Società Italiana di Economia dei Trasporti e della Logistica - XII Riunione Scientifica –Roma, 17-18 giugno 2010

Working Papers SIET 2010 –
ISSN 1973-3208

DYNAMIC ROLE OF ACTORS IN FREIGHT TRANSPORT AND LOGISTICS[1]

Giulia Arduino[2], *David G. Carrillo Murillo*[3]

***Keywords**:* association structures, dynamic supply, cooperation, reefer

1. Introduction

[1] Il presente testo riproduce l'intervento svolto in occasione della XII Riunione Scientifica Annuale della Società Italiana degli Economisti dei Trasporti. Una sintesi dello stesso è stata pubblicata nel volume: "Sostenibilità, qualità e sicurezza nei sistemi di trasporto e logistica", Marcucci E.(Cur.), Musso E.(Cur.). Roma, 17-18 Giugno 2010, Milano, Franco Angeli, ISBN/ISSN: 978-88-568-3797-1.

[2] Dipartimento di Economia e Metodi Quantitativi, Università degli Studi di Genova, Via Vivaldi 5, 16126 Genova, Italy, arduino@economia.unige.it

[3] Institute for Economic Policy Research (IWW), Karlsruhe Institute of Technology (KIT), Waldhornstr. 27, Building 01.96, 4th floor, Germany, carrillo@iww.uni-karlsruhe.de

Over the last decades, international trade via sea has increased continuously and massively. As a consequence, shipments of commodities have expanded and changed: the volumes of cargo carried by the specialised bulk fleets have been gradually eroded by the growing competition of global container operators. It turns out that container stakeholders have attracted the majority of the cargo flows since they work together in various forms. This strategy is based on synergies, improving returns to scale and scope.

The increasing trade of goods and the containerisation have generated new problems to solve for the global system of transportation. Not only maritime actors, but also ports have changed their role as nodes in a global network, allowing the interconnection between the foreland with the hinterland.

Currently there are emerging association structures even in the hinterland transportation system. Indeed, demand of global transport is located in hinterlands turning this environment highly competitive.

The historical development of strategic forms of collaborations has been observed at the maritime and port side. They emerged due to economic and logistics advantages. These advantages become more important whenever many modes, many actors and many network components provide similar services.

Contrarily to the main stream in global trade, the transport and logistics chain of bananas seems to develop contrarily. These flows are still opposing to the main trend caused by the phenomenon of containerisation. However, also the association of actors has always being present in the banana trade. In this case, stakeholders are interested in still receiving the benefits of the banana trade. The main finding is that the market power is owned by the multi-nationals who continue to be integrated and control the whole supply chain. That is why the supply providers have started to collaborate and to associate also in different forms in order to grab a part of the market power located at the demand side. The reason is simple, there is a slight difference in prices and a simple cost calculation can be done for revealing the economic benefits and to show the market power of every actor involved.

In order to investigate the role of actors in freight and transportation and its main dynamics, this paper has been divided into four sections. An overview of the collaboration forms in the shipping industry considering the main actors and their strategies been provided in section two. The third section is focused on the income that every actor involved in the banana cold chain receives, and a real case illustrates the costs for transporting a reefer container and a bulk reefer. Results show that a coordination of supply actors enforces competition between both ways for shipping reefer products. Finally, in section four some conclusions are drawn on the complete analysis, mainly concerning economic aspects of association structures among global actors.

2. Strategic forms of collaboration in the shipping industry

In logistics, a typical behaviour of supply actors is the strategic collaboration for increasing their scope. Likewise in global freight transportation, cooperation emerges as the result of a highly competitive environment.

At the maritime side, joint ventures and alliances rise between liners and terminal operators. At the port enclosure some kind of associations are shown by port authorities and port service suppliers in forms of concession. At the hinterland segment, collaboration is imminent since competition is given at the spatial, mode and intra-modal context. The cases of cooperation and collaboration are presented for the main actors in the global transport system.

2.1. Cooperation at the maritime side

Strategic alliances in the shipping industry were initially composed by liners co-operation through forms of operating agreements among global carriers in the maritime industry.

The main aim of these alliances is to enlarge the range of services provided by each member, through a geographical complementation where respective networks and markets are brought together.

This topic has already been analysed in literature at both, theoretical and practical studies. This studies have identified the raising effects of different forms of co-operation on the single firm, the maritime transport industry as a whole, the logistics industry, and on the supply chain[4]. The results generally show that co-operation may be necessary to pursue competition inside the shipping and logistics market.

