MAPPING THE GLOBE

THE PATTERNS OF MEGA-SHIPS

Dr César Ducruet and Justin Berli,
The National Center for Scientific Research (CNRS), Paris, France

This paper seeks to address the distribution of the largest containerships across the globe and thereby build a picture of the global network. Many issues have been raised since the advent of so-called 'mega-ships', ranging from port capacity issues, competitiveness, shipping alliances, and technological change, but the precise geography of their circulation had remained somewhat overlooked to date. Herein we aim to provide 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 , which we have done to create a unique database. Covering the complete months of June to December 2016, our database comprises 121 mega-ships, which are defined by a capacity over 14,000 TEU (meaning mega-ships actually make up just under 2% of the global fleet). This equals a total fleet capacity of 1,976,077 TEU (9.62% of 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) . The information we have highlights vessel movements between ports, yet does not express their exact circulation pattern or spatial trajectory; a method which allows for representing flows with accuracy following the principle of the shortest path. A port-to-port matrix was thus elaborated which included direct movements between ports (i.e. A-B, B-C, C-D) and 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. This subgroup of the world container fleet is highly selective in its network design and port choice when it comes to designing its services and routes.

THE GLOBAL PATTERN

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 specialization. First of all, the Maritime Silk Road has been a major highway since classical antiquity and continues to this day in the shape of the now famous One Belt, One Road vision of China. Secondly, the expansion of the Panama Canal was not sufficient to welcome true mega-ships, so their circulation pattern remains bound to this particular segment of the East-West trunk line. Despite recent announcements in the press about the launch of mega-ships on the Transpacific

