REEFER CARGO MARKET IN SOUTH AMERICAN EAST COAST: A COMPETITIVE ANALYSIS

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ABSTRACT

This paper analyses reefer cargo maritime shipping characteristics and recent development in South American East Coast ports. The geographical area studied goes from Punta Arenas (Chile) to Manaus (Brazil). In 2009, this area ports have moved around 750,000 TEUs, outbound cargo only. The study main hypothesis is reefer shipping as a profitable market niche in spite of higher operation costs and very demanding supply chain. The paper comprises three sections: the first one describes global reefer cargo transportation general characteristics. The second, reefer shipping in South American ports, focusing five main issues: (1) Cargo flows; (2) Ports infrastructure; (3) Post-Panamax vessels operation and its economies of scale; (4) Shippers and carriers' mergers and acquisitions processes and (5) Containerization process. Finally, it investigates the relationship between shippers and shipping liners. This exploratory study was based on technical reports and statistics analysis, and interviews with industry executives, performing a multicase study. The general conclusions indicate that South American reefer market has concluded its containerization and concentration process with very good region developing prospects. Some experts consider that the market will keep increasing as a result of enhancing cold logistics services providing and in spite of the international crisis, due to emergent markets buying and more demanding clients.
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Keywords: Reefer cargo; South America; containerization, cold logistics.

1. INTRODUCTION: THE WORLD OF PERISHABLE GOODS

The transport of perishable goods under refrigeration is relative new in shipping history, as refrigeration was not popularized before Nineteenth Century beginning and goods sea transport is dated from over 5,000 years. Foodstuff transportation between regions was made only in short distance and perishable goods were not even considered transportable. According to Waals (2010, p. 18) *"To bypass this problem, in 1879 the first ice-making machinery was installed onto a vessel, for the transport of chilled meat."*

Shipping industry historical background certainly requires a full detailed analysis that cannot fit into this paper. Despite ships remarkable technical development in terms of cargo capacity and technology, perishable goods regular trade still misses some of market determinants. That is, assuming market classical definition – as a place where sellers and buyers meet to sell and buy products – reefer trade in shipping industry could only take place by reefer cargo market establishment.

It can be considered that the elements for a consistent refrigerated cargo trade development only came after II World War ending, as, merchant ships could cross the Oceans and deep sea trades recover its frequent and regular basis; European countries were all under reconstruction and needed to be supplied (foodstuff inclusive); South American countries have had all production conditions to start a significant export trade of products like meat and fresh fruits.

Nowadays, according to Brazilian Poultry Raising (*União Brasileira de Avicultura* – UBABEF)[i] in the year 2010 Brazil has exported 5.7 millions of tons of meat, which 3,9 million referred to poultry[ii]. Also in the year 2010, Argentina has exported 395,000 tons of fresh fruit only from Patagonia area[iii], mainly apples and pears, confirming these two countries importance in the global perishable trade.

Perishable cargo can be transported by land, sea or air. The appropriated mode choice will be defined not only by cargo main characteristics like weight and volume, but also on special features as its value, packaging, its sensitiveness to time and, certainly, its origin and destination.

The paper focus is deep sea transport, but only for illustration: In 2012, according to International Air Transport Association (IATA)[iv], air transportation has moved 30% of worldwide all cargo (general and perishable) in value and 3% in volume. Perishable goods are among the main commodities carried by air and with effective techniques products chilled or frozen highly sensitive to temperature deviation. However, due its higher cost and space and weight limitations, in international trade the vast majority of perishable goods are transported by sea

This study aims to understand the characteristics and recent development of reefer cargo international sea transport in South American East Coast, including Brazilian, Argentinean Uruguayan ports and also Paraguayan cargo loaded on transhipment operation. So, the paper was divided in three sections. The first one describes global reefer cargo transportation general characteristics, which can be seen as a system comprised by reefer container itself, goods packaging, plugging devices and facilities in port terminals as complementary issues and ships with proper equipment to move reefer containers. The theory background is based upon competitive analysis and in its structure recent changes due to concentration process.

The second section reports recent development in five main market aspects: (1) Cargo flows; (2) Ports infrastructure; (3) Post-Panamax vessels operation and respective economies of scale; (4) Shippers and carriers' mergers and acquisitions processes and (5) Containerization process. Finally, third section analyses the relationship between shippers and shipping liners and their recent merging process impacts in the competitive environment.

1.1. Global reefer cargo transportation market

It is important to quote the technical definition of perishable cargo: *"Article that can lose its usefulness and value if not appropriately stored or transported or it not utilized within certain period".* (Business Dictionary, 2011) This paper focuses perishable cargo, not only sensitive to time but also with a clear need of temperature controlling[v].
The temperature control is still the main factor for foodstuff preservation and extending its consuming period, also known as days of shelf life. De Haan (2005) explains that:

> "The basic requirement in carriage of temperature-controlled cargoes is to deliver the goods, as far as is possible, in the same condition as that in which they were dispatched. As temperature-sensitive goods deteriorate at a rate that is temperature dependent, temperature maintenance is paramount." (DE HAAN, 2005, p.11)

Other settings may also be required like the humidity to prevent dehydration and ventilation to remove ethylene gas (and its effect of fruits ripening). As it is reported by Hamburg Süd (2010):