The majority of shipping alliances has been constituted in the 1990's among global container operators, such as Global Alliance (APL, Mitsui, OOCL, Nedlloyd) and Grand Alliance (NYK, Hapag Lloyd, Neptune Orient Line, P&O Line). However, the composition of these alliances has changed over the past 12 years, according to the consolidation occurred in the shipping industry.

The most significant impact of these association structures is represented by the economies of scope to compete in global markets (profits for each partner), obtained through higher load factor of the containerised fleet and higher range of liner services and capacity offered.

2.2 Cooperation at the port side

During the last decades, the progressive concentration in the liner shipping market led to a process of concentration even in the stevedoring market, where terminal operators developed strategies of enlargement of their assets. In particular, a liberalization process in many European ports allowed the concentration of the main stevedores: Hutchinson Port

[4] Doi, M., Ohta, H., and Itoh, H. (2000), “A theoretical analysis of liner shipping conferences and strategic alliances”, Review of Urban and Regional Development Studies, 12(3): 228-249.

Heaver, T., Meersman, H., Moglia, F., and Van de Voorde, E. (2000), “Do mergers and alliances influence European shipping and port competition?”, Maritime Policy & Management, 27: 363-373.

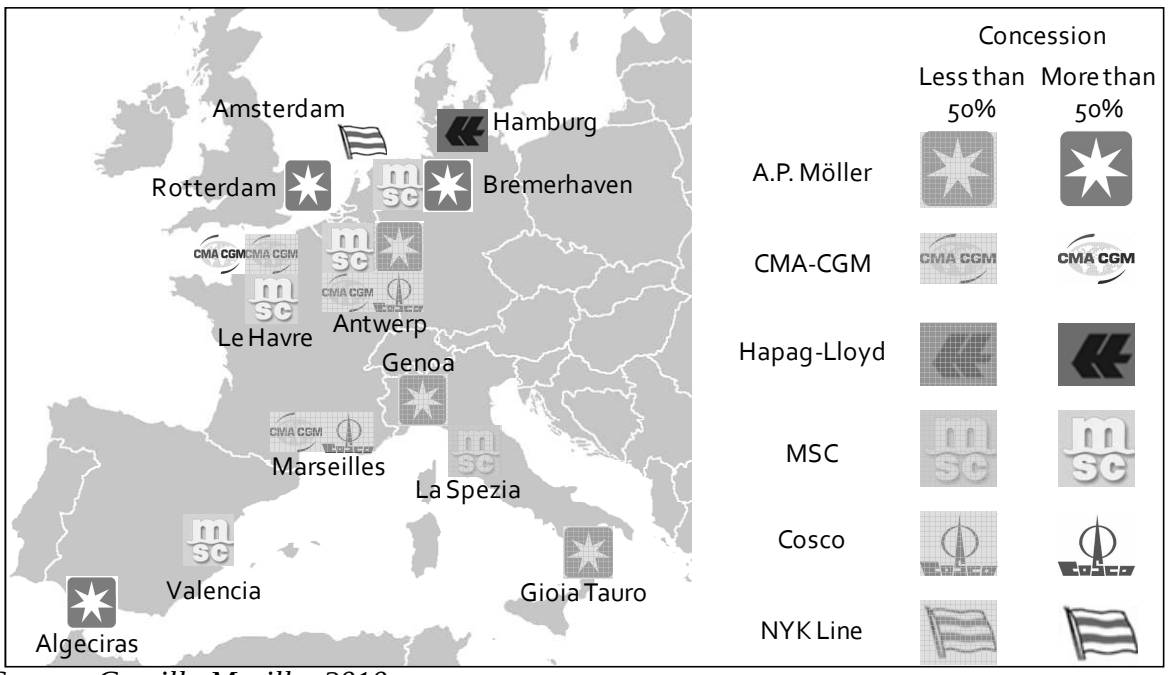
Slack, B., Comtois, C. and McCalla, R.J. (2002), “Strategic alliances in the container shipping industry: a global perspective”, Maritime Policy & Management, 29(1): pp. 65-76.

