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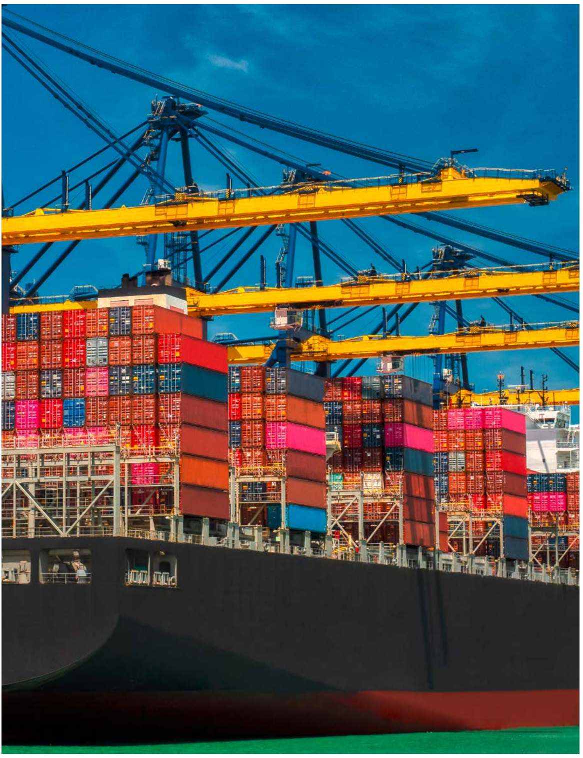

Ongoing challenges to ports: the increasing size of container ships

Introduction

Container ships have grown steadily in size, more so in the last 14 years. This trend, which has strategic implications for the shipping industry and the planning of ports and related activities, concerns not only the main world trade lanes but also north-south routes, which include Latin America.

This *FAL Bulletin* is part of the reflections on port planning that have been addressed in previous issues and in other publications of the Economic Commission for Latin America and the Caribbean (ECLAC).

This issue examines the dynamics of the increase in vessel size worldwide and the factors that explain it, and subsequently provides projections regarding the arrival of the largest ships currently in service to South American shores with a view to facilitating port planning.

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United Nations

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I. Large container vessels reflect a major trend in the container shipping industry

The ever increasing size of ships is a common thread in the main trends that have emerged in the container shipping industry over the past 15 years: gigantism, the decoupling between trade and fleet expansion, the volatility of volumes, an oversupply of vessels and market concentration, among others.

Figure 1A illustrates the trend towards gigantism of container ships between 2005 and 2022. There has been little change or a decline in the number of ships with capacity of up to 11,999 twenty-foot equivalent units (TEU) since 2015, when vessels exceeding 12,000 TEU began to dominate the industry. Figure 1B shows the prevalence of large container vessels on orderbooks for ships to be delivered in 2020 and 2021.

Figure 1
World:[a] trends in gigantism of container ships, 2005–2022
(Thousands of TEU and percentages)

A. Gigantism trends, 2005–2022

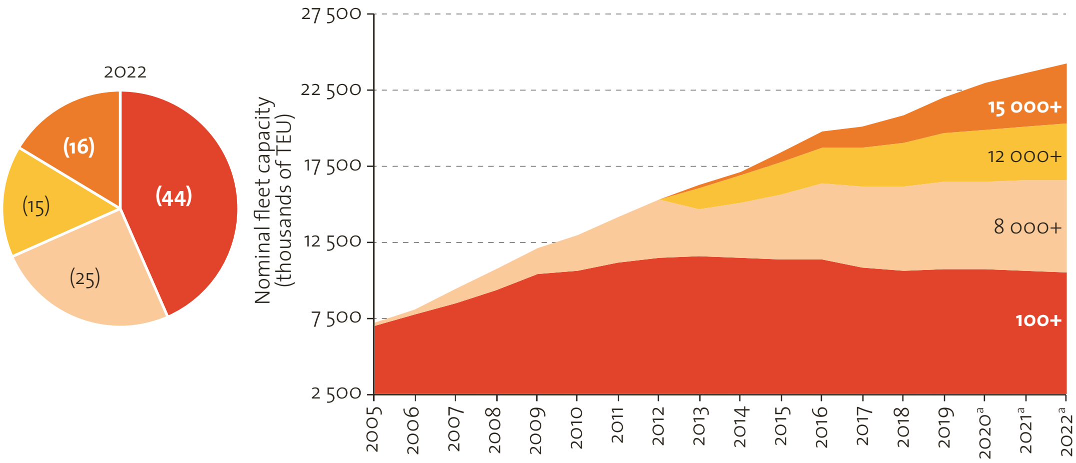
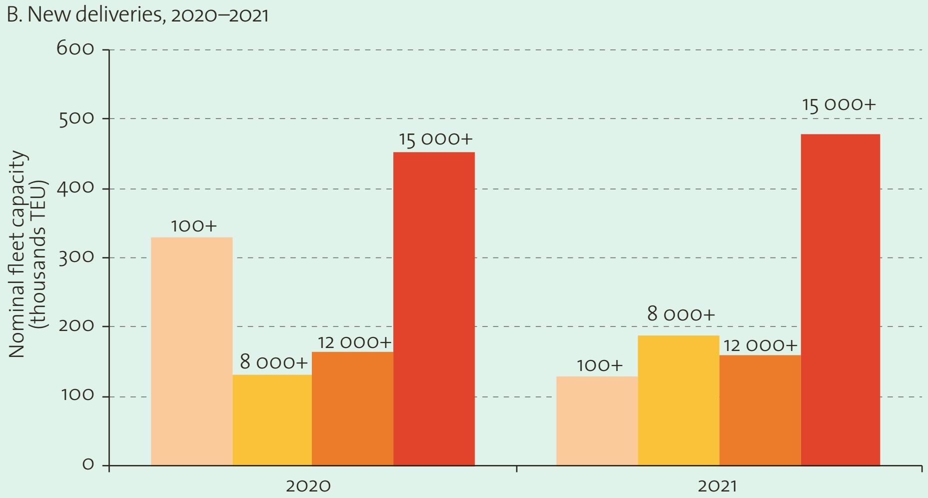


