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Evolution of shipping networks

Current challenges in emerging markets

Abstract: Maritime transport is a key facilitator of global trade. Competitiveness in world trade depends, among other factors, on a country's level of connectivity and its integration in the global container liner service network. Recent investigations show that spatial frictions are considerably influenced by the level of connectivity rather than the pure notion of distance. Technological advances, i.e. increases in ship size, demand growth in trade volumes and concentration in the liner shipping industry, are constant drivers of change in the structure of liner services. What has been the effect of market concentration in the liner shipping industry on emerging markets in terms of service levels and competition? Based on the analyses of the evolution of liner shipping services in the period from 2000 to 2009, this research addresses the expansion of hierarchical liner service network structures and market concentration, focussing on South America as an example of emerging markets. The results identify the effect of economic downturns on liner shipping networks in network peripheral markets and the potentially detrimental effects on the competitiveness of countries and regions beyond the general challenges that come from a less favourable economic climate.

Keywords: liner services, market concentration, economic crisis, Latin America, competitiveness

Introduction

It is when a thing is beginning to disappear that the concept appears: Take globalization: if there is so much talk of it, as obvious fact , as indisputable reality, that is perhaps because it is already no longer at its height and we are already contending with something else.“ (BAUDRILLARD 2009, 12)

Maritime transport is a key facilitator of global trade. Competitiveness in world trade depends, among other factors, on a country's level of connectivity and its integration in the global container liner service network. Recent investigations show that spatial frictions are significantly influenced by the level of connectivity rather than the pure notion of distance (WILMSMEIER/HOFFMANN 2008; MARQUEZ-RAMOS et al. 2010). States and nations are redefining their place in the world at the present time in the wake of the economic, political and cultural transnationalisation processes that have occurred in recent decades. Each country, each region is seeking to recast its role and potential in accord with its geographical location, its history and the times. This positioning is, of course, conditioned by multiple factors, which include conditions of production, economic and political interests and transport related issues especially.

Technological advances i.e. increases in container ship size on the one hand and concentration in the liner shipping industry on the other, are a constant driver of change in the structure of liner services.

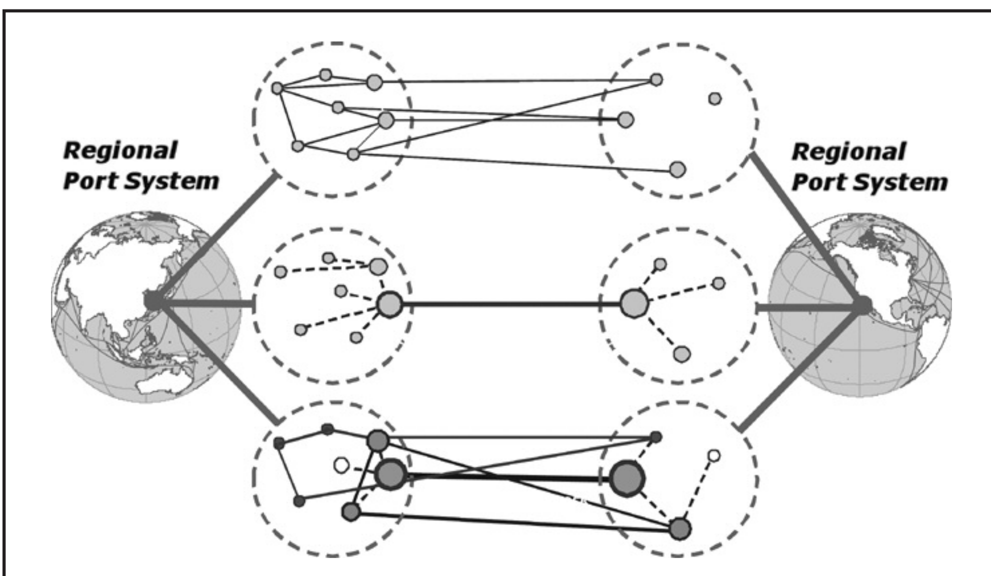
Container shipping lines operate in an increasingly competitive and market-oriented environment driven by global tendencies of market concentration in the maritime industry. Therefore, besides lowering shipping costs, container carriers enhance services to increase quality. Such factors for service enhancement include high sailing frequencies, reduction of shipping time, and a high level of reliability. This aims to satisfy shippers' interests in the minimisation of shipping and inventory costs and high reliability. The trade-off between customer demands and the strategies of shipping lines has led to the development of a co-existence of calling pattern such as hub-and-spoke, relay, feedering, and direct services, including point-to point and line bundling services. As the global liner shipping network has evolved from an interconnected and hub structure towards a hierarchical and varied network structure (ROBINSON 1998; NOTTEBOOM/RODRIGUE 2007), the question on the effect of concentration in maritime industry on emerging shipping markets in terms of service levels and competition appears.