Holdings (HPH) acquired a minority share of Europe Container Terminals (ECT) in Rotterdam and took over the company. In 2002, Port of Singapore Authority (PSA) took over Hesse Noord Natie, the main stevedoring company in Antwerp. Lastly, in 2005, Dubai Ports (DP) World took over the whole Peninsular & Oriental Steam Navigation Company (P&O) Ports' network in North Europe.

Currently, the main investments, in terms of container port capacity, come from Andreas Peter Møller (APM), HPH, PSA, DP World and China Ocean Shipping Company (Cosco) which constitute the five leading terminal operators with a global presence. More in detail, HPH, PSA and DP World can be defined as pure stevedores, whose primary business is port operations, while APM and Cosco are the so-called "hybrid" terminal operators, whose main activity is container shipping, but where a separate terminal operating division has been established and integrated with their shipping line service network. Furthermore, there are integrated carriers running terminals, such as MSC and Evergreen. They achieve benefits by choosing the best form of co-operation they can obtain. Thus, they are not tied to a specific terminal operator and develop strategic agreements also with local operators (Notteboom, 2007).

What is presently emerging in the container industry is a strategic reaction of the shipping lines to the process of stevedores' concentration, by adopting various forms of integration along the supply chain in order to control also terminal handling and land operations. Some acquire terminals; others are involved in collaborative ventures with pure stevedores by investing in terminals (minority shares, joint-venture, majority shares). For instances, Maersk Line and APM or Hapag Lloyd and European Container Terminal. Fig. 1 shows the acquisitions, collaborations and associations in Europe that allow shipping companies to hold a total or partial share in ports.

Fig. 1: Associations at the maritime and port sectors in Europe.



Source: Carrillo Murillo, 2010

As we can see in the figure above, the shipping companies realise the associations with the aim to increase their scope, control their market share and share their risk at the maritime side. These associations are so important for shipping liners since they can also reduce their empty containers costs and increase the use of their assets. Certainly, these strategies influence the demand and grab a part of the market power of demand actors (forwarders or shippers) by offering competitive prices. The main aim is that returns of scale are implicitly included in these associations. Furthermore, the range of bundled services are cheaper when purchased together than when being purchased separately.

2.3 Emergent collaborations in the hinterland

A hinterland is defined as the market are of a port. It is closely related with the transport modes connecting a port with the main spots of demand inland. The more developed the modal networks linked with a port, the higher the scope of the hinterland of that port. Thus, the hinterland can cover more than one country. Take the case of Rotterdam, connections are offered from or to this port to France, Switzerland, Germany, Italy, Austria, Benelux, etc.

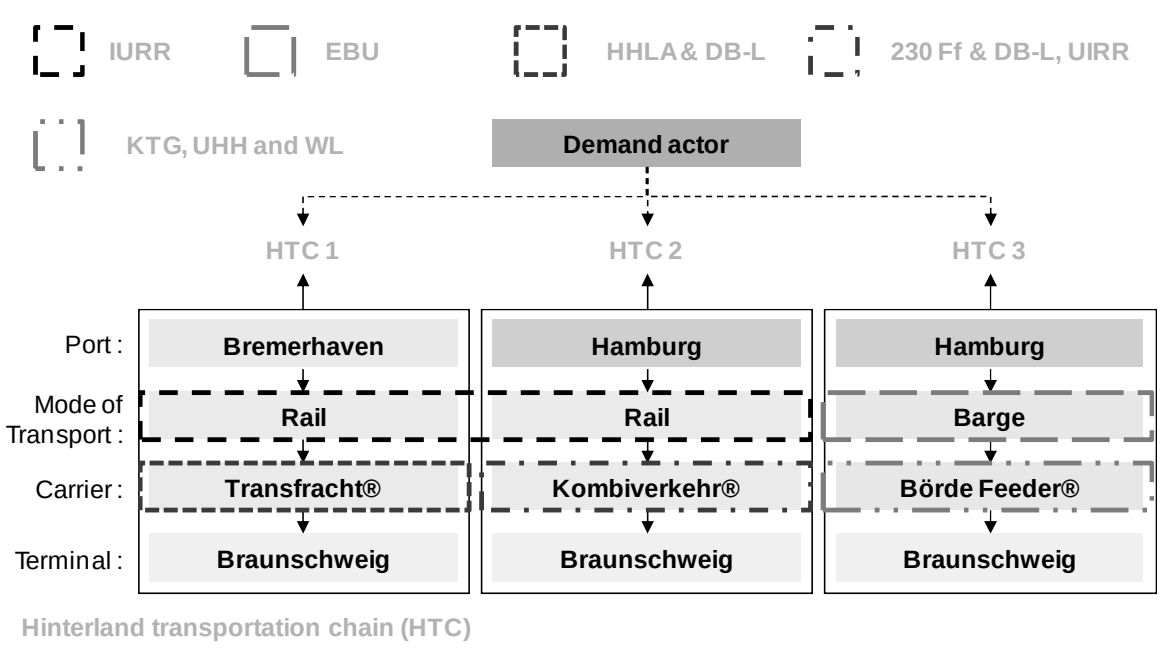
What is important in the hinterland is the increasingly growing transport services. Mainly the road-haulage is the most used transport mode. This mode provides flexibility and a high connectivity to the hinterland. However, not only this transport mode is available.

