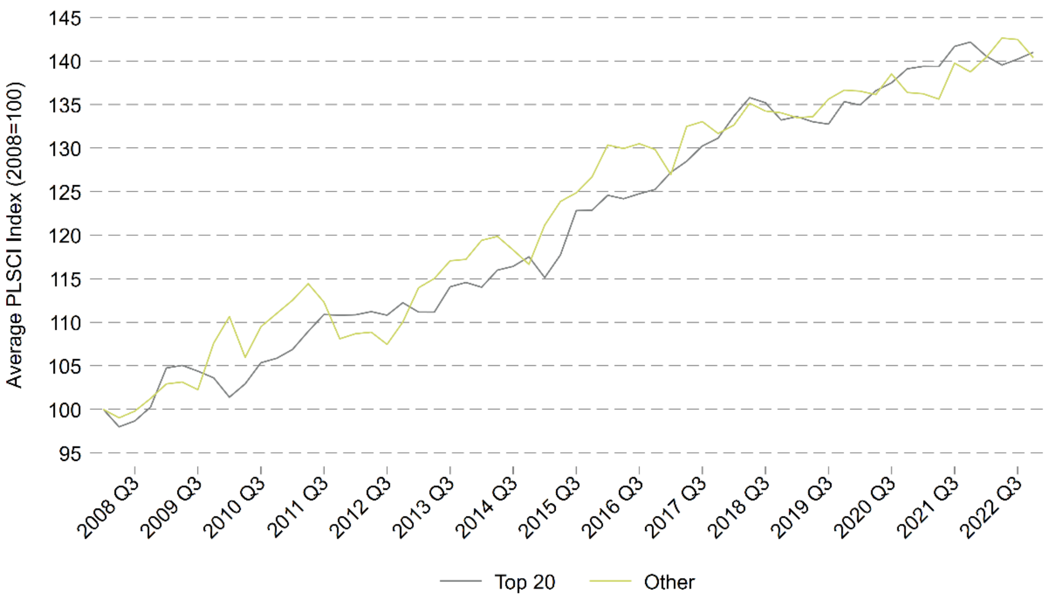
19 PLSC indices are expressed in terms that are relative to a benchmark value set as the score for the best-connected port, namely China, Hong Kong SAR, as of 2006T1, which is assigned a 100 PLSCI.

20 A direct service is defined as a regular service between two ports; and may include other stops in between, but not where the container requires trans-shipment. See https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=170026

- For the other smaller ports, the PLSCI would decrease, as these “non-hub” ports would be connected to fewer other ports, served by fewer regular services from a smaller number of carriers with smaller vessels, and a smaller deployed capacity.

55 We therefore focus on whether the PLSCI has fallen in practice for smaller ports. In this regard, Figure 11 below presents the average PLSCI for the 20 largest EU ports by handled tonnage, as well as the average PLSCI for all remaining other ports in the EU, over the period 2008 to 2022, indexed at their 2008Q1 values.[21] The figure shows that the index for the latter group of ports increased consistently over the period, and did so at a broadly similar rate as the index for the largest 20 ports. Both average PLSCIs have increased by around 40% between 2008 and 2022.

Figure 11: Index of average PLSCI for top 20 EU ports versus all other ports in the EU, 2008-2022



Source: *UNCTAD. See https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=170026*
Eurostat. See https://ec.europa.eu/eurostat/databrowser/explore/all/transp?lang=en&subtheme=mar.mar_go&display=list&sort=category

Notes: *The top 20 EU ports are based on total gross weight handled by these ports in thousand metric tons from 2008 to 2021. These are Rotterdam, Antwerp, Hamburg, Amsterdam, Marseille, Algeciras, Le Havre, Valencia, Bremerhaven, Trieste, Genoa, Barcelona, Gothenburg, Dunkirk, Constanta, Piraeus, Sines, Klaipeda, Riga and Tarragona.*

56 The increase in the PLSC indices of small ports is simply at odds with the narrative of services focusing on fewer major “hubs” and moving away from other smaller ports.

[21] The use of indices allows for a better visualisation of the trends, which is relevant here since the parameter of interest pertains to the evolution of each of these connectivity indices, and not their absolute values or how they compare to one another.