Mapping the globe. The patterns of mega-ships

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How is the shipping network of the largest containerships distributed across the globe? Many issues have been raised about the so-called mega-ships in terms of port capacity and competitiveness, shipping alliances, and technological change, but the precise geography of their circulation had remained somewhat overlooked to date. This article thus provides a concrete description and explanation of the observed pattern in the recent period, notwithstanding a brief explanation of the data and methodology used for such a purpose.

Data and methodology

The most efficient way to map and analyse the global container shipping network is to extract information from the *Lloyd's List Intelligence* database, produced by the world's leading maritime intelligence and insurance in history[1]. Covering the complete months of June and December 2016, our database comprises 121 mega-ships defined by a capacity over 14,000 TEUs (i.e. 1.98% of the total number of containerships), with a total fleet capacity of 1,976,077 TEUs (i.e. 9.62% of the total containership capacity). Mapping the combined traffic of all containerships (including mega-ships) for 2016 consisted in assigning "real flows" to a world maritime grid at both nodes (ports) and links (segments)[2]. Lloyd's information being vessel movements between ports without knowledge on their exact circulation pattern or spatial trajectory, such a method allowed for representing flows with accuracy following the principle of the shortest path. A port-to-port matrix was thus elaborated including not only direct movements between ports (i.e. A-B, B-C, C-D) but also indirect linkages (AC, BD) in order to consider the full voyage of the ships. As a preliminary result and among the 1,000 ports connected by containerships in 2016, only 67 have welcomed mega-ships, thus only 6.7% of world ports. This subgroup of the world container fleet is thus highly selective in its network design and port choice when designing its services and routes.

The global pattern of mega-ship traffic

The cartography of the distribution of global containership traffic first confirms the importance of the round-the-world trunk line connecting the main economic centres of the world or "Triade" in the Northern hemisphere, with smaller routes being more north-south, south-south, or intra-regional (Figure 1). What is absolutely striking is the fact that mega-ship traffic (illustrated in dark colour) remains spatially concentrated along the Europe-Asia route, without any presence elsewhere. A number of factors can explain such a network structure and specialisation. First of all, the maritime silk road has long been a major highway since Antiquity and prolonged in colonial times as well as nowadays with the now famous One Belt, One Road vision and strategy of China. Second, the

[1] For a review about the variety of all sorts of shipping data, see Ducruet (2017)

[2] For more information on the creation of the grid with an application to the Mediterranean basin, see Ducruet and Bunel (2017)

expansion of the Panama Canal was not sufficient to welcome such sea giants, so that their circulation pattern remains bound to this particular segment of the global, East-West trunk line. Despite recent announcements in the press about the launch of mega-ships on the Transpacific route (Knowler, 2015), the long-term effects of the 2009 global financial crisis had the major effect to concentrate the services of alliances and individual shipping lines on the more lucrative Europe-Asia segment.

Implications for ports

A zoom on this specific Europe-Asia route allows figuring the port hierarchy along this route as well as the share of mega-ship traffic (%TEUs) in the total containership traffic of ports (Figure 2). Such results reveal that port size is not always reflected by the absolute or relative importance of mega-ship traffic (see also Table 1). Statistically speaking, the linear (Pearson) correlation coefficient between total traffic and mega-ship traffic is only about 0.44, while the power-law line based on a log-log fit of the same variables reached only 0.38 (R^2). The direct implication of these results is that other factors than size come to play, mainly related to the location and function of ports.