In the global economy, potential market failures, such as quasimonopolistic market structures, may pose significant barriers to the competitiveness of emerging markets and as such may hinder economic development. Within the current situation, South America is a particularly interesting case. Maritime transport, the related infrastructural development, institutional reforms and the way the region imagines its place within the global trading pattern have been greatly changing in the last decade, driven by trade liberalisation and globalisation, as have the strategies and structure of the maritime industry and the liner shipping networks supplying the region. While the former have been described in detail in existing literature (UNCTAD 2009, earlier, SÁNCHEZ/WILMSMEIER 2005), the latter has received less attention (WILMSMEIER/NOTTEBOOM 2009; WILMSMEIER/HOFFMANN 2008; WILMSMEIER/SÁNCHEZ 2010; WILMSMEIER/SÁNCHEZ 2008) and is discussed in the following. This work investigates the evolution of liner shipping services in the period from 2000 to 2009 in terms of connectivity, competition, and structure of liner services. Specifically, the research analyses the expansion of the hierarchical network structure, market concentration, and focuses on the three regional markets in South America, West Coast of South America (WCSA), East Coast of South America (ECSA) and North Coast of South America (NCSA), as examples of emerging and medium size markets.

Key concepts in the maritime industry

Operation in the maritime industry is capital intensive with high income risk, due to the price instability (freight rates) and the perishability of service supply (space for goods transportation). Further, the differences in product structure generate different market segments (BROOKS 2000; DUESI/SÁNCHEZ 2008). From a microeconomic perspective, shipping lines are multiproduct service companies. This becomes obvious if a company delivers regular or non regular services for container or other types of cargoes. In this case the line operates in differ-

Fig 1: Liner service network types



Source: NOTTEBOOM/RODRIGUE 2007, based on ROBINSON 1998 ent markets with different production costs for each product (service). However, the case in which a line only offers container services on one or more routes, with multiple port calls, each combination in the calling pattern is a different market and for each exist individual production costs (GONZALEZ-LAXE/SÁNCHEZ, 2007). Maritime containerised trade is mainly delivered by regular liner services. Since the sixties the market for liner shipping has evolved due to the globalization process and the increase in the use of freight transportation. The development of liner shipping networks is primarily driven by the demand for containerised transport with transport demand being basically a derived demand from general economic activity at different spatial levels, regional, national, international. Accordingly, it is highly interrelated to the oscillation of economic development. PETERS (2001) argues for the existence of a positive interrelationship in the evolution of maritime containerised transport flows based on two pillars:

– organic growth related to globalisation; third party hiring; reduction of trade barriers, free trade treaties; and

– growth driven by technological change and new forms of organization, operation, and using economies of scale.

Additionally, containerised transport volumes are driven by an induced growth originating from trade imbalances and the related repositioning of empty containers. The application of hub and spoke strategies is a further driver to induced growth. This work focuses only on the container shipping market.

Economies of scale, density and scope

In the maritime industry, two types of economies of scale may be identified: external economies of scale, where the unit cost depends on the size of the shipping company, and internal economies of scale, where the unit costs depend on the size of the individual transporting unit (ship). The latter will be referred to as technological economies of scale (STOPFORD 2009, 545). A continuous increase in vessel size has been observed over recent years (JANSSON/SHNEERSON 1982; TALLEY 1990; LIM 1998; TOZER/PENFOLD 2000; *Lloyds's Register Technical Association* 2002). TOZER/PENFOLD (2000) indicate that even if there are limits to scale economies, where further increases in vessel size provide only limited unit cost reductions, this inflexion point has not yet been reached. In container shipping economies of scale can lead to a cost saving per TEU transported of 23 % (considering 100 % capacity utilisation) when replacing a 1,200 TEU ship with as 2,600 TEU ship. However, the potential saving decreases with increase in ship size; replacing 4,300 TEU vessel with a 6,500 TEU vessel generates cost savings per TEU transported of about 9 % (considering 100 % capacity utilisation)(STOPFORD 2009, 545). In both cases economies of scale occur when long run average production costs decrease as output increases. The high capital costs of ships are spread across a greater number of units (containers) as more can be transported. If output increases by a factor of two, for example, the cost of production would increase by less than a factor of two. For further insights in the effect of scale increase in container ship see e.g. CULLINANE et al. 1999 and STOPFORD 2009.

In business, economies of scale are usually considered in relation to specific areas of the production process, which may be technical, managerial, marketing, finance, and risk. External economies of scale can also be produced when firms that need to cover similar routes operate their services together, when the joint operation allows for deploying bigger scale ships. Cooperation thus allows for sharing of the resulting economies of scale. Economies of density are defined as an increase in output resulting in a less than proportional increase in total costs. Economies of density may be defined as the change in total costs due to the change in the output, holding network size constant. This means that a shipping company, in this case, increases its transported volumes without adding new ports of call to the routes. A firm that works with economies of density can fix its price for transport above the level of marginal costs, in order to avoid the entrance of new competitors to its market. Economies of density can, for example, arise from network reconfiguration from point-to-point networks to hub and spoke networks. Alliances and other forms of cooperation are a company's external strategies to gain economies of density, but also so that it can benefit from technological economies of scale as described above (for an overview see HEAVER/MEERSMAN/VAN DE VOORDE 2000). In network economies, the marginal cost of the carried unit is reduced with the positive externalities of the network, and at the same time this increases the economies of scale. The mean cost of transport decreases remarkably with the increase in size of the network and intensity of its use. For the markets, net effects have implications similar to economies of scale, in the sense that they seek economies of costs, acting over the mean and the marginal cost. In fact, JARA-DÍAZ/CORTES (1996) state that in the end, scale economies and density economies are different expressions of the same phenomena.