Figure 1 (concluded)

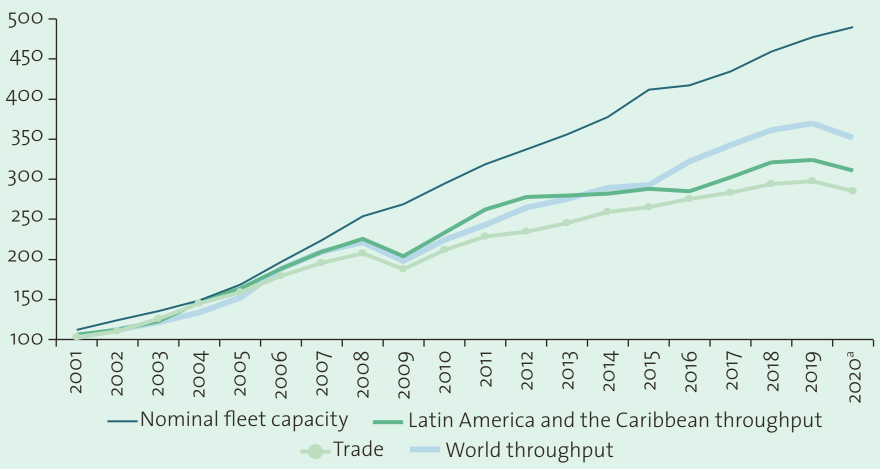


Source: Prepared by the authors, on the basis of Dynamar, DynaLiners Weekly [online] https://www.dynamar.com/.
[a] Figures from 2020 onwards are projections.

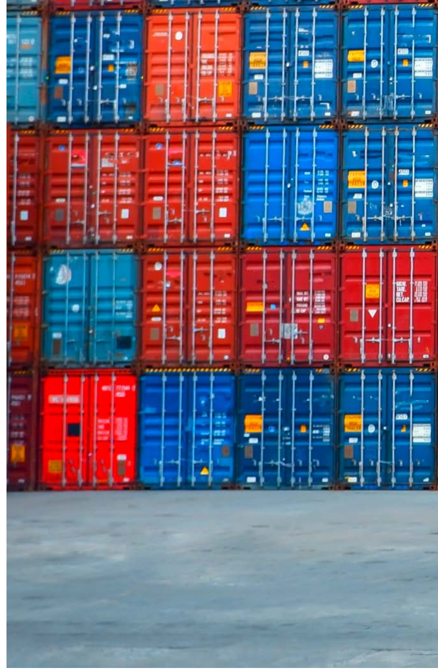
Figure 1B shows that 25% of the number of newbuilds on order are vessels larger than 12,000 TEU (15% are >15,000 TEU and 10% are between 12,000 and 14,999 TEU). In terms of nominal capacity, 25% of the new units to be delivered account for 67% of the global orderbook. Under these conditions, by early 2022, 16% of the total fleet will be in the 15,000+ size range and 15% in the 12,000+ range.

Other industry trends reflecting the gigantism of ships at the global level are illustrated in figures 2 and 3 below. The increase in fleet capacity was similar to that of port throughput in the world and in Latin America until 2009, when the effects of the global crisis reversed this trend and opened a gap between the expansion of transport capacity and trade volumes (see figure 2).

Figure 2
Latin America and the world:[a] shipping trade, fleets and port throughput, 2001–2020
(Index 2000=100 -TEU)



Source: Prepared by the authors, on the basis of R. J. Sánchez and E. Barleta, "Reflections on the future of container ports in view of the new containerization trends", *FAL Bulletin*, No. 366, Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2018.
[a] Figures from 2020 onwards are projections.



Decoupling is the result of the combination of the overexpansion of fleet capacity (see figure 3B) and the excessive volatility of maritime trade (figure 3A). The sum of the areas between the capacity and trade curves (figure 3b) shows the cumulative overcapacity during the period under consideration: between 2012 and 2019 the fleet, measured in nominal capacity, grew at a compound annual growth rate (CAGR) of 5.5%, while maritime trade grew at 3.8%.

Figure 3
Latin America and the world: year-on-year variation in shipping trade and fleet capacity
(Percentages)

Source: Prepared by the authors, on the basis of data from Container Intelligence Monthly [online] https://www.clarksons.com/.
[a] Projections.

The high level of concentration in the industry is a major consideration at present. It is the result of the mergers, acquisitions and alliances seen in recent years and the reason for which gigantism could potentially work.

Since 2009, concentration has picked up speed, coinciding in particular with the increasing decoupling, volatility and overcapacity of the industry. The three main alliances currently account for more than 84% of the global container transport capacity.

In summary, while this article does not seek to analyse all the current trends in the container shipping industry, the upsizing of vessels is clearly one of the major issues. The pace of this upsizing has also been remarkable: vessel sizes have increased more rapidly than anticipated, as just a few years ago it was hardly imaginable that a 24,000 TEU vessel would currently be in service.

Maritime transport has always faced a high degree of uncertainty stemming from the myriad social, political and economic factors at play in the industry. Today, the heightened interdependence resulting from globalization can mean that a given event, involving a single actor or occurring in one market, can trigger a large-scale impact, not to mention various crises, until equilibrium is restored. The current coronavirus disease (COVID-19) pandemic, which has had an impact on shipping activity, is a clear example of this.