> "When it comes to transporting reefer cargo, factors such as temperature control, air exchange, humidity level and proper packing and loading become extremely important and it varies from commodity to commodity, handling procedures and transit environment as well." (HAMBURG SÜD, 2010, p. 07)

The temperature control represents a determinant factor for successful refrigerated goods transportation, in a way that temperature control responsibility is a constant carriers and shipping lines concern as temperature diversions are one of the main reasons for cargo damages and claims (MMS, 2006). In this sense, specialists[vi] also say that product practical shelf life will be determined by three key factors: cargo preparation, preservation and packaging and the transit time and temperature composition. (Maersk, 2006)
So far, there is no technology available to reverse goods deterioration caused by temperature effects. Hence the temperature control must be done all through the supply chain, from origin to destination. Any error or miss in temperature control during transportation could have consequences for the remaining cold chain links. This actually explains why perishable goods are almost a synonym of refrigerated cargo or just reefer cargo, as it is usually known in the industry. The reefer market Hamburg Süd executive, Mr Henrik Simon[vii] uses to say that "reefer chain has value only when it is unbroken."
As said, this paper takes for grant that reefer cargo is a general expression for all cargo shipped under temperature control, typically, foodstuff, but it could be also chemical products, medicaments, art crafts etc. The paper is focused on foodstuff segment due to its major share in the South American East Coast trades, as further is demonstrated.
Reefer cargo transportation, despite its higher costs and risks (in comparison with general dry cargo) can be considered as a maritime container market profitable niche with a remarkable development in the last years, following the several changes occurred in the international logistics of perishable goods. In fact, shipping this kind of goods became

cheaper and trustable and supermarkets and retailers can keep products' range less seasonal, inducing new consumers' habits of foodstuff. This process however, has taken a few decades. In shipping business, reefer cargo can be classified as specialized and liner shipping as Stopford (2009) defines:

> "[…] we saw that over the last 50 years the shipping industry has developed a new transport system based on mechanization and systems technology. Within this system the economic pressures arising from the parcel size distribution and demand differentiation create the demand for different types of shipping service. Today`s shipping market has evolved into three separate but closely connected segments: bulk shipping, specialized shipping and liner shipping." (STOPFORD, 2009, p. 61)

The transport of good under active cooling systems is a relatively new in comparison with shipping industry history. According to Waals (2010):

> "Refrigeration is a relatively young phenomenon. Chemical refrigeration dates back to the Sixteenth Century. By adding sodium nitrate or potassium nitrate to water the temperature of this fluid could be lowered and could be used to chill foodstuffs. […]. While the first overland shipments of perishable were made in 1857, the first patent for a specialized refrigerator car was not obtained until 1987 by J.B. Sutherland of Detroit." (WAALS, 2009, p. 18)

Levinson (2006) when describing the history of containers trades' development stated that:

> "A transport innovation of the 1880s, the refrigerated railcar, made meat affordable for average households by allowing meat companies to ship carcasses rather than live animals cross the country." (LEVINSON, 2006, p. 12).

There were several trials of refrigerated shipments overseas during the 1860s, but only at 1870s end a ship named "Paraguay" was successful in frozen meat transportation from Buenos Aires (Argentina) to Marseille (France). Stopford (2009) states that:

> "In 1880, Australia shipped its first cargoes in Strathleven which loaded 40 tons of beef and mutton which was frozen on board and delivered in London in perfect condition. […] The first New Zealand frozen cargo in 1982 sold in London for twice the market price in New Zealand, which gives an idea of the financial incentive driving the trade."(STOPFORD, 2009, p. 489).

From these successful experiences, specialized ships fleet with refrigerated or insulated holds has substantially increased. Statistics are somehow unreliable, but Waals (2010) gives an idea how fast this development was:

> "In 1902, the refrigerated fleet had risen to 460 ships, with the British fleet dominant. In 1902, they owned, in volume of cargo capacity, three-quarters of the world fleet, while in 1939 this was still two-thirds […]; they show an increase from 2 million m^3 in 1914 to 4 million m^3 in 1939." (WAALS, 2009, p. 18)

This historic background demonstrates that technological development could not only make shipping industry more diversified, but the market itself expanded. Figure 1 shows in a nutshell the main route directions of perishable goods: very much concentrated in the South-North trade.

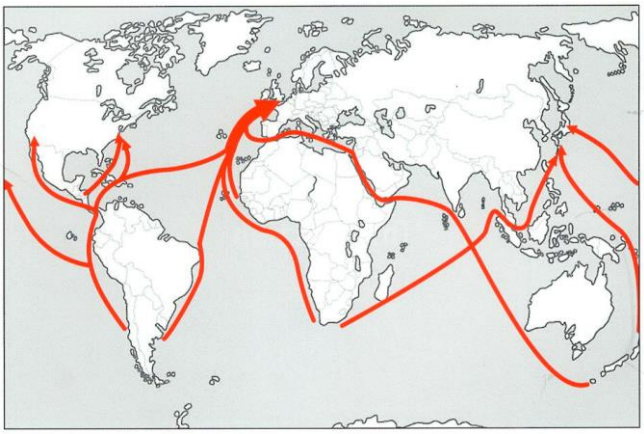


Figure 1 - Perishable Food trade main routes. Source: De Haan (2005).

1.2 The Fleet

Nowadays, the reefer fleet can be divided in two main groups: full reefer vessels and reefer containers. The reefer container is a typical sea-freight container, i.e., a metal box with standard measures in order to secure international standardization and operation on vessels, terminals and Lorries (chassis) and it is equipped with special devices to control inside temperatures.