Networks and connectivity

The routing of containerised trade flows depends on the strategies of shipping companies and the demand of the shippers for specific service characteristics. As such, the location of a port or a region within the global liner shipping network and its connectivity is to a significant extent determined by the density of trade flows to and from a specific port or region. Liner services have the common characteristic of most services, that is, they are non-storable and non-transportable, but an additional and significant fact is that they are spatially unique in the sense that transport between C and D is normally not a substitute for transport between A and B (JANSSON 2001). Shipping lines will determine their calling patterns and services structures in a region based on trade and port specific characteristics, primarily concentrating on markets that allow for making use of economies of scale, density and positive network effects (see also YOSHIDA/YANGKIM 2005). The spatial spread, concentration and direction of trade flows in regions have driven the development in two directions. Furthermore, paths must be designed in such way that the profit is maximized with regard to shipping the cargo.

On the routes where a shipping line cannot generate sufficient traffic to deploy its own ships, agreements (i.e. slot charter, vessel sharing) have become common to gain economies of density and scale through pooling. The more common strategy is the development of hub and spoke networks, where attempts are made to generate economies of density on specific legs of a route. This gives the shipping lines the possibility to maximise the use of economies of scale on the trunk routes and at the same time to generate economies of density on the secondary routes. Bundling is one of the key driving forces of container service network dynamics (NOTTEBOOM 2004). Different types of complex bundling networks (i.e. line-bundling, hub-and-spoke, triangular, pendulum, butterfly) are used as an alternative to direct point-to-point container services. The advantages of complex bundling are higher load factors and/or the use of larger vessels in terms of TEU capacity and/or higher frequencies and/or more destinations served. The main disadvantages of complex bundling networks are the need for extra container handlings at intermediate terminals, longer transport distances and a higher dependency on service quality and synchronisation. These elements incur additional costs and as such could counterbalance the cost advantages linked to higher load factors or the use of larger vessels (WILMSMEIER/NOTTEBOOM 2009).

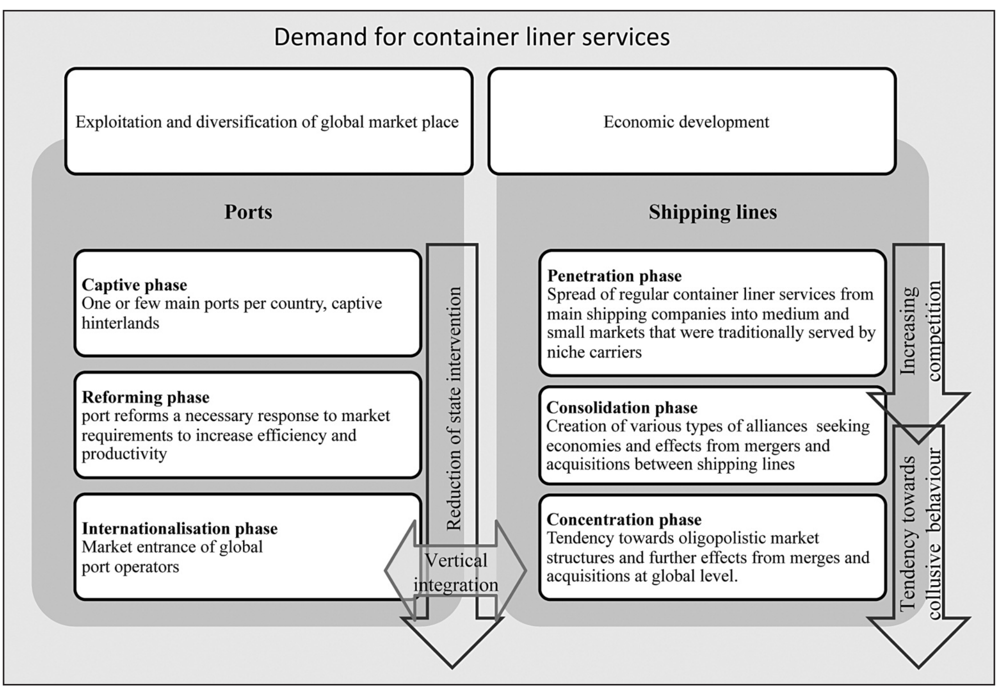
The design of individual liner services is often linked to other liner services of the same shipping line. Hence, shipping lines can have operational incentives to concentrate several calls in one or more hubs in a region. CULLINANE/KHANNA (2000) and FRÉMONT/SOPPÉ (2007) referred to the concentration of cargo at the level of liner networks of individual carriers. From a shipping line's perspective, the economies of scale in shipping, port operations and inland operations would favour a very limited number of load centres in a region. The advantages of concentrating cargo in only one or a few ports of call would be stronger at the level of a shipping line than at the port level, simply because not all carriers will choose the same load centres in their liner service networks. Under the condition of a globalised container shipping industry, shipping lines evaluate the importance of a specific market (trade route) in a global context. In growing markets, this leads to competition between trade routes and the constant reorganisation of networks. This reorganisation is driven by the underlying economics of the industry. FAGERHOLT (2004) argues that the service frequency (including the fixed days/hours of the week for departure/arrival), loading capacity of the transport equipment used, number of port calls per roundtrip and stops at intermediate terminals (transhipment/relay) define the level of connectivity or a region or country.