However, the COVID-19 outbreak is not the first historical event to have disrupted the balance in maritime transport. In the past, there have been many incidents, exogenous to shipping, that have prompted sudden and substantial changes in routes, business practices or even the very configuration of ships. The closure to navigation of the Suez Canal —first in 1956 and again in 1967, which led to the birth of supertankers— are two widely acknowledged events in this regard. The building of the first Panamax vessel in 1972 was a milestone in container ship size The 1973 oil crisis, followed by a second one in 1979, are also examples in a non-exhaustive list of historical events that can be mentioned. Authors such as Cipoletta Tomassian and Sánchez (2009) and Stopford (2009) show the impact of economic events on maritime transport, while Gómez Paz (2013) adopts a historical perspective.

The last major economic crisis was that of 2008–2009. Before the launch of the Triple E-class 18,000 TEU *Maersk Mc-Kinney Møller* in 2013, itself preceded by the *Emma Maersk* (2006) with a capacity of around 14,000 TEU, predictions for larger ships varied widely based on different factors: the downtrend in trade and the increase in ship orders (UNCTAD, several years), the implications for ports (Penfold, 2017), and transport infrastructure such as the new Panama Canal locks. All these factors were thought to indicate a slowing of the trend, but large ports such as Rotterdam and Le Havre were adapting their designs to accommodate these larger ships, while other factors facilitating the upsizing of vessels, such as concentration of shipping companies, economies of scale, falling shipbuilding prices and the shift towards more sustainable vessels, were gaining in importance.

II. Multifarious factors determine the growth of large container ships

A foresight analysis, conducted between 2008 and 2013, based on a semi-quantitative Delphi methodology and a quantitative model was used to predict future scenarios. It found that ship size was limited mainly by canal and port depth, while other factors such as new CO_2 emissions limits, oil prices, certain economic variables, transport costs per unit and the concentration of shipping companies drove the trend towards larger ships, upsetting the balance between supply and demand (Gómez Paz, 2013). The methodology applied has been validated and is based on the drivers or inhibitors of the growth trend in large container ships. In addition to the scenarios derived using the methodology, a dynamic model was created to allow for simple and objective changes to be made to the variables and observe their effects on scenarios.

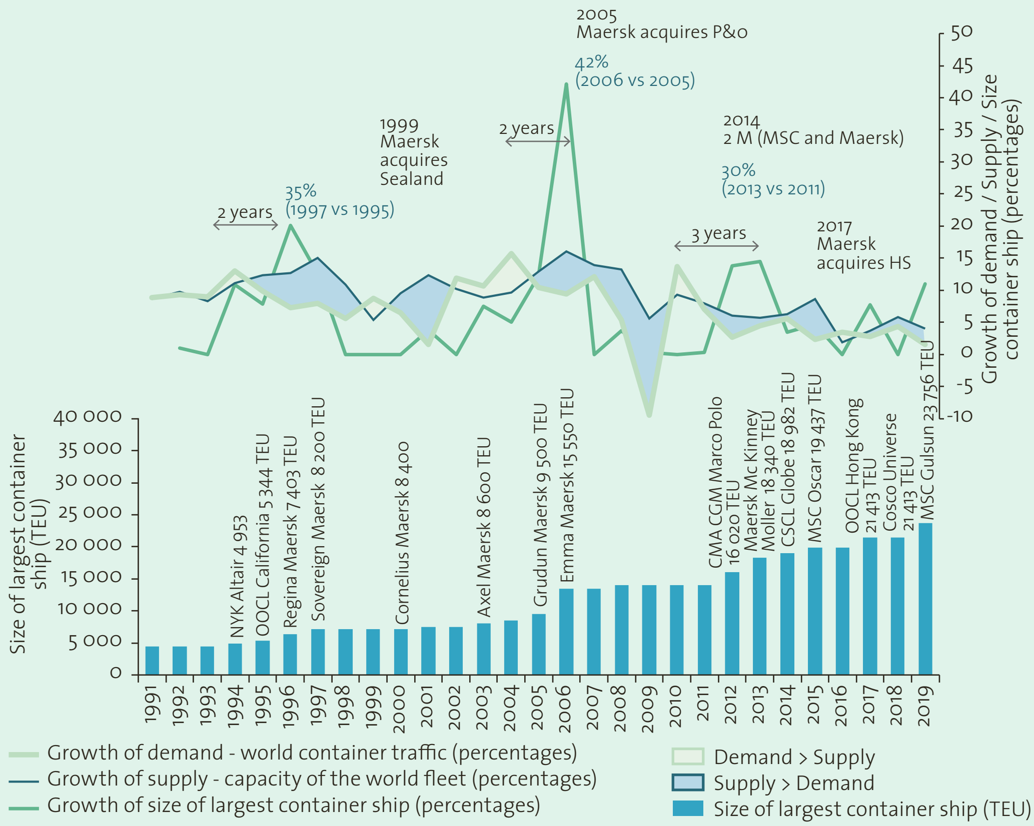
In Latin America, preparations are being made to bring vessels of 400 m in length to ports on the west coast of South America (Portal Portuario, 2020). Sánchez and Perrotti (2012) had already projected the arrival of large ships in Latin America, noting that it would take progressively fewer years for the large vessels operating on the main routes to begin calling at ports on the coasts of South America. The study estimated that 13,500 TEU vessels would arrive between 2017 and 2019, and this was borne out by the appearance of these vessels beginning in 2017.

The desire for larger ships has always existed. Wijnolst, Scholstens and Waals (1999) encouraged the idea of large container vessels, such as the Malaccamax (limited by the depth of the Malacca Strait). Advances have been made in the upsizing of vessels and in the technology used. In 2008, STX Offshore & Shipbuilding of the Republic of Korea announced that it had designed a 22,000 TEU vessel, while in 2011 there had been rumours that Maersk planned to order 18,000 TEU and 20,000 TEU vessels for 2014 (Alphaliner, 2011).