The sea-container appeared in 1956 created by Malcon McLean and its measure standardization a little later facilitating cargo consolidation and vessel operation[viii]. Containers have been largely used in reefer market following mechanical and chemical refrigeration systems development as portable units. Stopford (2009) observes that:

> "[…] when diesel engines replaced gas-powered refrigeration in late 1950s the technology became more reliable and cheaper to run, especially on long trips with high run hours. This coincided with the start of containerization by sea, and from the outset new seaborne container business carried refrigerated containers, competing with the conventional reefer ships." (STOPFORD, 2009, p. 489)

The combination of container, refrigeration portable systems (adapted to containers composing reefer containers) and the development of liner services[ix] gave the required elements for a rapid and consistent trade of reefer containers. The first reefer container liner

service was established in 1971 from Australia and New Zealand to U. S. A. West Coast and further during the 1970s to Europe. (HAMBURG SÜD, 2010)

Reefer vessels are characterized as typical break bulk ships with refrigerated holes, normally segregate by commodity type transported (fresh, frozen). They had a dominant share in perishable goods transportation until mid-1980 when the reefer container fleet started a fast growth.

The containerized fleet capacity has surpassed the full reefer capacity (see Figure 2) due to its advantages as: suitability to smaller lots of cargo; unbroken cold chain (as mentioned before, a key factor for success in refrigerated transport); minimum; intermediate storage elimination and possible door-to-door deliveries (as the container can be carried by lorry to any place).

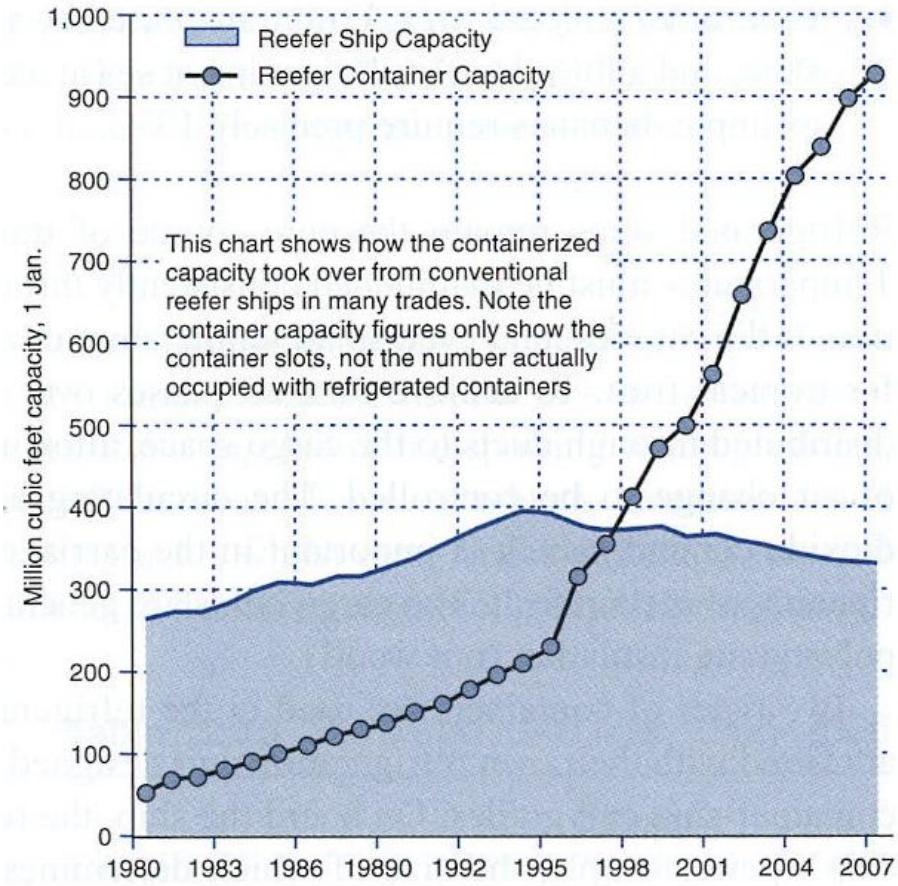


Figure 2 - Reefer fleet and the reefer container capacities 1980-2007. Source: Clarkson Research Reefer and Container Registers in Stopford (2009)