Evolution of liner shipping networks

Beyond the description of liner shipping networks at a specific point in time WILMSMEIER/NOTTEBOOM (2009) develop a framework for the evolution of liner shipping networks which depicts the interrelationship between the three different categories (see Fig. 2). Based on empirical evidence they argue that shipping network evolution and port development go hand in hand with the development of demand on a trade route and historically have developed in a somewhat parallel way. These developments are converging through vertical integration in the maritime and port industry. Specific trade route analysis also shows that in a penetration period shipping lines try to develop new markets and aim for a global coverage (see Wilmsmeier/Sánchez 2009; Guy 2003 for South America). These authors find further evidence that shipping lines move towards consolidation in those markets, as the overall market size is not sufficient to allow the realisation of economies of scale and density in a highly competitive environment. It can therefore be observed that shipping companies tend to create alliances or other forms of agreements to maintain market presence, but at the same time reduce risk levels and competition. In the region under study ports are currently in the transition between the reforming and internationalisation phase (Fig. 2), while the container shipping industry can be categorised to be somewhere between the consolidation and concentration phase. Differences between the ECSA, NCSA and WCSA exist in so far that the ports on the WCSA are still in the reforming phase (i.e. Peru and Ecuador), while the container shipping industry has clearly reached the concentration phase, which will be described in more detail later in this work.

The tendency of liner shipping companies using the above described economies includes the risk that a market develops towards an oligopolistic or even monopolistic structure. Lam/Yap/Cullinane (2007) argue that the general concentration of the maritime shipping liner industry has developed in parallel to the increase in container ship size. The concentration of shipping capacity in fewer shipping companies implies changes in market efficiency and market entrance, which affects competition in the maritime industry. It can also have implications on international trade, through changes in costs and routing and thus on the economic development of countries and regions. This is especially true for more peripheral markets with limited overall market size. Such quasi-oligopolistic structures may act as entry barriers to new competitors or only allow new entrants to form part

Fig. 2: Determinants and evolution of container liner network configurations



Source: authors, based on Wilmsmeier/Notteboom 2009 of the existing alliances. In the case of such an occurrence, networks effects are most likely lost to the user of the transport service, because shipping lines will not pass on their savings. The dynamism and feedback loops of these consolidation processes also change the position of shipping lines towards ports in terms of negotiating the terms of usage, especially in competitive port environments. If a shipping company exceeds a certain market share in one port its negotiating position may develop into a situation where it can use and potentially abuse market power. This again is especially true in smaller markets, but will not be discussed in depth in this paper.

Recent research has shown the complexity in determinants of maritime transport costs (Micco/Pérez 2002; Wilmsmeier/Mártinez-Zarzoso 2010) and revealed that maritime transport costs are market driven (Wilmsmeier/Hoffmann 2008). This leads to circular causation and relationships between transport costs, production locations and trade patterns become non linear (*World Bank* 2009). According to the *World Bank* (2009, 172) "… falling transport costs first led to countries trading more with countries that were distant but dissimilar. When they fell further, they led to more trade with neighbouring countries. Similarly, when transport costs fell from moderate levels, production concentrated in and around large markets." The market concentration in relation to the evolution of liner shipping networks (which has resulted in increased capacity and supply concentration in a small number of companies) creates new interdependencies of exporters and importers from individual companies, especially in peripheral markets. Such development might have adverse effects on economic development as decision-making on the level of market accessibility is dependent on global private companies. This system potentially works during relative equilibrium between supply and demand but can have distorting effects where equilibrium conditions are not present. Thus it seems important to be able to measure the level of connectivity of a country or region in order to be able to understand arising challenges and risks.

Measuring shipping networks and their evolution

From an abstracted network point of view the degree of interconnectedness of linkages (liner services) related to a set of nodes (ports) is a fundamental question. Connectivity is an attribute of networks and refers to the quality and costs of moving freight between two points in space (Greenhuizen 2000). The degree of connection between all linkages is defined as connectivity (Taaffe/Gauthier 1973, 101). The concept of connectivity is most meaningful when a given network is either compared with other networks or its growth is viewed through time (see Taaffe/Gauthier 1973). The use of connectivity measures allows the integration of the factor space in non-Euclidean and fluid frameworks and it yields useful insights about the variability in convergence and divergence among places within a network (Janelle 1991). The search for an indicator to represent connectivity within a network has to consider the following aspects:

- measure of network density,
- indicators are either spatially or mode specific (in this case related to regular liner shipping networks),
- improvement in connectivity cannot be unequivocally taken as an indicator of improvement in economic performance or welfare,
- the balance between links and nodes and the critical position of key hubs,
- the requirement of clear understanding of appropriate markets and threats posed by actors (opportunities / competitive threats),
- the importance of competition between and within modes (in this case the liner shipping industry).

A number of variables describe connectivity in maritime transport. The performance and structure of liner shipping services, including industry structure and mobile entities (ships) defines connectivity between origin and destination in maritime transport. Moreover, the fit between the mobile entities and ports is essential for the efficiency and effectiveness of the maritime network (Wilmsmeier/Hoffmann 2008). The functioning of the network and its structure involve complex interaction patterns that subsequently influence the cost of transport in the relation between two ports or regions.