All these projections for large vessels have been surpassed and today there are ultra-large container ships of up to 24,000 TEU in service, equipped with the latest technology and compliant with current requirements. According to Alphaliner (2019), which identifies the largest major vessels and the number in each size range, there are a total of 89 vessels with a capacity of between 18,000 and 24,000 TEU, most of which are owned by Maersk (35%), Mediterranean Shipping Company (MSC) (20%), COSCO Shipping Lines (19%), Evergreen Marine (12%), Mitsui O.S.K. Lines (MOL) (7%) and United Arab Shipping Company (UASC) (7%). The publication also notes that a total of 32 Megamax-24 (MGX-24) newbuilds, with 24 container rows and a beam of 61.5 m, have been ordered by Hyundai Merchant Marine (HMM), MSC and CMA CGM. These operated vessels of 18,000-24,000 TEU are 400 m long, with beams of 58.6 m-61.5 m and a draught of 16-16.5 m. The *MSC Gülsün* represents a breakthrough not only because of its unprecedented size —with a 23,756 TEU capacity— but also because it incorporates new collision avoidance, space optimization and marine and environmental protection technologies (Russo, 2018).

Gómez Paz (2013) found consensus among experts on the factors that are likely to limit and condition the growth trend of large ships in the future. To establish the experts' vision, a pre-foresight analysis of the factors that have influenced the growth trend in the past was carried out. A first outcome is presented in figure 4, which shows the patterns in demand (traffic), capacity (fleet) and size of container ships, updated to 2019. The figure shows that the main spikes in ship size generally occur two years after demand (container traffic in TEU) exceeds supply (nominal fleet capacity measured in TEU). However, the data show that this rule no longer held true at a given point, suggesting that there are other factors influencing the trend. Figure 4 also illustrates the periods of surplus and deficit that lead to overcapacity (as seen in figure 3b) as well as the acquisitions and mergers that coincide with increases in vessel size.

Figure 4
World: increases in vessel size in relation to changes in fleet supply and demand, 1991–2019
(TEU and percentages)



Source: Prepared by the authors on the basis of M. Gómez Paz, "Diseño y aplicación de una metodología prospectiva para la determinación de los condicionantes futuros del crecimiento de los grandes buques portacontenedores", doctoral thesis, Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos, Technical University of Madrid (UPM), 2013; Clarkson Research, *Container Intelligence Monthly*, several years; Alphaliner, "Chart of the week: evolution of the world's largest containerships 1985-2011", *Alphaliner Weekly Newsletter*, vol. 2011, No. 4, 2011, "Chart of the week. The world's largest containership: who are the contenders?", *Alphaliner Weekly Newsletter*, vol. 2014, No. 52, 2014; "Chart of the week: the world's largest containerships", *Alphaliner Weekly Newsletter*, vol. 2019, No. 28, 2019; "Table of the week: containership fleet: key figures (1 Jan 2020 vs 2019)", *Alphaliner Weekly Newsletter*, vol. 2020, No. 1, 2020; and Barry Rogliano Sales (several years).

Note: Major acquisitions and mergers are indicated in the top half of the figure. The total fleet (top half of figure) includes both in-service and out-of-service vessels and vessel capacities are estimates. The *CMA CGM Marco Polo* entered into service in 2012.

In the pre-foresight analysis, mind maps and timelines were used to identify and characterize different factors. On this basis, the Delphi method was used to construct successive surveys and establish an experts' judgement on the factors that would limit and condition the growth trend of large container ships over the next 20 years. Gomez Paz, Camarero and González (2014) describe the methodology and its outcome in detail. To establish the vision, 83 experts, primarily from Europe and the Americas, participated in three anonymous rounds, with the results obtained at each previous round presented. The final vision was agreed upon by 82% of the experts. The results indicated that the factors most likely to influence and/or limit the growth of vessels were nautical access, berth depth and air draught, and economic uncertainties. Meanwhile, environmental factors, oil prices and the lack of technology and innovation were identified as having an average probability of influence but a lower probability of being a constraint. In the final vision, the factors identified as least likely to be limits and constraints were maritime safety, productivity in other subsystems and global conflicts. Other factors considered in the successive rounds were the concentration of shipping companies and changes in consumption, among others.

This paper finds that the vision remained unchanged in 2020, with environmental issues gaining prominence. In line with the Sustainable Development Goals, the International Maritime Organization (IMO) (2018), adopted an initial strategy on the reduction of greenhouse gas emissions from ships, aiming specifically to reduce emissions from international shipping by at least 50% by 2050 compared to 2008. Against the backdrop of these regulations and the fact that liquefied natural gas (LNG) is now a viable solution, the Dalian Shipbuilding Industry Company and DNV GL signed an agreement to develop a 23,000 TEU vessel fuelled by LNG (DNV- GL, 2018). Similarly, CMA CGM announced the launch of the LNG-powered *CMA CGM Jacques Saadé* and eight sister ships with a capacity of 23,000 TEU, for delivery from 2020 (CMA CGM, 2019).

According to Russo (2018), the main driver for ordering bigger vessels is to reduce the energy needed to transport each individual container. More energy efficiency lowers costs and helps to minimize CO_2 emissions, which improves profitability and reduces the environmental impact of global supply chains. With respect to the question of whether ships could grow larger still, he cites an industry professional, who states that, "Technically speaking there are no fundamental physical constraints, and from an operational point of view, a commercial case could certainly be made. The barrier, however, is shore-side infrastructure. We are approaching the maximum size that ports can handle."

Stopford (2019) indicates three factors that are pushing the maritime industry into a new era —digital technology, regional re-alignment and environmental emissions— and proposes strategies for adapting to them. Penfold (2017) focuses on the requirements for ports: environmental, technical adaptation to larger ship sizes, automation, and political and economic factors. Ports seem to be adapting to the trends. UNCTAD (several years) analyses investment projects undertaken between 2017 and 2019, highlighting their objectives with regard to the development and improvement of port infrastructure. The Next Generation Tuas Port project, spearheaded by the Maritime and Port Authority of Singapore, stands out as a pioneering initiative to build a smart, safe, green and community-oriented port designed with a depth of 23m to berth mega container ships in the long term (MPA Singapore, 2019).