As a matter of fact, ports with a lower share of mega-ship traffic are often gateway ports which main function is to serve hinterlands. However, this same share is also low at ports known to be dominantly transhipment ports, mainly because of the frequency and intensity of smaller vessel movements between hub ports and feeder ports, which has the effect of reducing the relative importance of mega-ships. Ports being both gateways and transhipment hubs, such as Rotterdam, Antwerp, and Busan, thus have a lower share of mega-ship traffic. Of course, the quality of port infrastructure also plays a role, as seen with the higher percentage of mega-ship traffic in Yangshan, Shanghai's offshore hub, but also in Piraeus, where the terminal handling company COSCO obtained a concession nearly a decade ago. Last but not least, a number of smaller ports exhibit a higher share of mega-ship traffic mainly in Europe, such as Gdansk, Aarhus, Bremerhaven, Felixstowe, but also in Asia with the case of Dalian. Such effects as mainly conjectural and supported by specific windows of opportunity, such as in Gdansk, the largest port of the Baltic Sea in in the mid-2010s, which stands out due to its recent inclusion in the services of the G6 alliance (OECD-ITF, 2016).

Acknowledgements

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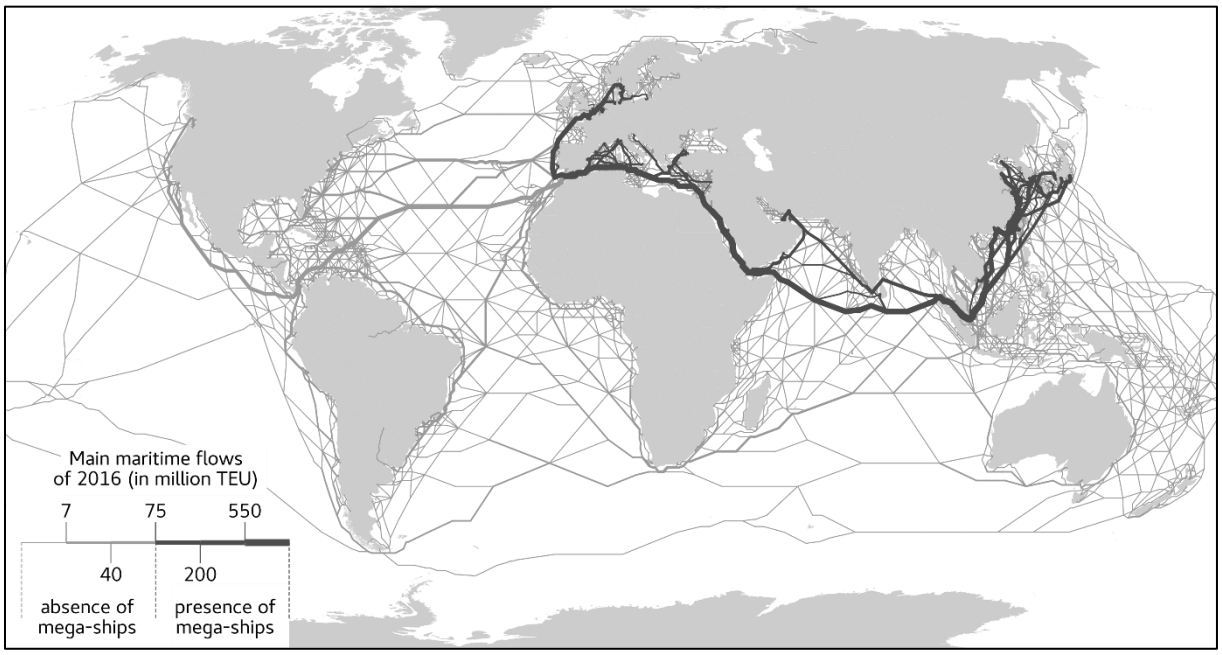

Figure 1: Mapping the presence of mega-ships in the global container shipping network