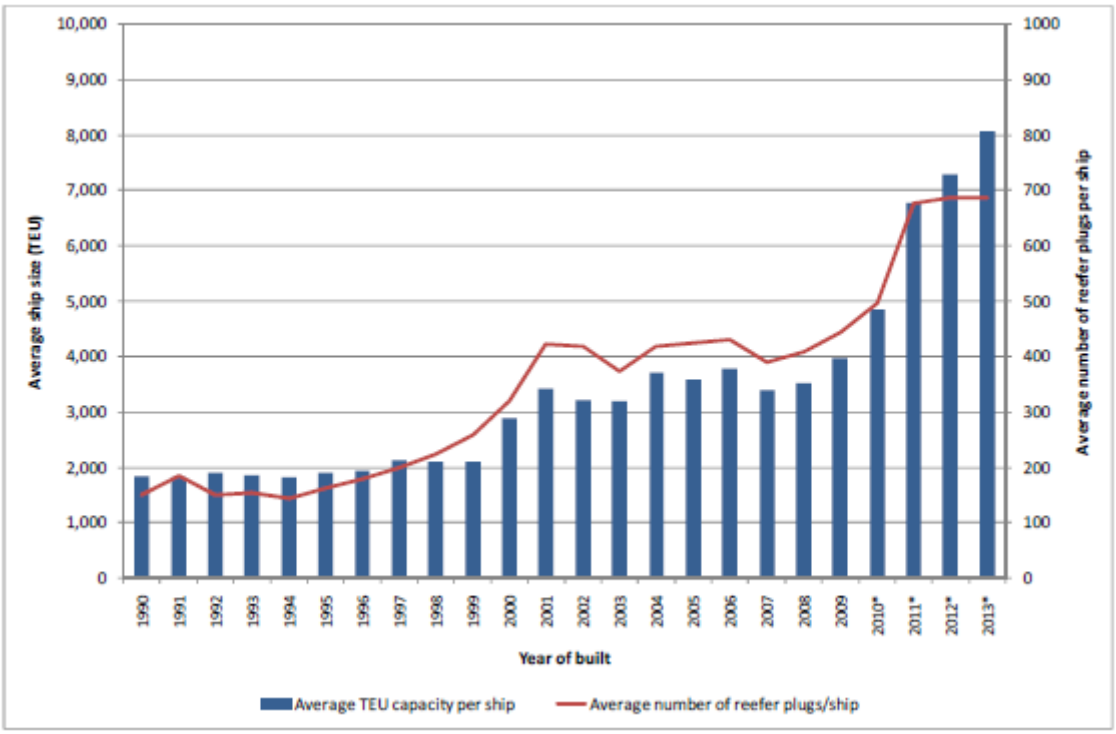
For certain trades, specifically due to volumes and port pairs involved, the full reefer ships present advantages over the container such as: faster transit time, due to the much reduced number of port calls and direct transhipment from vessel to vessel (more relevant in the case of fish catching).

It is very important that either chilled of frozen, reefer equipment in the container or in full reefer hatch is designed to maintain transport temperature, but not to cool the cargo down.

The cooling process has to be done previously to cargo shipment or loading in the container or vessel hatch, otherwise, the cargo might lose some important hours or day of shelf life due to temperature diversion.[x]

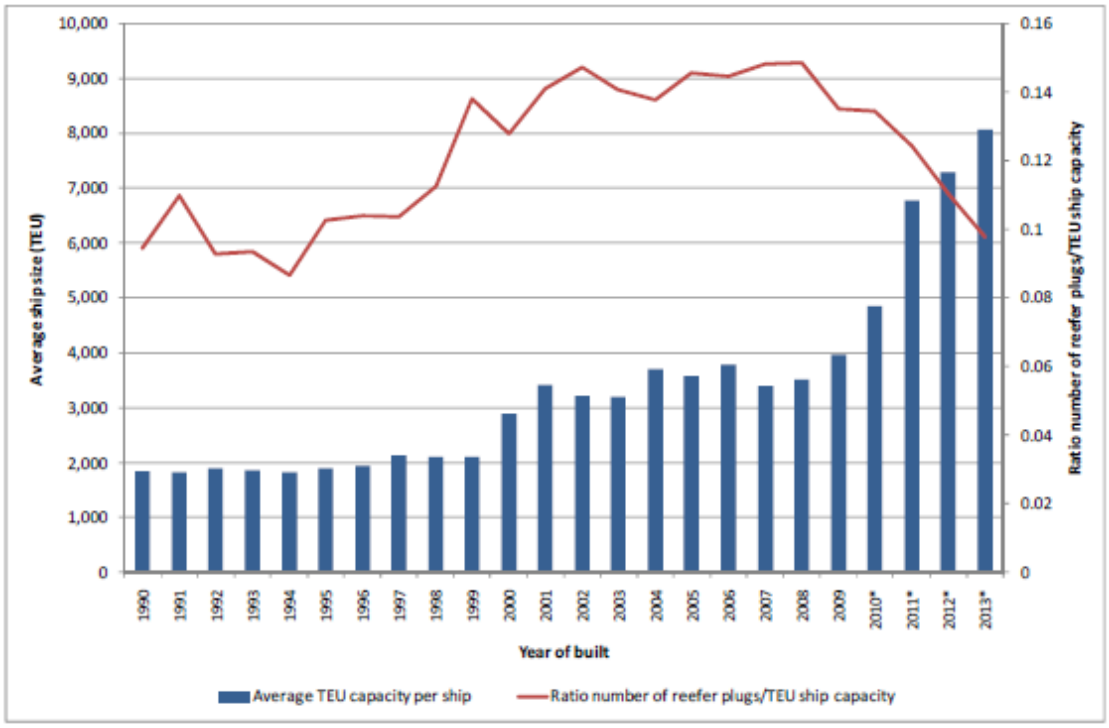
Technically there is no difference if the cargo is transported in a container or in a reefer ship, regarding its settings (temperature, ventilation and humidity) and packaging. However, economic data available make it clear that the containerization process is full swing and unless significant changes in shipping building (as consequence of carriers investment), the reefer container will replace full reefer vessels.

In this regard, it is are relevant to quote: first, the increasing proportion of reefer plugs on container vessels as shown on Figures 3 and 4, clearly indicating a massive carrier's investment in reefer capacity in larger ships aiming economies of scale. Secondly, the increasing average age of full reefer vessels, as demonstrated on Figures 5 and 6.