Haralambides (2019) gives a detailed account of the economies of scale in shipping and diseconomies of scale in ports and the hinterland. However, container ships do not only affect land-side operations. Yap and Loh (2019) suggest that in addition to traffic on land, congestion in terms of sea space must also be considered. Ge and others (2019) evaluate under which economic, operational and environmental conditions and expectations, shipping companies are likely to push the ultra-large containership (ULCS) size from 18,000 to 20,000 TEU to 25,000 TEU. The study finds that 25,000 TEU vessels continue to generate economies of scale provided that capacity utilization and freight rates remain high.

The demand for freight that feeds container trade has an impact on shipping. According to the results of the above-mentioned study (Ge and others, 2019), the load factor is influenced by fleet capacity and trade volumes. Consequently, it is likely that lower demand for container traffic would affect vessels' load factor and result in a different scenario. Images of vast numbers of ships at berth and the adoption of slow steaming by shipping lines in the wake of the 2008 financial crisis are a not-so-distant reminder of this.

The view on "economies of scale" also offers other important aspects that are worthy of consideration. Sanchez and Wilmsmeier (2017), revisiting the traditional analyses of maritime transport, find that concepts of economy of scale, scope and density can be applied to the present-day characteristics of maritime transport in which shipping lines offer transport services ranging from different types of containers at different rates to various geographical distances, with units that are increasingly larger and in oversupply, vessel sharing agreements (VSAs) between shipping companies to generate economies of service, and positioning in negotiations with ports. These and other factors debunk the old myths of the maritime industry. All these dynamics generate new challenges for ports: first, the size of the ships is increasing, but not at the same pace of growth in port throughput, which requires investment in infrastructure and superstructure; second, with the creation of new business opportunities, investment is required to provide new services. Ports try to keep up with these new challenges to avoid losing services, leading them to assume even greater financial and operational risks in port planning.

Economies of scale are defined by Wilmsmeier, Gonzalez Aregall and Sánchez (2017) as one of the ingredients, along with concentration and cyclical effects (supply/demand interaction), of a "pre-hangover" cocktail. They explore and discuss future challenges and highlight the need to monitor the behaviour of alliances. The spread of the "hangover" will differ geographically, with a global concentration that will have a stronger impact on secondary and tertiary routes. Emphasis is placed on the importance of integrated international, regional and national policies and regulations, and of port and infrastructure planning beyond logistics chains to take into account production, financing and marketing.

Vertical integration, which occurs when carriers expand into terminal handling and logistics operations, is a major concern. Brooks, Vanelslander and Sys (2019) and Haralambides (2019) call integration into question and present their views on this issue. Sánchez and Chauvet (2020), in particular, put forward arguments on governance, infrastructure concessions, public-private partnerships and the main characteristics thereof, and the protection of competition. The latter study stresses the importance of institutions and mechanisms to prevent anti-competitive behaviour and cautions on the risks of vertical integration. Incomplete concession contracts that did not anticipate the current situation abound, and institutions may not be in a position to resolve conflicts when renegotiating a contract, which could lead to anti-competitive behaviour and adversely affect development and well-being.

III. When might the next "world's largest ship" appear?

Given the many uncertainties involved in quantitative forecasting, it has long been recommended that infrastructure development plans should be flexible. UNCTAD (1985) mentions the importance of flexible plans: "A key principle in planning seaport facilities therefore, is that development plans should be as flexible as possible to allow a prompt response to changing demand." Taneja and others (2010) propose Adaptive Port Planning (APP), which aims to close the gaps in traditional planning and thus bring about "flexible port infrastructure". Van Dorsser, Taneja and Vellinga (2018) present a new approach for developing a shared vision on the future development of the port of Rotterdam. Simulation has also become an important part of the planning, renovation and modernization of port terminals and waterways, helping to optimize and minimize investments in infrastructure while maintaining efficiency and safety (Gomez Garay, 2014).

Gómez Paz (2013) objectively combines pre-foresight analyses and the "expert vision" regarding the future determinants for the growth of large container ships and a quantitative model in order to identify the factors that will promote, slow down or limit the growth of ships. The initial objective was to identify a probable scenario. However, as the determinants of the growth trend of ships fluctuated continuously and resulted in varying scenarios, the quantitative model was converted to a predictive game model. It contains a control panel with historical information summarized by periods and a scenario selection control. Adjusting the determinants of growth of ships generates possible scenarios with varying sizes of ships and an indicating the factors that limit the trend of growth of ships. The model thus changes from static to dynamic.

In summary, the dynamic predictive game model looks at a current situation and moves it to a future situation that may be possible and desirable, based on a probable and consistent progression of the factors that, according to the expert's judgement, will determine the growth trend of ships. Both methodologies —the dynamic quantitative model based on predictive game theory and the Delphi method using expert opinions— are complementary and validated.

The model is run for different growth trends and reveals how an anticipated change in a variable that determines the upsizing of large ships can advance or delay the appearance of a larger vessel on a timeline. It can be seen that in 2011, the indicators related to economic growth —container traffic demand— were likely to slow down the growth of vessels, a perception influenced by the low expectations for economic growth. However, this perception changed in 2013 and the model showed that economic growth would foster the increase in vessel size, thus predicting the emergence of a larger vessel.

The main factors driving the growth of large ships identified by the predictive game model were: concern for the environment, positive economic growth forecasts and technological advances resulting in savings per unit of transport. The model also found that a strong concentration of shipping companies were drivers of larger ship sizes and that the adaptation to new logistic requirements and the need to improve crane productivity were the main factors that slowed the growth trend. Meanwhile, investment in large infrastructure works for navigation and port, channel and strait access were the most significant inhibitors of the trend towards larger vessels.