UNCTAD (*United Nations Conference for Trade and Development*) developed the *Liner Shipping*

Connectivity Index (LSCI) which aims at capturing a country's level of integration into the existing liner shipping network (UNCTAD 2005a). The original version of the LSCI was reviewed in 2006 and the current version measures connectivity using five variables, thus describing liner shipping connectivity between two countries, A and B. These variables are: number of deployed ships, capacity in TEU, number of shipping companies offering direct services, number of direct services, and maximum size of vessels deployed. The evolution of these five single LSCI indicators in the period from 2004 to 2009 at a global level is described in Fig. 3.

Two diverging trends can be observed: On the one hand the number of shipping companies providing liner shipping services has reduced continuously (Sánchez 2010). This concentration process coincides with the reduction in the number of services. The reduction in the number of services also reflects the evolution of the shipping network towards a more hierarchical network, driven by the hub and spoke strategies of shipping companies. On the other hand the maximum size of vessels in the liner shipping trade has increased constantly and significantly. The evolution of the overall deployed capacity in TEU has shown a similar growth pattern up to 2008. The number of vessels increased until 2008; however, at a lower level. In 2009 the data reflects the impact of the economic crisis. Between July 2008 and July 2009, the numbers of ships, their total TEU carrying capacity, the number of services and the number of companies have all decreased. Only the maximum vessel size has continued to increase as new and larger vessels are being delivered by the world's shipyards. Many of these larger ships then replace smaller vessels, leading to a significant increase in vessel size.

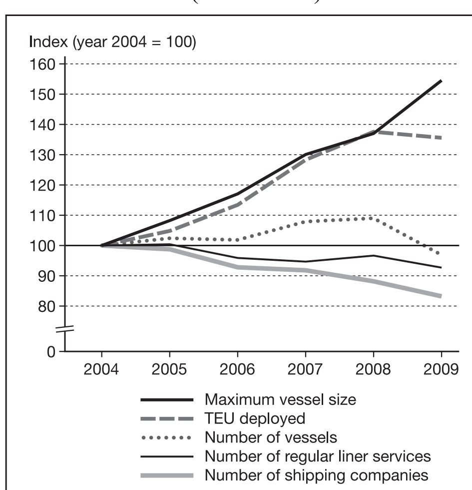
The higher the score of the LSCI, the easier it is to access a high capacity and high frequency global maritime freight transport system and thus effectively to participate in international trade. The LSCI can be considered a proxy measure of direct accessibility to global trade at country level. Recent research has examined various aspects of maritime connectivity. Kumar/Hoffmann (2002), Marquez-Ramos et al. (2006) and Wilmsmeier/Hoffmann (2008) incorporate measures of connectivity into research on maritime transport costs. Angeloudis et al. (2006) and Bichou (2004) look at connectivity in the context of maritime security. McCalla et al. (2005) measure intermediacy and connectivity for Caribbean shipping networks and Notteboom (2006b) for seaport systems. Notteboom (2006a) also investigates the time factor in liner shipping services.

Approaches to measure the structure of liner shipping services show the complexity and interdependencies between the variables describing network structures (e.g. Wilmsmeier/ Mártinez-Zarzoso 2010; Wilmsmeier/ Hoffmann 2008). Liner shipping networks and the position of a country within these networks determine that country's accessibility to global trade. The more central a country is in terms of accessing a high capacity and high frequency global maritime freight transport system, the greater its competitiveness in world trade (UNCTAD 2009a; *World Bank* 2009). The level of connectivity of countries is the response of shipping lines to a country's or region's demand in terms of trade volumes. Thus, the level of service is an exogenous factor to a country's economy that is determined by shipping lines, whose decisions are primarily profit driven.

Evolution of shipping networks in South America

Liner shipping capacity on principal routes to South America, NCSA - North America (NA),

Fig. 3: Evolution of single connectivity indicators (2004 = 100)

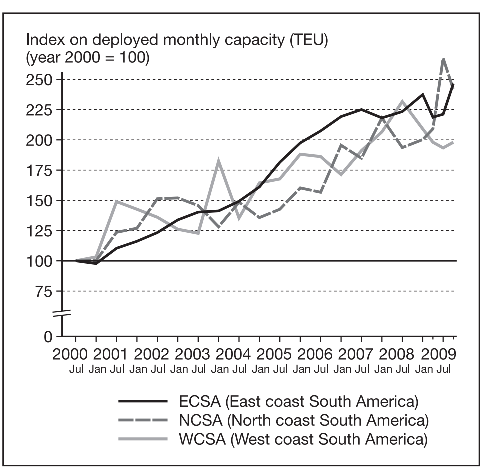


Source: UNCTAD 2009, based on *Containerization International Online*

ECSA – NA, Asia – WCSA, and Europe-ECSA, has increased in response to market demands. Capacity supply grew strongest for services to the ECSA. The direct impact of changes in economic development, such as the latest economic crisis which began in 2008, is reflected in the development of capacity supply (Fig. 4) and shows how quickly the liner shipping sector reacts to market changes. However, the development of liner shipping capacity supply during the crisis was not uniform and effects appeared but with a certain delay. While capacity was stagnant and even declined on certain routes (WCSA), capacity on the ECSA routes grew at a slower rate and returned to growth in the second half of 2009.