* Forecast

Figure 3 - Average ship size *vs.* number of reefer plugs, by year of built. Source: Dynamar (2010).



* Forecast
Figure 4 - Relationship between reefers plugs number and ship size, by built year. Source: Dynamar (Sep, 2010).

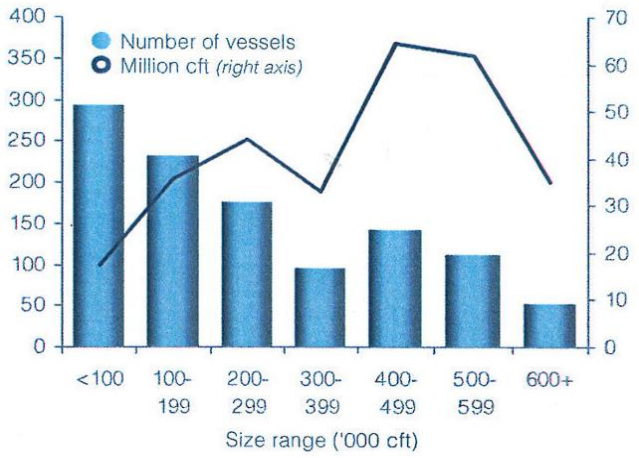


Figure 5 - Specialized reefer and freezer fleet: size summary by June 2010. Source: Drewry 2010 (Sextant Consultancy)

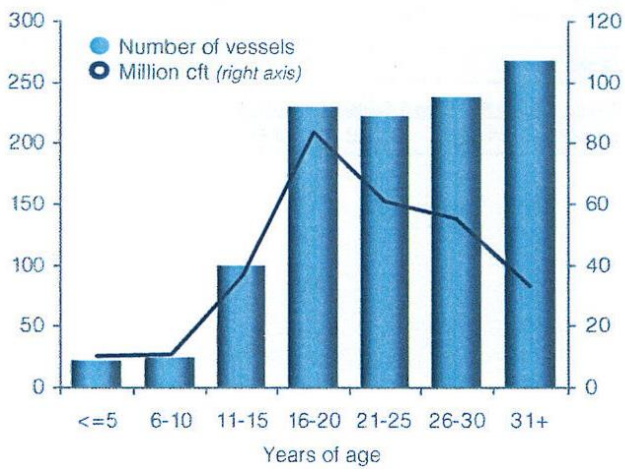


Figure 6 - Specialized reefer and freezer fleet: age summary by June 2010. Source: Drewry 2010 (Sextant Consultancy**)**

As demonstrated, full reefer vessels capacity is decreasing, as every year larger vessels go on scrapping as new vessels are taken place to service. This process direct consequence is cargo containerization. Table 1 shows the forecast until 2015, as presented by Drewry (2010).

Table 1 - Estimated perishable reefer cargo modal split 2009-2015.

Commodity	2009		2010		2012		2015	
	Non-container	Container	Non-container	Container	Non-container	Container	Non-container	Container
Bananas	67,1%	32,9%	67,0%	33,0%	62,0%	38,0%	53,0%	47,0%
Citrus	61,4%	38,6%	53,0%	47,0%	45,0%	55,0%	32,0%	68,0%
Deciduous	46,8%	53,2%	41,0%	59,0%	35,0%	65,0%	28,0%	72,0%
Exotics	41,4%	58,6%	38,0%	62,0%	32,0%	68,0%	21,0%	79,0%
Fish/Seafood	50,0%	50,0%	44,0%	56,0%	38,0%	62,0%	31,0%	69,0%
Meat/Poultry	27,1%	72,9%	23,0%	77,0%	19,0%	81,0%	15,0%	85,0%
Dairy	5,6%	94,4%	7,0%	93,0%	5,0%	95,0%	4,0%	96,0%
Other	7,1%	92,9%	7,0%	93,0%	6,0%	94,0%	4,0%	96,0%
Total	**38,2%**	**61,8%**	**35,1%**	**64,9%**	**30,0%**	**70,0%**	**24,3%**	**75,7%**

Source: Drewry research & Sextant Consultancy (2010)

On this particular issue, Stopford (2009) pointed that:

> "In the 1960s more reefer services were containerized, including the important Australia to Europe Trade, and the reefer operators responded by palletizing the cargo and building ships designed to handle and stow pallets efficiently. Initially this defensive strategy was successful, but in the 1999 container capacity finally overtook conventional reefer capacity, forcing a decline in the fleet of dedicated reefer ships." (STOPFORD, 2009, p. 491)

Unless nothing changes in this trend, one could conclude that the containerization process is moving to a complete substitution of traditional full reefer vessels. How long this process will last, it will depend on how full reefers can survive or re-invent their features, which can be considered very difficult considering the trades' trend as detailed in the next section.

1.3 The Cargo

In the last 10 years, perishable cargo reefer volume corresponds to over 50% of total seaborne volume, as authors analysed from Drewry Reefer Shipping Market 2010/11; FAO database 2005, GTIS, 2006 and Sextant Consultancy. This information alone gives also an important hint on future studies of reefer cargo transported by other transport modes, but for the purpose of this paper, the analysis is concentrated on the seaborne transport of goods.