Whether container ships become larger will depend on the interaction of various determinants and new relationships between them. Dynamic forecasting tools that integrate different expert views and use historical data and predictive analysis to provide guidance on global trends are useful instruments for anticipating new determinants and future scenarios, and actively getting ahead of them.

IV. When will South America see next generation container ships?

This section presents the econometric models used to forecast the arrival of ultra large container ships in the region, information which is crucial for efficient port planning. The models presented here are updated versions of Sanchez and Perrotti (2012), where the objective is to estimate the arrival of post-Panamax vessels in South America, using as a dependent variable the nominal capacity of the vessels (measured in TEU). An alternative model has also been incorporated using length overall (LOA) as a dependent variable.

The variables used in the models are: **TEU** (Twenty-Foot Equivalent Unit), represented as Max in models 1 and 2, which denotes ship capacity measured by the amount of TEU that can be held on board. **LOA**, Max in model 3, which denotes the measured length from the forwardmost tip to the aftermost end of the vessel and is used to measure the berth space needed. **Port throughput** (Pa in the model): represents the amount of cargo handled by ports on the east and west coasts of South America, measured in TEU. As demand derived from economic activity, it is closely correlated with GDP. **Gap**: Denotes the percentage difference between the maximum size (in TEU or LOA) of vessels sailing to South America and those operating the main trade routes at the same time. This variable captures the cascade effect produced when larger newbuilds on the primary routes push some of the older fleet onto secondary routes (e.g. Latin America). An analogy for this effect is that of coin cascade (or coin pusher) machine, where the introduction of a new coin (new ship) pushes other coins (older ships) to spill into the coin bucket (secondary routes).

Two models were tested to address the aim of the study. Model 1 is a pooled model that incorporates dynamic behaviour through the use of a lagged dependent variable, while model 2 is a pooled model that incorporates an error-correction mechanism.

It is important to bear in mind the advantages of pooled analysis (Podesta, 2000). First, it mitigates the problem of too few observations that can occur with cross-sectional and time series analysis. Generally, when there are few observations, the total number of potential explanatory variables exceeds the degree of freedom. With pooled models, this condition is relaxed thanks to the combined use of cross-sectional and time-series variables, allowing a greater number of predictors to be tested in the framework of multivariate analysis. Second, pooled models can be used to conduct analysis within variables, deepening the one-dimensional study of time series or cross-sectional analysis. Some characteristics of cross-sectional series tend to be temporally invariant. Therefore, an analysis of pooled data combining space and time may rely upon higher variability of data in respect to a simple time series or cross-section design research. Third, pooled models use all the available cross-sectional series over time, instead of testing a cross-section model at one point in time or testing a time series model.

The results of the estimates show statistical significance for all parameters of both model 1 equations, with a confidence interval of least 90%. For model 2, with the exception of the individual effects of the east coast parameter, all other parameters are significant, with a confidence interval of at least 90%.

The assumptions in tables 1 and 3 below were applied to models 1 and 2 in order to make the projections regarding the sailing of 18,000 TEU ships to the coasts of South America.

Table 1
Latin America: assumptions of average annual growth in port throughput and gaps, by coast and scenario
(Percentages)

Scenario	West coast throughput	East coast throughput	West coast gap	East coast gap
Historical	6	4	3	5
Positive	7	5	3	5
Negative	5	4	3	5
Negative_2	3	3	3	5

Source: Prepared by the authors.

The outcome of the forecasts for each model, by coast and scenario, are summarized in table 2 below.

Table 2
Latin America: projected year of arrival of 18,000 TEU ships, by model, coast and scenario

East coast			West coast		
Scenario	Model 1	Model 2	Scenario	Model 1	Model 2
Historical	2028	2029	Historical	2024	2025
Positive	2027	2028	Positive	2024	2024
Negative	2029	2029	Negative	2025	2025
Negative_2	2030	2031	Negative_2	2027	2026

Source: Prepared by the authors.

A model similar to model 2 (i.e. a pooled model that incorporates dynamics through a lagged dependent variable) was applied when using length as a dependent variable. The parameters show statistics with acceptable levels of significance (a confidence interval above 90%).

To forecast the year of arrival of the vessels, a number of assumptions were made, where the gap refers to differences in lengths. The assumptions used for model 3 are shown in table 3 below.

Table 3
Latin America: assumptions of average annual growth and gaps in port throughput, by coast and scenario
(Percentages)

Scenario	West coast throughput	East coast throughput	West coast gap	East coast gap
Historical	6	4	-7	-2
Positive	7	5	-7	-2
Negative	5	4	-7	-2
Negative_2	3	3	-7	-2

Source: Prepared by the authors.

The projected arrival years, based on the coast and scenario applied, are as follows (see table 4).

Table 4
Latin America: projected year of arrival of 400 m ships, by coast and scenario

Scenario	West coast	East coast
Historical	2021	2022
Positive	2021	2022
Negative	2021	2022
Negative_2	2022	2022

Source: Prepared by the authors.

V. Concluding remarks

At the time of writing, the world was in the midst of the COVID-19 pandemic, which has had an impact not seen for 120 years and is affecting trade and shipping significantly. Drewry (2020) notes that "the only certainty is supply and demand volatility". In the early days of the outbreak, shipping companies introduced blank sailings and are expected to continue to do so, and it is still too early to tell how the pandemic will ultimately impact the industry. Added to this was the sudden plunge in the price of oil due to a price war, creating a perfect storm of changing, interrelated variables that generate new scenarios that must be adapted to in the short term.

Beyond the pandemic's tremendous impact on industry demand, the most severe shock (related to the arrival of large ships in South America) will be seen on the supply side. Notably, some port infrastructure upgrades are expected to suffer delays, thus the scenarios presented will likely skew more towards the negative than towards historical ones. However, it is highly possible that the effects will be temporary, with delays observed, but with no profound shift away from gigantism.