Alternatively, intermodal services have been emerging by linking inland waterways and railways to intermodal terminals. Then, the cargo could be transferred at these terminals and further shipped to the final destination.

Interestingly, the high range of transport and logistics services encourages the association of service providers. These associations are similar as those at the maritime and port sectors. Take the case of a container being shipped from a given port to an inland city, the services associated and being offered by one provider allow cost reductions, synergies and increase the scope of a single service. Indeed, these types of partnerships are based on vertical and horizontal integration. Vertical because there is a sequence of services provided for the cargo. Horizontal because the same type of services could be served by the nearest provider geographically.

In order to illustrate the vertical and horizontal integration of service provider in hinterlands, fig. 2 shows real practices out of the set of services that can be found at the website of the Port Authority of Hamburg (Hamburg-Hafen, 2010).

Fig. 2: Examples of associations in hinterland transportation chains.



Source: Carrillo Murillo, 2010

The example of horizontal and vertical integration in fig. 2 confirm the associations in hinterlands. As can be seen in the figure, the vertical integration follows a set of multi-step services that together perform better in the market. The horizontal integration, however, emerges as an alternative to increase the scope of the services, ensuring the coverage of the transport and logistics services. In the vertical integration, port services, mode of transport, carrier and terminal are working together. At the horizontal integration, the partnerships are also evident. Rail undertakings group in associations such as the International Union of combined Road-Rail transport companies. Barge operators instead associate into the European Barge Union. Carriers like transfracht, kombiverkehr and Börde Feeder emerge from joint-ventures. These joint-ventures are Deustche Bahn Mobility Logsitics AG (DB-L) and Hamburger Hafen und Logistik AG (Transfracht, 2010); 230 freight forwarders and DB-L (Kombiverkehr, 2010); and Kali-Transport Gesellschaft mbH (KTG), a 100% subsidiary of K + S Aktiengesellschaft, transshipment and trading company Haldensleben mbH (UHH) and Walter Lauk Container Spedition GmbH (WL) respectively (Börde Feeder, 2010). Also, Kombiverkehr form part fot he IURR (Kombiverkehr, 2010).

As one can note, the associations of service providers (supply) are vital in hinterlands as well as in the port and maritime sector. This statement show the importance for targeting the correct entities operating in the global freight transport system. Since it is hard to obtain or follow these associations (they are dynamic), it could be better to model them as entities for estimating transport flows. It is important to say that these entities join at the infrastructure points (terminals and ports). Therefore, it could be easier to follow all the associations of services and correctly model the transport and logistics sector.

Alternatively, the concept of grouping them into structures could be extended to every logistics service following the same procedure. Indeed, this structures could be linked with the concept of colloidal structures as suggested by McFadden (2007). Furthermore, a study

based on hinterland transportation the working structures presented in this paper have been developed for hinterlands (Carrillo Murillo, 2010). This study shows the potential for modeling the associations in colloidal structures for estimating transport flows.

In order to show the incentive of service providers to group into colloidal structures, a case study based on two types of cargo flows will be shown. This case study has been based on a recent study on the reefer sector (Arduino, 2010).

3. Case study on banana trade in the reefer sector

The aim of this section is to analyse the complex structure of the cold chain of bananas considering the role of actors from demand and supply side. This analysis will show the interest of every actor and the incentives to group together in practice. The banana trade represents one of the most significant freight markets. The former represents almost a third of the overall bulk reefer trade and the volumes of these flows in containers are continuously increasing (Arduino, 2010). However, bulk reefer remains as the prevalent mode with more than 70% of the seaborne trade[5] confirming the historical trend described by Stopford (2009). For this purpose, the disaggregation of cost for this commodity has been calculated. Both trades, bulk and container, are compared and the profits of the stakeholders at each stage of the cold chain are provided. In this way, the economic reasons of actors to control as many as possible stages along the whole cold chain are revealed.