Source: own elaboration based on Lloyd's List Intelligence data

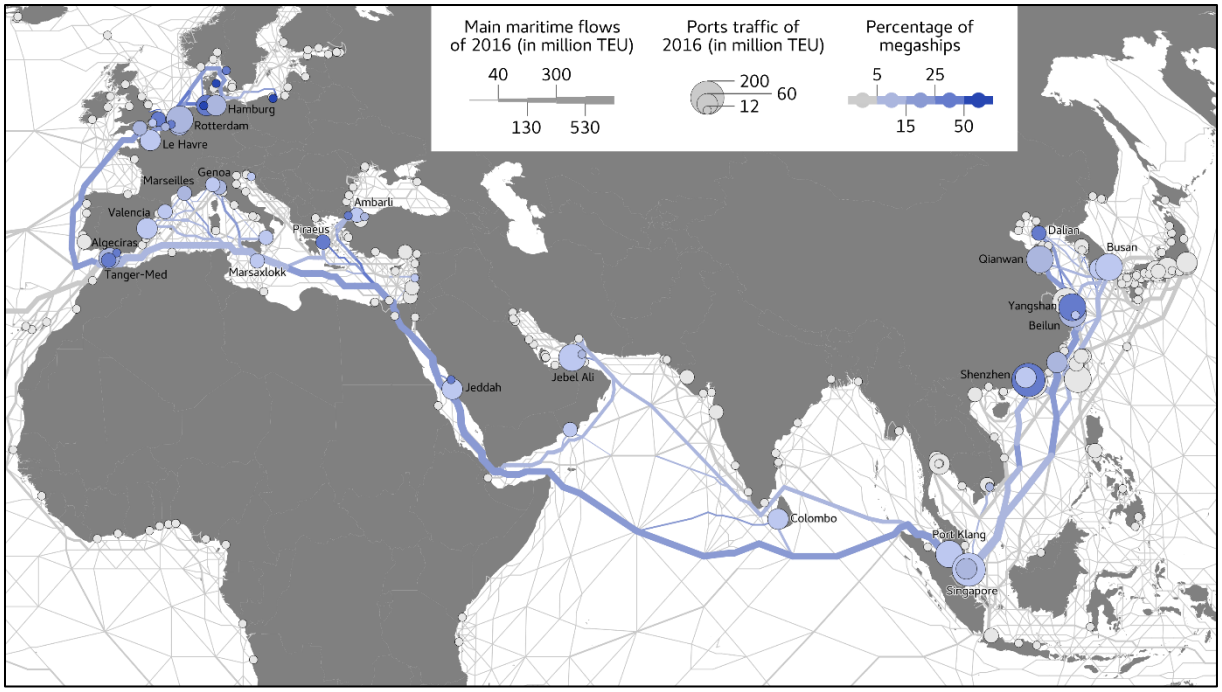

Figure 2: Relative importance of mega-ship traffic along the Europe-Asia route

Source: own elaboration based on Lloyd's List Intelligence data

Rank	By total mega-ship traffic (TEUs)		By share of mega-ship traffic (%TEUs)	
	Port	%	Port	%
1	Shenzhen	26.5	Gdansk	99.9
2	Yangshan	41.5	Aarhus	85.7
3	Singapore	10.5	Wilhelmshaven	67.4
4	Rotterdam	22.5	Felixstowe	47.5
5	Beilun	18.3	King Abdullah Port	46.0
6	Busan	11.2	Yangshan	41.5
7	Bremerhaven	39.6	Bremerhaven	39.6
8	Qianwan	17.9	Asyaport	35.1
9	Xiamen	22.0	Gothenburg	33.9
10	Felixstowe	47.5	Malaga	32.4
11	Port Klang	11.8	Ningbo	30.9
12	Hamburg	21.3	Zeebrugge	29.7
13	Antwerp	15.8	Tangier-Med	27.3
14	Tanjung Pelepas	19.2	Dalian	27.2
15	Tangier-Med	27.3	Shenzhen	26.5
16	Qingdao	18.7	Piraeus	26.0

17	Ningbo	30.9	Cai Mep	23.9
18	Piraeus	26.0	Dunkirk	23.2
19	Algeciras	16.9	Rotterdam	22.5
20	Dalian	27.2	Khor Fakkan	22.2
21	Colombo	13.6	Xiamen	22.0
22	Jebel Ali	7.7	Evyap	21.9
23	Hong Kong	3.1	Hamburg	21.3
24	King Abdullah Port	46.0	La Spezia	20.7

Table 1: Top 25 ports in the world handling mega-ships, 2016

Source: own elaboration based on Lloyd's List Intelligence data