The objective to achieve economies of scale is reflected by the continuous growth of ship size in container shipping. This is can also be observed in the increase of ship size in the main trade routes to/from between South America over the last decade. Average ship size on the main routes to the ECSA and the Asia – WCSA route rose from 1,700 TEU (July 2000) to just above 3,900 TEU (October 2009). It has to be assumed that scale increases in ship size on the other WCSA routes would be similar if infrastructural bottlenecks such as limited maximum draft in a number of main ports (e.g. Guayaquil, Buenaventura) were eliminated Sánchez/Wilmsmeier 2005). However, on the Europe –WCSA and NA-WCSA routes as well as the

Fig. 4: Index on evolution of monthly capacity supply (TEU) 2000 - 2009

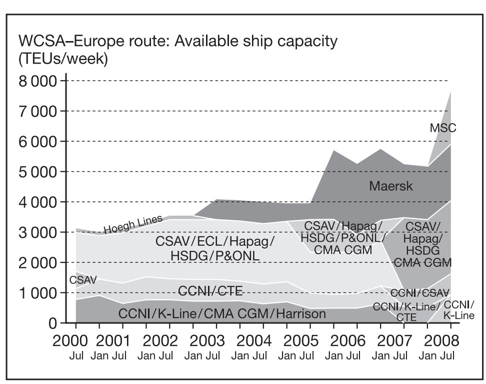


Source: authors, based on *ComPair Data* various years

NCSA routes average ship sizes only reached between 2100 and 2500 TEU (October 2009). In the case of WCSA – Europe, Mediterranean and USEC and Gulf services, ship size is also limited by the Panama Canal. The widening of the Panama Canal will open new opportunities for using bigger ships in these services. Currently, South American liner service networks are far from reaching the theoretical inflexion point of technical economies of scale of ship size due to the previously mentioned infrastructural constraints.

Besides capacity supply and technological economies of scale, the level of competition in the provision of liner services is relevant in understanding the evolution of liner shipping networks. On first sight the analysis of liner service structures in South America reveals a significant number of shipping lines competing in the South America trades. Guy (2003) describes that in the period from 1989 to 1999 the number of carriers in the South American market has risen significantly. According to Guy (2003), the rise in the number of active carriers in the market is not directly linked to an increase in shipping capacity. Guy (2003) hints that many shipping companies have entered the market through collaborative agreements rather than additions to capacity. In the period to 1999, shipping lines aimed at expanding their networks towards global coverage. Since 2003, a tendency towards a reduction in the number of shipping lines active in the region can be observed (Fig. 5), which to a certain extent re-

Fig. 5: Number of shipping providing regular liner services on main routes to/from South America 2000-2008



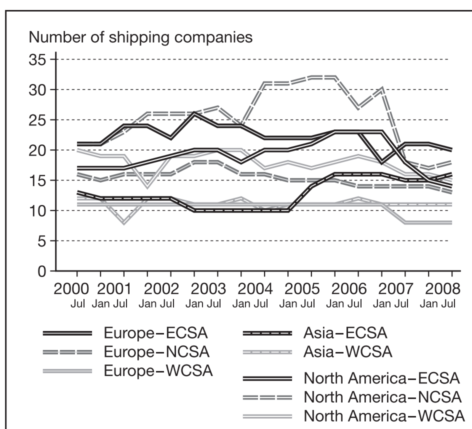
Source: authors, based on *Compair Data,* various years flects the effects of mergers and acquisitions taking place during the period, e.g. the takeover of *P&O Nedlloyd* by *Maersk*. The number of shipping companies, however, is only a relative indicator of the level of existing competition in a market, since it does not take into account existing alliances and other agreements, such as slot charters, as described above. WILMSMEIER/SÁNCHEZ (2010) identified nine alliances, consortia and conferences in the region in 2008. In the following, the WCSA-Europe route is used to exemplify the effects of concentration in emerging markets.

The weekly capacity in the WCSA – Europe trades increased from 3,110 TEU to 7,690 TEU between July 2000 and July 2008 (Fig. 6). Capacity growth is marked by two events: a) the expansion of *Maersk's* capacity in January 2006; and b) the entrance of *Mediterranean Shipping Co SA's* (MSC) capacity in July 2008, which is also accompanied by an increase in *Compañía Chilena de Navegacion Interoceanica S.A.* (CCNI)/*"K" Line* and *Maersk's* weekly capacities. The former can be explained by the change in *Maersk's* strategy for the WCSA: the observed capacity expansion appears simultaneously to the termination of *Maersk's* WC-CA/*Peru service* calls in WCSA, eliminating 884 TEUs per week in the WCSA – North America trades. The capacity expansion on the WCSA - Europe route thus allows *Maersk* to use this service to feeder to its Asia and North America services using Panama as a hub port, using economies of densities by consolidating traffic along the WCSA and consequently reaching for economies of scale on the transpacific voyage leg. Further, this strategy allows it to deploy postpanamax ships and thus greater economies of scale on the Asia route, since avoiding the WCSA with this service allows for the circumventing of draft restrictions in WCSA ports such as Guayaquil, Ecuador and Buenaventura (all three of which have 10 m drafts).

Until the second half of 2003, WCSA – Europe trades were dominated by direct services from three groups each led by one of the two regional shipping companies *Compañía Sudamericana de Vapores* (CSAV) and CCNI. These companies also form part of the EUROSAL consortium. With the entrance of *Maersk* in July 2003, a new independent competitor appeared in the market and added significant capacity to the trades. Further, within two and a half years *Maersk* more than tripled its capacity and by that offered 40 % of all service capacity in direct services in these trades. Form the point of entry of *Maersk* until the first half of 2008 the established carriers did not expand their capacity. This indicates a potential agreement of the market players. At the same time, the appearance of MSC as a new entrant to the trade attracts a different response from the carriers of today's EUROSAL consortium, namely, a capacity increase. Despite this latest response, the share of the traditional market players has reduced from a capacity share of over 90 % (2000) to just above 50 % (2008).