Role of the actors

Bananas are very delicate fruits whose temperature should be maintained along the transportation chain to avoid them freezing or maturating previously. Thus, the cold chain might be managed with extreme care by all the suppliers involved at each function, from the production until their arrival to the supermarkets.

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[5] Source: Drewry Shipping Consultants 2006.

All functions constituting the banana cold chain are involved with commercial or physical agents[6]. The commercial functions of each actor relate to the cargo ownership. The physical or logistics functions concern the transportation of the commodity. Transportation chains are decided according to the availability of transport modes, services and needs for shipping a commodity from an origin like a production site to a destination where the final clients need it.

From a demand perspective, there are actors asking for transport services (producers, importers and exporters) whose business is the banana trade itself. While on the supply side, the cargo intermediaries provide the services (forwarders, carriers, terminal operators, shipping companies, etc.) mixing logistics and transportation.

The presence of economic actors is very different from country to country. Producers can be small independent growers (mainly in the Caribbean countries and Ecuador), national companies (in Ecuador and Colombia) or multinational companies (in Central America). Ocean carriers move bananas in containers or bulk ships. They can be independent or part of the multinational companies (e.g. Dole, Chiquita, Del Monte, etc.). Port operators at the importing countries unload these goods and they are usually port-based. Importers trade these commodities to retail outlets in order to be sold to final consumers.

Despite the heterogeneity of actors, the international banana market has an oligopolistic nature due to the presence of a few major transnational companies. These companies tend to dominate the overall international trade. Furthermore, they control several or all the stages of bananas cold chain including production and logistics[7]. This condition gives them the market power of being flexible and autonomous for taking decisions at all levels. That is why even the

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[6] Following a classification proposed by Van Der Lugt and Veenstra 2001.

[7] The major multinational banana companies at present are Dole Food Company, Chiquita Brands International, Fresh Del Monte Produce, Fyffes (the leader European fresh products' distributor) and Noboa Corporations.

supply actors are interested in being integrated in groups of services or partnerships in order to grab a part of the market power of the demand.

Tab.1: Actors involved in bananas cold chain by function and revenue.

Function	Actors or agents	Revenue (€/Kg)	Revenue (in %)
PRODUCTION	Plantation owner and labourer, exporter (consignor) and importer (consignee)	**0,42**	**22%**
LOGISTICS AND TRANSPORTATION	Carrier, terminal operator, forwarder, shipping company	**0,29**	**15%**
TAXATION	Customs	**0,44**	**23%**
DISTRIBUTION AND RETAIL	Retailer and wholesaler	**0,76**	**40%**
AVERAGE PRICE 1 KG BANANAS IN MILAN[8]		**1,91**	**100%**

Source: expert-interviews in Arduino, 2010

An economic analysis, on the revenues that every actor obtains, has been developed for the banana cold chain between Costa Rica and Italy. In this context, the economic interests of every stakeholder involved in the banana cold chain[9] can be revealed. These actors have very different benefits in terms of revenues. The constitution of the costs leading to the average price of one kg of bananas at the super market in Italy is shown in table 1.

The first three functions composing the cold chain - production, logistics (including transportation) and taxation - allow the actors to obtain a revenue between 15% and 23% each. While the distribution and retail turns out to be the most profitable sector with revenues

[8] Source: www.osservatorioprezzi.it, consulted in January 2010.

[9] The cost of production (Costa Rica), transport and logistics, taxation, distribution and retail (Italy) were calculated in Euros (2010). However, the unique category that changes according to the distance is of course the transportation and logistics. For this category the distance estimated was km. All the values were obtained through interviews to logistics-providers tailored for this study.

reaching 40 per cent of the final price[10]. In fact, the retail organisations are the leaders in terms of market power. This finding confirms the hard competition for the rest of the involved sectors.

It is important to underline the weakness of the basic production on the overall composition of costs. It represents only the 3,3 per cent of the whole trading process in economic terms. Transportation, however, requires a fourth of the costs. This sector includes forwarders, ocean and inland carriers, terminal operators and road hauliers. Since the present paper is focused on transportation, a detailed analysis has also been carried out only for transport stakeholders.