Perishable goods are typically divided in two groups of fresh and frozen cargo. The fresh cargo is characterized by products that have a shorter shelf life as they are stored and transported at positive temperatures around Zero Celsius degrees. The frozen cargo corresponds to products transported under negative temperature. It is possible, however, that other kind of cargoes, non-foodstuff, require controlled temperature to be transported, as pharmaceutical products, art crafts, chemicals, photographic paper, etc.

The cargo care with temperature and other reefer settings is anyhow from shipper and carrier the same. So states De Haan (2005):

> "There are three types of cargo that dominate the reefer industry: bananas, deciduous fruits and other citrus fruits. Other commodities are meat, fish, seafood, vegetables, dairy products and exotic produce.

> Specialized reefer ships and reefer containers carry all these cargoes, each having their own reefer characteristics." (DE HAAN, 2005, p. 6)

Table 2 shows perishable foodstuff world trade evolution from 1983 to 2005 resulting in a stable growth rate. That behaviour can be explained by demand for products on regular basis (non-season variations) and increasing population with stable income (indicated by meat group present and forecasted share and exotics as more expensive products, see Tables 4 and 5). The Southern Hemisphere can produce perishable goods during Northern Hemisphere winter and the fact that Northern Hemisphere has still the largest population (UNITED NATIONS, 2011), perishable trade flow is much South-North oriented.

Table 2 - World trade in perishable foodstuff (Mt)

Year	Bananas	Citrus Fruits	Deciduous	*Total fruit*	Dairy products	Meat	Fish	*Total trade*	Total Growth	Memo:Other Fruit & Veg
1983	6	7	5	*19*	10	9	20	*58*		59
1984	7	8	5	*20*	11	9	22	*61*	5,90%	63
1985	7	7	5	*19*	12	9	25	*64*	5,10%	66
1986	7	9	5	*21*	12	10	27	*69*	7,70%	70
1987	8	8	6	*21*	12	10	28	*71*	2,80%	73
1988	8	8	6	*21*	13	11	29	*74*	3,50%	77
1989	8	8	6	*22*	13	11	31	*77*	4,50%	81
1990	9	8	6	*24*	12	12	29	*77*	-0,50%	84
1991	10	8	7	*25*	13	13	29	*81*	5,10%	88
1992	11	9	7	*26*	15	14	31	*85*	5,40%	91
1993	12	9	8	*29*	15	14	34	*92*	7,80%	96
1994	13	10	8	*31*	16	16	41	*103*	12,50%	102
1995	13	10	8	*32*	16	17	38	*103*	0,00%	101
1996	14	10	9	*33*	17	18	38	*105*	1,70%	104
1997	15	10	9	*34*	18	19	39	*110*	4,50%	107
1998	14	11	9	*33*	18	19	32	*104*	-5,40%	109
1999	14	10	9	*34*	19	21	36	*110*	6,10%	115
2000	14	11	9	*34*	20	22	41	*117*	6,70%	117
2001	15	11	10	*35*	20	22	41	*118*	0,90%	123
2002	14	12	10	*36*	20	23	41	*120*	1,80%	126
2003	15	12	11	*38*	21	24	41	*124*	3,00%	129
2004	16	13	11	*40*	21	26	41	*128*	3,00%	131
2005	16	14	11	*41*	21	27	41	*130*	1,40%	133
average (1983-2005):									3,80%	

Remark: Includes land and seaborne trades.
Source: Stopford (2009) based on FAO Yearbook and FAO Yearbook of Fishery Statistics.

As shown in Tables 2 and 3, the main foodstuff products transported are Meat (red and poultry); Fish/seafood and Fruits (especially bananas). These three groups are responsible for more than 57% of the total transported.

Cargo seasonality and flows pushed by demand determine how reefer carriers have to operate their fleet, considering not only their risk and return, but also the fact that foodstuff distribution channels are organized on weekly basis. In this regard, the main questions should be: How to operate on weekly basis if the distances between markets are different? How to combine the seasons with the limited capacity increase in the short term? How to get alternative utilization to reefer vessels and reefer containers during the off-season periods? All these questions remain still as captivating challenges to specialized carriers.

Table 3 - Seaborne transport market share of main reefer commodities 2000-2010

Commodity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bananas	20,5%	20,1%	19,3%	19,2%	19,0%	18,6%	18,5%	18,1%	17,5%	17,1%	16,9%
Total Citrus	7,1%	6,8%	7,1%	7,1%	7,1%	6,8%	6,5%	6,3%	6,3%	6,7%	6,8%
Total Deciduous	8,3%	8,3%	8,4%	8,7%	8,9%	9,1%	8,9%	9,0%	9,0%	9,3%	9,4%
Total Exotics	1,9%	2,0%	2,1%	2,2%	2,6%	2,9%	3,1%	3,3%	3,3%	3,5%	3,4%
Fish / Seafood	17,4%	18,4%	18,2%	17,5%	18,0%	18,1%	18,0%	18,0%	17,1%	17,4%	17,8%
Total Meat / Poultry	22,1%	21,4%	21,9%	21,9%	21,1%	21,6%	22,1%	22,7%	24,5%	23,9%	24,1%
Total Dairy	2,0%	2,1%	2,0%	2,1%	2,2%	2,0%	2,1%	2,1%	2,0%	2,1%	2,0%
Total others	20,6%	20,9%	21,0%	21,3%	21,2%	20,9%	20,7%	20,5%	20,5%	20,0%	19,6%
grand total	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Source: Authors on elaboration of data based on Drewry Reefer Shipping Market 2010/11 based on FAO database 2005, GTIS from 2006 and Sextant Consultancy

1.4 The market

The reefer market can be describe, in this paper approach, by a general market[xi] composition as, the product is transport service offered by reefer carriers (conventional and container); the market place are all ports located in South American East Coast, as a geographical scope determination; the price is sea freight rates by container, as product/service is the transportation from origin to destination and not the vessel charter; finally the way that carriers offer their service to customers, typically firms exporting goods to all possible trades.