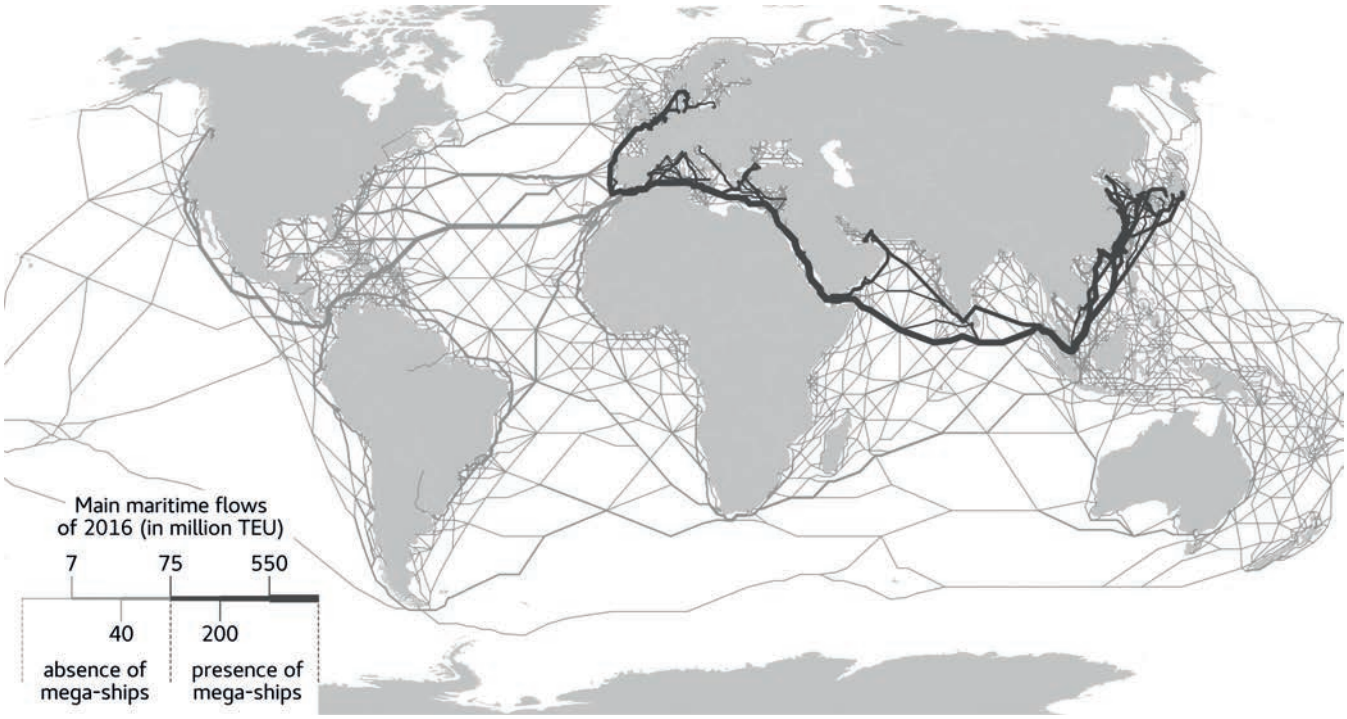

Figure 1: Mapping the presence of mega-ships in the global container shipping network
Source: Elaborated on Lloyd's List Intelligence data