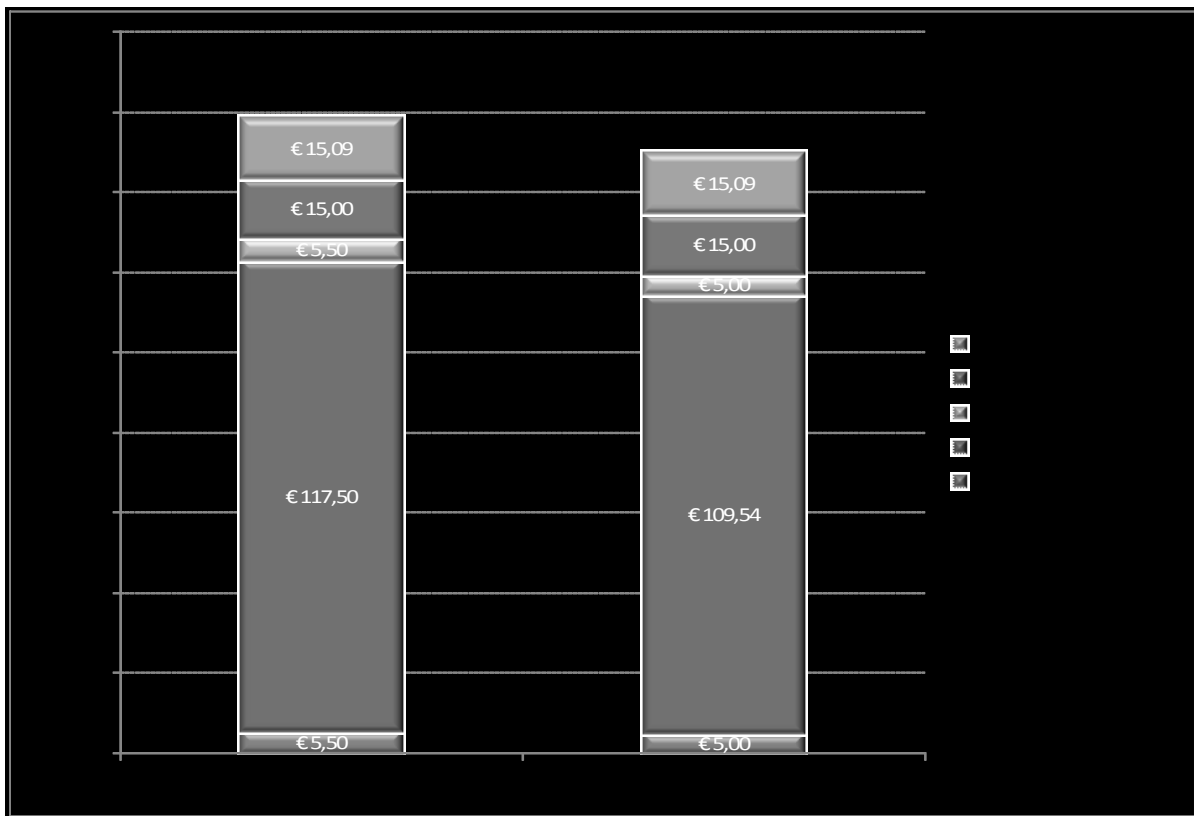
3.2 Cost analysis of reefer transportation

Considering the case study, the trade is the one between Costa Rica, as production site, and dedicated fruit terminal at the Italian port of Vado Ligure, until the final hinterland market of Milan.
From this trade route, the transportation costs were calculated. It relates to the costs generated by a pallet of bananas. This measure has been chosen in order to highlight the cost generated at a disaggregated level (logisticians and transport agents). Nevertheless, a comparison has resulted since data on the two trades could be obtained, namely, container reefer and bulk reefer vessel[11].

Fig. 3: The transportation cost per pallet by container and bulk

[10] The calculation was based on the following hypothesis: one kg of bananas transported from Costa Rica to Italy (port of Vado Ligure), until the final market of Milano. It has been used one reefer container *High Cube* 40’ with 20 pallets (1.000 kg each); the importation duty is €176 /ton. Source: expert-interviews.

[11] The costs include the loading and unloading, the maritime transportation from Costa Rica to Vado Ligure, and the road haulage from Vado to Milan (about 180 km).