Another issue is to understand how firms behave and establish their strategies to market their products in a profitable way. The classical market characterization can be applied by relevant information: number of players; product homogeneity and of barriers of entry existence.

South American East Coast reefer trades are performed by a limited number of companies in a relatively high concentrated market. The top 15 operators concentrate about 68% of conventional reefer ships capacity and top 25 companies concentrate 85% of reefer containers. Dynamar (Sep 2010).

The product/service (transport) can be considered in general as homogeneous; transport services from A to B, but, each company may offer some kind of differential on trade as transit time, vessel type, logistics services, etc. Nevertheless, products/services offered by reefer container carriers cannot easily be replaced by the conventional reefer carriers. Actually, in many cases, the containerization process is a one-way road as reverting the process implies in major additional operational costs.

A clear barrier of market entry is the expressive capital requirement, not only for setting up the service (vessel charters and/or leasing of reefer boxes), but also service management capability, as specialized knowledge is required to combine reefer cargo seasons; equipment typology and adequate transit times to products shelf life.

Regarding reefer market characterization Stopford (2009) commented that: "*Perhaps the most interesting aspect of the refrigerated cargo trade from the maritime economics viewpoint is the competition between different transport modes of type of cargo*". (STOPFORD, 2009, p. 491)

Porter (2008) proposes an industry characterization model which analyses five interrelated forces, as pointed by the author:

> "Yet competition for profits goes beyond established industry rivals to include four other competitive forces as well: customers, suppliers, potential entrants, and substitute products. The extended rivalry that results from all five forces defines an industry's structure and shapes the nature of competitive interaction within an industry. As different from one another as industries might appear on the surface, the underlying drivers of profitability are the same." (PORTER, 2008)

Porter´s five forces model applied to South American reefer market can result:

1. New entrants threat is relatively low due to strong entry barriers;
2. Practically there is no substitute to reefer cargo sea transport, mainly due to its large volumes and suppliersxii power over the reefer carriers can be neutralized;
3. In buyers side can be identified an increasing growth in their bargain power resulting from an expressive concentration process via mergers and acquisitions operations.
4. There is a remarkable concurrence between carriers and the rivalry conditions are aggressive and permanent.

In other words, the reefer carriers' profitability will depend on their interrelationship, as their reduced number could result in a high interdependence in their pricing policies. This was for sure a very brief application of theoretical competitive analysis to reefer cargo industry in the South American area. The market complexity can, certainly, be approached by other theories that could supplement or even replace the analysis. This, surely, can be a theme for further studies and researches and the theme, regardless its importance it was considered by authors as beyond this paper focus.

2. SOUTH AMERICAN EAST COAST REEFER MARKET

The South American East Coast reefer market can be divided in two main areas: Brazilian Coast and River Plate ports. Traditionally due to its exporting vocation of basic and agriculture products, the three countries Brazil, Uruguay and Argentina are by default reefer market traditional players. Dynamar (2010) reports these countries relevance in South America as a whole, as follows:

> "With exports in 2007 exceeding 24 million tons, countries in South America are a major driver behind seaborne reefer trade. In particular, Brazil, Ecuador and Chile and to a lesser extent Argentina and Colombia sell sizeable quantities of produce. With more than 8 million tons, meat is the biggest category, mainly poultry (3.7 million tons) and bovine meat (3.0 million tons). Brazil is responsible for more than three quarters of this total; Argentina follows with a share of 8%." (DYNAMAR, 2010, p. 37)

The analysis is divided in five sub-sections as follows: (1) Cargo flows; (2) Ports infrastructure; (3) Post-panamax vessels operation and respective economies of scale; (4) Shippers and carriers' mergers and acquisitions processes and (5) Containerization process in course. The analysis was supported by interviews with reefer senior managers active in the Brazilian and Plate area reefer markets.
The specialists interviewed were: Mr. Henrik Simon – senior reefer director at Hamburg Süd; Roberto Aschenberger - former reefer manager of Maersk Sealand at Salvador; Rogerio Meneghetti – sales reefer manager at Samskip (Freight Forwarder); Santiago Rigby – senior Sales manager at Hamburg Süd Uruguay and Americo Veiga – owner of Navitradeship (Reefer broker based in São Paulo and with activities in the main reefer markets in South America). The interviews took place during April and May, 2011 and were performed per phone, e-mail and complemented with direct contact with the market experts.