Significant milestones have been reached in terms of gigantism, with the launch of the *Emma Maersk* (15,500 TEU) in 2006, the Maersk Triple E-class (18,000 TEU) in 2013, and the *MSC Gülsün* (23,756 TEU) —already classed in the MGX-24 category— in 2019. This trend has not escaped Latin America, as by a cascade effect, ships with a capacity of 14,200 TEU and length of 367 m now arrive at its shores.

Container fleets and business practices have undergone changes not only in capacity terms but also with respect to technology, as they pursue compliance with environmental sustainability objectives and better operational and commercial efficiency through alternative fuels, container management, cost reduction, digitization, rate differentiation and collaborative practices, such as alliances and VSAs. Shipping companies have also shifted their business models towards vertical integration, adding to their ocean freight services the handling of specialized port terminals and hinterland distribution. However, these changes, particularly the emergence of ultra large vessels on the main routes, have caused a cascading effect transferring vessels to secondary and tertiary routes and creating new challenges for ports. In an effort to adapt and not lose services, ports are compelled to invest in equipment, infrastructure and superstructures to service larger vessels and port authorities must assume new roles and tackle new goals.

Beyond gigantism, there is a new global context: new, broad-ranging and highly concentrated services pose novel challenges to ports, especially those that have been affected by the cascading of ships from other routes. There is also a need for significant infrastructure investment and the development of new businesses. There is a knock-on effect on ports and the entire logistics chain, including production, which, in turn, affects sustainable development.

This paper has presented different forecast methodologies which all point to the arrival of large ships within this decade. These models also identify the future determinants of the increase in size of large ships, highlighting the infrastructure-related factors that limit growth in ports and shipping lanes, and others related to environmental requirements that drive the increase in size of large ships.

The methodology applied in Sánchez and Perrotti (2012) was used to study the determinants for the arrival of the world's large container ships in South America, with the main determinants being the level of economic activity and the cascading effect (the gap between the ships operating the major trade routes and those in Latin America).

Two parameters for measuring the size of the ships are presented in this paper: (a) ships with a nominal capacity of 18,000 TEU, estimated to arrive on the east coast by 2027 and on the west coast by 2024; (b) ships with an LOA of 400 m, forecast to arrive on the west coast by 2021 and the east coast by 2022

It should be clarified here that the reasons for the different timelines in two separate forecasts that analyse the same concept are technical in nature. Since the nominal capacity of 400 m long ships varies from 15,500 TEU to 23,700 TEU, it is not impossible for longer ships to arrive before those with a greater TEU capacity. However, from a port planning perspective, it is entirely appropriate to take the forecasts of the length model into account, as this determines physical needs in terms of docks, facilities and equipment.

Furthermore, as the Gómez Paz model (2013) shows, it can be assumed that the upsizing of container ships will also continue at international level, although the COVID-19 pandemic may slow this growth rate in the next few years.

It has also been observed ultra large container ships have resulted in the decoupling between trade and fleet capacity, coinciding with concentration of the industry. These considerations call into question the explanations commonly used to justify concentration, such as the search for economies of scale (Sanchez and Wilmsmeier 2017).

In addition, the COVID-19 pandemic has not sparked uniform reactions across the shipping industry. While it would be presumptuous to offer a conclusive assessment, it would appear that the financial outcome of the current crisis may significantly alter the degree of industry concentration and, thereby, the speed of fleet growth and the expansion of fleets at the global level, with a consequent impact on the region.

In an ever more globalized world, flexible short-, medium- and long-term planning, together with the formulation of integrated international, regional and national policies and regulations will help to maintain and even increase productivity, while softening the blow of shocks caused by new factors.

VI. Bibliography

Alphaliner (2020), *Alphaliner Weekly Newsletter*, vol. 2020, No. 1.

___(2019), *Alphaliner Weekly Newsletter*, vol. 2019, No. 28.

___(2014), *Alphaliner Weekly Newsletter*, vol. 2014, No. 52.

___(2011), *Alphaliner Weekly Newsletter*, vol. 2011, No. 4.

BRS Group (several years), *Annual Review*, vols. 2010-2020.

Brooks, M. and others (2019), *Technical Report: Regulation in the Liner Shipping Industry: Pathways to a Balance of Interests*, Antwerp, Dalhousie University/Department of Transport and Regional Economics of the University of Antwerp.

Cipoletta Tomassian, G. and R. Sánchez (2010), "La industria del transporte marítimo y las crisis económicas", *Natural Resources and Infrastructure series*, No. 149 (LC/L.3206-P), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).

CMA CGM (2019), "The CMA CGM JACQUES SAADE, the world's first 23,000 TEU powered by LNG" [online] https://cmacgm-group.com/en/launching-cmacgm-jacques-saad%C3%A9-world's-first-ultra-large-vessel-powered-by-lng [accessed on: 1 April 2020].

DNV GL (2018), "DNV GL and DSIC sign JDP to develop LNG fuelled 23,000 TEU ultra large container vessel", 5 September [online] https://www.dnvgl.com/news/dnv-gl-and-dsic-sign-jdp-to-develop-lng-fuelled-23-000-teu-ultra-large-container-vessel-128569 [accessed on: 21 March 2020].

Drewry (2020), "Coronavirus: rationing container capacity", 1 April [online] https://www.drewry.co.uk/maritime-research-opinion-browser/maritime-research-opinion-browser/coronavirus-rationing-container-capacity.

Clarksons Research (several years), *Container Intelligence Monthly*, vols. 1998-2020.

Ge, J. and others (2019), "Towards 25,000 TEU vessels? A comparative economic analysis of ultra-large containership sizes under different market and operational conditions", *Maritime Economics & Logistics*, Palgrave.

Gomez Garay, G. (2014), "La simulación marítima y su incidencia en seguridad, efectividad, confiabilidad y ahorro de recursos económicos en la operación portuaria", FORCE Technology Dinamarca, paper presented at IX Congreso Argentino de Ingeniería Portuaria, Buenos Aires, 5-7 May.