Source: expert-interviews in Arduino 2010

Results show a little difference between the bulk reefer and the reefer container (only 10 € of difference as graphed in fig. 3). The leader in cost terms is allocated to the bulk vessels even though, unloading commodities from a bulk ship usually takes several days (3-4 normally). In contrast, containers can be unloaded in a maximum of 24h. Therefore, the real advantage in terms of non-monetary costs (time, flexibility, reliability) is allocated to the container.

The reefer container has the advantage of including black boxes in order to determine the guilt of freezing or previous maturation of the cargo. Furthermore, in containers the cargo is safer and easier for handling. However, if considering the savings between bulk or container, the transport performed by bulk can attain more than 200 Euros per container if considering that every container can carry 20 pallets.

4. Conclusion

The strategic alliances emerged originally among shipping companies. Then, this strategy has been extended to all sorts of cooperation at all areas

of the global transportation system. This development was followed by port operators to finally reach also the hinterlands. This strategy to associate emerged as a consequence of the reaction of actors from the supply side to grab a part of the market power.

In order to show the interest of transport stakeholders to group, a real case study has been developed to show the disaggregated cost of transportation services for bananas. The main finding has been the similarity in cost of the reefer container and bulk reefer. In fact, none real economic advantage for using bulk reefer in spite of containers has been found, as previously found in literature.

One of the main reasons for still using bulk relates to the profit of some of the managing actors. Indeed, this type of transportation chain is generally under strict control of very few multinationals. They are directly involved in many functions of the chain, from production to transportation until reaching the retail infrastructure. Interestingly, the high-volume and homogenous commodities such as bananas and other tropical fruits are currently fulfilling the conventional ships owned or operated by multinationals. The bulk reefer business is still surviving and competing against the container boom even though vertical and horizontal integrated actors do exist. But, even these supply actors are more willing to collaborate in order to grab their part of the market power and share.

Bibliography

Arduino, G. (2010), “Dal trasporto marittimo alla logistica a servizio dei flussi di merci refrigerate. Struttura e segmentazione del mercato, ruolo degli operatori e prospettive di sviluppo dei porti”, PhD thesis, Centro Italiano di Eccellenza sulla Logistica Integrata (CIELI), Università degli Studi di Genova.

Börde Feeder (2010) Firmenprofil, Germany. Consulted in April. Available in: www.boerde-container-feeder.de

Carrillo Murillo, D. (2010), “Demand and supply interaction in transport models: the case of hinterland transportation”, PhD thesis, Institute of Economic Policy Research (IWW), Karlsruhe Institute of Technology (KIT).

Doi, M., Ohta, H., and Itoh, H. (2000), “A theoretical analysis of liner shipping conferences and strategic alliances”, Review of Urban and Regional Development Studies, 12(3): 228-249.

Drewry Shipping Consultants (2006), Annual Reefer Shipping Market Review and Forecast 2006/2007, Drewry Shipping Consultants, London.

Hamburg-Hafen (2010) Hinterland services database, HHLA, Hamburg, Germany. Available in: www.hhla.de

Heaver, T., Meersman, H., Moglia, F., and Van de Voorde, E. (2000), “Do mergers and alliances influence European shipping and port competition?”, Maritime Policy & Management, 27: 363-373.

Kombiverkehr (2010), Über Kombiverkehr: Kombiverkehr – Europas Nummer 1 im Kombinierten Verkehr Schiene-Straße, Germany. Consulted in April. Available in: www.kombiverkehr.de

McFadden, D. (2007) , Keynote speech at the World Conference of Transport Research, Berkeley, U.S.

Notteboom, T. (2007), “The changing face of the terminal operator business: lesson for the regulator”, ACCC Regulatory Conference, Gold Coast, Australia.

Slack, B., Comtois, C. and McCalla, R.J. (2002), “Strategic alliances in the container shipping industry: a global perspective”, Maritime Policy & Management, 29(1): pp. 65-76.

Stopford, M. (2009), Maritime Economics, Routledge, London.

Transfracht (2010) 40 Jahre Faszination im Kombinierten Verkehr, Germany. Consulted in April. Available in: www.transfracht.com

Van Der Lugt, L.M. and Veenstra, A.W. (2001), “Supply chain analysis in the maritime reefer market: a tool for technological development”, Erasmus University Rotterdam (NL), European Transport Conference Proceedings 2001, published online: www.etcproceedings.org.