An expansion of the hierarchical liner shipping network can also be observed with CMA CGM, *Hapag-Lloyd*, MOL and APL preparing to enter the West Coast of South America trade with new feeder services. All four lines are trying to link up to their mainline east-west services running through the Panama Canal with these feeder services in the Panamanian port of Balboa (Containerisation International, 27.7.2010). The strategic alliance between CCNI and CSAV not only becomes obvious in the joint operation of a service as of the 2nd half of 2007 onwards, but CSAV also bought a significant share of CCNI stocks thus creating an equity al-

Fig. 6: Capacity supply WCSA-Europe trades, 2000-2008



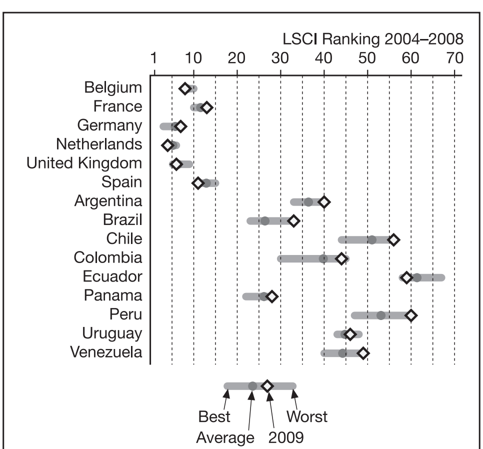
Source: authors, based on *Compair Data*, various years

Shipping company abbreviations: *Compania Trasatlantica Espanol* (CTE); *Hamburg-Suedamerikanische Dampfschifffahrtsgesellschaft Eggert & Amsinck* (HSDG); *Hapag-Lloyd AG* (HAPAG); CMA CGM SA (CMA CGM); *Mediterranean Shipping Co SA* (MSC); *P&O Nedlloyd* (P&ONL)

liance among these regional carriers. From a theoretical perspective, demand growth should allow new opportunities for entry in contestable markets. Demand growth of over 250 % in the period under study allowed the entrance of two new players who were able to capture almost 50 % of the market share. The fact that no other regional player appeared in the market under these conditions feeds the suspicion of high entrance barriers and collusive behaviour. The new entrants are leading global operators, thus, significant entrance barriers seem to exist. Further, it is interesting that the traditional players do not increase capacity in the same way as demand grows and therefore leave the market growth to be captured by the new players. Finally, the capacity expansion of *Maersk* in the WCSA - Europe trade has to be seen context of all WCSA trades as it feeds into the company's overall strategy for WCSA. Evidence for this is provided and discussed in *Maersk's* strategy (for further details WILMSMEIER/SÁNCHEZ 2010). The evolution of capacity and entrance and exit of market players (all exits are result of acquisitions e.g. *Harrison Line*) reveal that the Europe-WCSA route is dominated by an oligopoly.

The evolution of demand also has repercussions on the use of technology. In containerised transport, the age of the fleet in service and its evolution is an indicator of the implementation of new ship technology in the region. The route that has experienced the highest level of fleet renewal is WCSA - Europe. In the services Europe – WCSA and Europe ECSA, the deployed fleet was the most modern with an average ship age of seven years (UNCTAD 2009). The oldest and the most diverse fleets operate on the routes Asia – WCSA, North America - ECSA and North America - NCSA. The lowest level of fleet replenishment with newer vessels can be observed on the Asia -WCSA routes between 2000 and 2007 (UNCTAD 2009).

Fig. 7: Level of connectivity in container liner shipping network, LSCI ranking 2004 - 2008



Source: own elaboration, based on LSCI (UNCTAD 2008a, 2009a)

Discussion

Taking the described evolution of liner service structure forward and using it to interpret the level of direct connectivity as presented by the LSCI, a number of observations are relevant. The ranking of South American countries in the LSCI is not stable, which means that the countries' direct connectivity does not develop in a similar manner and/or with the same pattern as that of other countries. The development also seems to show South American countries loose in the ranking, particularly in 2008, while the ranking of European countries is stable. However, this does not mean that the accessibility of these countries has been reduced; it only reflects the fact that the changes in the direct liner services provided to that country have improved less than those in other countries. The discussion in this paper shows that the liner service network in South America is still developing and has not reached a mature status, as that serving Europe, for example. Further, the spread of hub and spoke strategies, as described in the example of the WCSA, does lead to loss in direct connectivity as measured by the LSCI, since the index does not measure connectivity through hub and spoke networks. The question thus arises, how far does the LSCI represents connectivity in the emerging hierarchical network as described by RODRIGUE/NOTTEBOOM (2007)?

While the LSCI measures the number of shipping lines active in the market, it does not consider the various types of cooperation (a.o. alliances, slot charter) in the liner shipping industry. However, the existence of wide collaboration, as exemplified above, reduces the effective competition within the market under study. The question thus remains whether competition at a global level and commonly used contractual practices are sufficient to restrain players from using market power at a regional level. Furthermore, it might be argued that by the example of the WCSA it was possible to observe an impeded contestability and a leaning towards market concentration in a period of almost continuous demand growth. The evolution of liner services in the trades under study have the potential to lead into more general problems, especially in the absence of an effective policy to maintain market contestability where it prevails and enhance it where it does not (for discussion see Davies 1990).