Gómez Paz, M. (2013), "Diseño y aplicación de una metodología prospectiva para la determinación de los condicionantes futuros del crecimiento de los grandes buques portacontenedores", doctoral thesis, Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos, Technical University of Madrid (UPM).

Gómez Paz, M., A. Camarero Orive and N. González Cancelas (2015), "Use of the Delphi method to determine the constraints that affect the future size of large container ships", *Maritime Policy & Management*, vol. 42, No. 3.

Haralambides, H. E. (2019), "Gigantism in container shipping, ports and global logistics: a time-lapse into the future", *Maritime Economics & Logistics*, vol. 21.

IMO (International Maritime Organization) (2018), "Initial IMO Strategy on Reduction of GHG Emissions from ships and existing IMO activity related to reducing GHG emissions in the shipping sector", United Nations Conference on Trade and Development (UNCTAD) [online] https://unctad.org/meetings/en/Contribution/dtltlbts-MyEM6thd04_IMO_en.pdf.

MPA Singapore (Maritime and Port Authority of Singapore) (2019), "Maritime and Port Authority of Singapore – Singapore's Next Generation Tuas Port Project" [online] https://sustainableworldports.org/project/maritime-and-port-authority-of-singapore-singapores-next-generation-port/.

Penfold, A. (2017), "The politics of trade and pressures on the supply chain: economic, political and environmental issues", WSP [online] http://aapa.files.cms-plus.com/2017Seminars/17Spring/Andre%20Penfold%20Final.pdf.

Podestá, F. (2000), "Recent developments in quantitative comparative methodology: the case of pooled time series cross-section analysis", McDonough School of Business, Georgetown University.

PortalPortuario (2020), "MSC plantea intención de traer buques de 400 metros de eslora a Chile", 27 February [online] https://portalportuario.cl/msc-plantea-intencion-de-traer-buques-de-400-metros-de-eslora-a-chile/.

Russo, D. (2018) "Raising the baseline for ULCV", 9 December [online] https://www.dnvgl.com/expert-story/maritime-impact/raising-the-baseline-for-ULCV.html [accessed on: 1 April 2020].

Sánchez, R. J. and D. E. Perrotti (2012), "Looking into the future: big full containerships and their arrival to South American ports", *Maritime Policy & Management*, vol. 39, No. 6.

Sánchez, R. J. and P. Chauvet (2020), "Contratos de concesión de infraestructura: incompletitud, obstáculos y efectos sobre la competencia", *International Trade series*, No. 150 (LC/TS.2019/104), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).

Sánchez, R. J. and E. Barleta (2018), "Reflections on the future of container ports in view of the new containerization trends", *FAL Bulletin*, No. 366, Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).

Sánchez, R. J. and G. Wilmsmeier (2017), "Port management implications from economies of scale in the liner container shipping industry", *Port Management: Cases in Port Geography, Operations and Policy*, S. Pettit, A. Beresford, London, Kogan Page.

Stopford, M. (2019), "Coming to terms with the new era for shipping and ports", presentation at the European Sea Ports Organisation (ESPO) Conference, Livorno, 23 May [online] https://www.espo.be/media/23-05%201100%20Martin%20Stopford.pdf.

___(2009), "Forecasting - an impossible job? What will the global stimulus package do for shipping? Is it all about China? Are we heading for another dry bulk Bonanza?", paper presented at the Tradewinds Norshipping Conference, Oslo, 10 June.

Taneja, P. and others (2010), "Implications of an uncertain future for port planning", *Maritime Policy & Management*, vol. 37, No. 3.

UNCTAD (United Nations Conference on Trade and Development) (several years), *Review of Maritime Transport*, New York.

___(1985), *Port Development: A Handbook for Planners in Developing Countries* (TD/B/C.4/175/Rev.1), New York.

Van Dorsser, C., P. Taneja and T. Vellinga (2018), *Port Metatrends: Impact of Long Term Trends on Business Activities, Spatial Use and Maritime Infrastructure Requirements in the Port of Rotterdam*, Delft, Delft University of Technology.

Wijnolst, N., M. Scholtens and F. Waals (1999), *MALACCA MAX-The Ultimate Container Carrier,* Delft, Delft University Press.

Wilmsmeier, G., M. Gonzalez-Aregall and R. J. Sánchez (2017), "Before the "hangover"?", *Maritime Mobilities*, J. Monios and G. Wilmsmeier (eds.), Abingdon, Routledge.

Yap, W. Y. and H. S. Loh (2019), "Next generation mega container ports: implications of traffic composition on sea space demand", *Maritime Policy & Management*, vol. 46, No. 6.

VII. Publications of interest

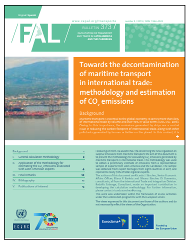
FAL Bulletin No. 376

The evolution of modal split in freight transport in South America, 2014–2017

This *FAL Bulletin* analyses data on the commodities traded and modes of transport used between nine South American countries between 2014 and 2017.

The aim is to identify the current modal split in intraregional freight transport and to ascertain the level and evolution of trade flows and imbalances by mode. The authors conclude with some policy recommendations.

Available in: Spanish English



FAL Bulletin No. 373

Towards the decontamination of maritime transport in international trade: methodology and estimation of CO_2 emissions

Following on from *FAL Bulletin* No. 372 concerning the new regulation on sulphur emissions from maritime transport, the aim of this document is to present the methodology for calculating CO_2 emissions generated by maritime transport in international trade. This methodology was used to obtain a preliminary estimate of emissions from a representative sample of exports from Latin America and the Caribbean. The sample was obtained from export tonnages from eight countries in 2017, and represents nearly 70% of total regional exports.

Available in: Spanish English