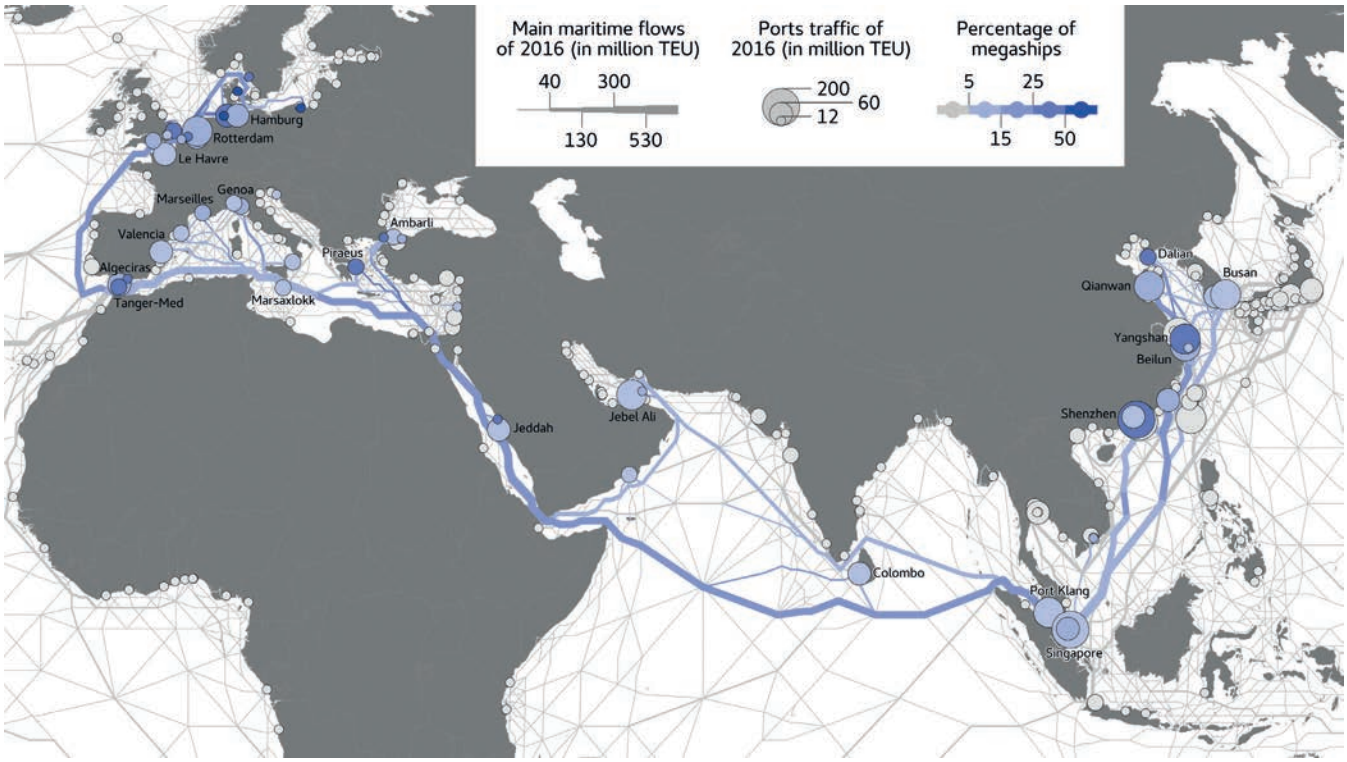

Figure 2: Relative importance of mega-ship traffic along the Europe-Asia route
Source: Elaborated on Lloyd's List Intelligence data

route (Knowler, 2015), the long-term effects of the 2009 global financial crisis still linger, meaning the services of major alliances and individual shipping lines have focussed on the more lucrative Europe-Asia segment.

IMPLICATIONS FOR PORTS

A closer look into the Europe-Asia route allows us to note the port hierarchy along this route, as well as the share of mega-ship traffic compared to 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 (Table 1). Statistically speaking, the linear (Pearson) correlation coefficient between total traffic and mega-ship traffic is only about 0.44, while the

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	28.5
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
25	Le Havre	12.7	Fos (Marseilles)	19.6

Table 1: Top 25 ports in the world handling mega-ships, 2016
Source: elaborated on Lloyd's List Intelligence data

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 differentiating factors other than size come to play, and these are 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 whose main function is to serve hinterlands. However, this same share is also low at ports known to be dominantly transhipment ports. This is 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 that are both gateways and transhipment hubs, such as Rotterdam, Antwerp and Busan, thereby have a lower share of mega-ship traffic.

It is also true of course that the quality of port infrastructure also plays a role also, as has been seen with the higher percentage of mega-ship traffic in Yangshan, Shanghai's offshore hub, but this is also true 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 in Europe. Ports such as Gdansk, Aarhus, Bremerhaven and Felixstowe all exhibit this trend. It is also witnessed in Asia, with the case of Dalian. Such models are supported by specific windows of opportunity, such as is the case with Gdansk in Poland, 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).

The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013) / ERC Grant Agreement n. [313847] "World Seastems".

REFERENCES

Ducruet C. (Ed.) (2017) Advances in Shipping Data Analysis and Modeling. Tracking and Mapping Maritime Flows in the Age of Big Data. Routledge Studies in Transport Analysis, Routledge: London & New York, pp472

Ducruet C., Bunel M. (2017) GeoSeastems: an innovative tool to map global shipping flows. Application to the Mediterranean region. Portus Online, pp33

Knowler G. (2015) Mega-ship era hits the trans-Pacific trade. Journal of Commerce, December 14, 2017

OECD-ITF (2016) The Impact of Mega-Ships. The Case of Gothenburg. Case-Specific Policy Analysis

ABOUT THE AUTHOR

Dr César Ducruet is geographer and senior researcher at CNRS / Géographie-Cités. His research interests include network analysis, urban & regional development, and spatial analysis, with a particular focus on ports and shipping flows. He current leads the ERC World Seastems project analysing the evolution of global shipping networks since the late 19th century.

Justin Berli is an engineer in humanities and social sciences at CNRS / Géographie-cités. He holds a Bachelor's in oceanography-surveying and a Master's Degree of Geography. He is presently working on the automated integration of the world's road network into GeoSeastems, as well as the platform's general development.

ABOUT THE ORGANIZATION

The National Center for Scientific Research, or CNRS, is a public organization under the responsibility of the French Ministry of Education and Research. Since 1939 the CNRS aims to evaluate, carry out, advance, promote, develop and support knowledge creation and bringing social, cultural, and economic benefits for society.

ENQUIRIES

CNRS Laboratory
UMR 8504 Géographie-cités
13 rue du Four, F-75006
Paris, France
Web: www.parisgeo.cnrs.fr
Web: www.world-seastems.cnrs.fr