A continuation of this trend might lead to competitive advantages for market leaders and a centralisation of market power in a few actors. A reduced number of competitors and close cooperation also increase the interdependencies among actors and lead to an increased reactivity to actions of the competitors. Freight rate analysis nourishes the suspicions of interest symmetries of the suppliers. Only a few studies so far discuss the effect of service levels, i.e. effect of frequency on maritime transport costs. Sánchez et al. (2003) find that a one percent increase in the frequency or number of available liner services per month, serving a particular route and port, lowers transport costs between 0.1 and 0.2 percent. Wilmsmeier/Martínez-Zarzoso (2010) find empirical evidence for the relative importance of spatial distance and liner service network structure on maritime transport costs. The results indicate a significant effect of the liner service network structure on transport costs. The more centrally a trade route is located in the maritime liner service network the lower the average transport costs. This opens the important discussion on the cost of being peripheral. The calculated elasticities show that the impact of being peripheral in the maritime network is higher than the impact of distance. Network peripheral countries pay higher prices for transporting their exports, especially when they trade with other peripheral countries. Countries that are both peripheral in the maritime network and distant from other export markets face higher freight rates. Location is an important issue in Latin America, given the insular geographic character of the Caribbean and given that countries on the west and east coast of South America are located at the endpoint of the global maritime liner shipping network. The development of a hierarchical network, with the growing importance of transhipment centres in Panama, Callao (Peru) or Manta (Ecuador) and of some intermediary ports on the east coast in Brazil, might leave certain regions in even more peripheral positions. Wilmsmeier (2009) integrates the impact of centrality in an empirical analysis using a *transhipment connectivity index*[1], which measures the centrality of a country within the global shipping network taking transhipment requirements into account. His results show that if a country can double its centrality in the network, meaning a significant increase in direct liner services to a wider range of countries, transport costs may decrease up to 15.4 %. This important finding needs to be seen in the context of the influencing variables of liner network connectivity, such as ship size and frequency, which are determined by the overall level of trade, spatial position, and last but not least, port infrastructure endowment and development options. Oligopolistic market structures stimulate cooperative behaviour and joint action as a collective monopoly. The latest developments of falling demand have not yet led to further concentration in the shipping market. Falling demand has freed shipping capacity and the rapid increase of ship size in deployed ships is evidence of increased competition as shipping lines are aiming for economies of scale, but are at the same time under pressure to maximise capacity utilisation to avoid the effects of diseconomies of scale. At least three scenarios might arise: a) intensification of collective action of suppliers and thus artificial pricing, which does not reflect the real market situation, but is a protectionist measure of the industry; b) withdrawal of shipping lines from peripheral markets and concentration on key market areas; c) overcapacity leading to ruinous competition among suppliers, thus leading to a continued drop in freight rates which leaves markets with a higher level of concentration as those of today, because competitors are pushed out.

The economic downturn has particularly driven scenario a) with a number of collective actions. One example is the rationalisation of capacity as collective action like the joining of *Hamburg Sud*, CCNI and MSC cutting 2,500 TEU in their Asia -WCSA service (*Containerisation International* 23/02/2009). Evergreen and COSCON rationalise Asia-ECSA trade with service merge (*Containerisation International* 01/07/2009). Further, changes in the alliances are restructuring market shares as a response to the current economic development CMA CGM switched cooperation to HSDG and HAPAG in WCSA-

Europe services, terminating its co-operative pact CSAV (*Containerisation International* 18/11/2008).

Conclusion

This paper discusses recent development in the maritime industry, concentration tendencies through mergers and takeovers, conditions that are changing the structure in specific markets, and reflects upon the repercussions in the liner service network in emerging markets. Smaller markets are especially under threat of suffering from collusive behaviour and oligopolistic market structures, with shippers paying high prices for shipping services that might leave there products in an uncompetitive position at a global scale. The authors present evidence from liner service development in different trades in South America, showing that market concentration might be more prevalent than it appears in the available indicators. The analysis delivers to a more in depth understanding of the evolution of liner services in emerging markets. Further, it identifies potential threats from the economic downturn on liner shipping networks in network peripheral markets and the possible detrimental effects on the competitiveness of countries and regions beyond the general challenges that come from a less favourable economic climate and lack of port infrastructural endowment. Future research should focus on the latent challenges and risks of globalisation, the concept of which has not yet been fully understood.

Note

1 This index aims at reflecting the spatial aspects of liner service supply and is based on the type of connections between countries ranging from a first- to a fourth-order connection. In the absence of direct liner shipping between two countries, the cargo will have to be transhipped in a port of a third or even fourth country in order to reach the destination country. A first-order connection is a connection without transshipment; a second-order connection is a connection with one transhipment, and so on. First-order connections have the most positive impact on cargo movement. Therefore, the type of connections per country has been weighted as follows: first order connections are multiplied by 1.0, second-order connections by 0.5, third-order connections by 0.33, and fourth-order connections by 0.25. The score is the sum of the four connection types (UNCTAD, Transport Section-Trade Logistics Branch).

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