2.1 The cargo flow

The cargo flow analysed presents two basic aspects: First, the imbalance between outbound (exports) and inbound (imports) cargo. As previously stated, South American East coast is typically a refrigerated goods exporting area. Therefore, reefer import trades are much smaller in absolute as well as in relative terms, as shown in Table 4. Over the past four years (from 2007 to 2011) reefer imports are growing, as consequence of macroeconomic situation (pushed by Brazilian internal market and US Dollar exchange rate to Brazilian Reais and Argentinean Pesos), but it is still a much smaller market than exports. This imbalance leads reefer carriers to an unpleasant situation, lack of return cargo for reefer ships and/or reefer containers. This adds costs which impact shipping liners pricing policy.[xiii]

Table 4 - South American East Coast Exports vs. Imports (in TEUs)

All Carriers, all trades:					
	2007	2008	2009	2010	2011 (until Nov 30th)
EXP ttl	715.919	735.054	740.831	730.363	665.876
IMP ttl	39.437	50.110	63.126	72.108	78.996
EXP/IMP	18,2	14,7	11,7	10,1	8,4

Source: Authors elaboration based on Dataliner/Centronave (2011).

When analysing the reefer trades of exports volumes, it is remarkable how Middle East and West Africa have increased their share (almost doubled) in overall trade in a relatively short period (from 2006 to 2010). At the same time, European trades have lost position, as shown in Table 5. This fact can be explained by the increasing Brazilian share in foodstuff supply to countries like Saudi Arabia, Iran, Venezuela, Egypt, and, of course, China.
Table 6 shows commodities share and it indicates while poultry has increased its share over the past four years from 27.6% in 2006 to 41.9% in 2011, the bovine meat has reduced it on significant basis from 23.9% in 2006 to 13.3% in 2011. This situation has very much to do with spectacular development of Brazilian poultry industry and the decline of bovine meat production in Argentina due to dramatic changes in governmental subsidization policies.

Table 5 - South American East Coast reefer container share (in % of TEUs)

Trade	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
North Europe & Russia	36,4%	37,8%	36,4%	32,8%	30,2%	28,4%
Asia	17,6%	17,4%	18,9%	19,7%	19,5%	22,1%
Middle East	9,6%	10,9%	13,2%	17,2%	18,6%	18,4%
East Mediterranean	11,6%	9,1%	8,1%	8,2%	8,1%	7,5%
Gulf & Caribbean Island	4,8%	5,7%	7,4%	5,1%	5,5%	6,3%
West Mediterranean	7,2%	7,5%	5,8%	6,0%	6,6%	5,2%
West Africa	2,7%	3,1%	3,5%	4,3%	4,4%	5,1%
East Coast North America	5,1%	4,2%	2,9%	2,7%	2,6%	2,8%
South Africa	3,3%	2,6%	2,1%	2,4%	2,6%	2,7%
Mercosul	0,8%	0,7%	0,6%	0,9%	1,2%	0,7%
West Coast South America	0,6%	0,5%	0,4%	0,4%	0,6%	0,5%
Others	0,4%	0,5%	0,6%	0,3%	0,2%	0,3%
Total	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**

Source: Authors own elaboration based on Dataliner/Centronave (2011).

Table 6 - Commodity share at South American East Coast ports (all in TEUs)

Commodity	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Meat Poultry	27,6%	29,6%	36,2%	36,0%	40,1%	41,9%
Fruits, veg. & flowers	19,1%	22,4%	21,8%	18,0%	19,0%	18,2%
Meat Bovine	23,9%	21,2%	15,8%	17,7%	15,3%	13,3%
Meat Pork & Offal	12,0%	12,0%	12,5%	13,4%	12,8%	12,9%
Fish and crustaceans	7,8%	6,3%	6,1%	5,5%	5,1%	5,7%
Fruit juice	3,2%	3,0%	2,8%	2,9%	2,7%	2,7%
Food / Beverage	2,3%	2,0%	2,7%	2,4%	2,5%	2,5%
Others	4,0%	3,5%	2,2%	4,0%	2,7%	2,7%
Total geral	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**

Source: Authors own elaboration based on Dataliner/Centronave (2011).

The fresh fruits share can vary from year to year depending on seasonal factors, like weather and competition with other growing areas (apples from Chile or citrus from South Africa coming at the same time onto European trades). The other commodity groups have more or less stable share and development over the years.

2.2 Ports Infrastructure

There is certainly more than one way to analyse ports infrastructure. The data available for the reefer cargo per loading port is rare and time series were not found to identifying the evolution of ports increasing capacity for reefer cargo.
Table 7 demonstrates container terminals predominance over conventional reefer ships terminals. Also relevant is the official draft informed by ports authorities: with few exceptions ports vast majority presents an average draft of 10 to 11 m, which limits the operation of vessel with larger capacity like the Post-Panamax.

Table 7 - South American East Coast reefer cargo load main ports - 2006-2010 (in TEUs)

Port of Load	2006	2007	2008	2009	2010
Itajai /Sao Francisco do Sul	148.825	153.172	158.262	132.554	152.025
Paranagua	56.885	87.618	107.175	136.622	136.445
Santos	126.667	141.871	133.675	125.629	128.069
Rio Grande	43.581	52.002	57.507	61.237	57.572
Fortaleza / Mucuripe	30.175	40.589	39.831	32.870	32.629
Salvador	12.387	12.427	12.649	8.531	9.266
Natal	2.134	2.627	4.736	4.988	5.778
Rio de Janeiro / Sepetiba	5.212	6.404	5.177	4.252	4.711
Recife / Suape	6.161	2.876	6.480	8.266	4.394
Belem / Vila do Conde	1.516	1.613	1.729	2.457	3.618
Vitoria	976	645	536	694	638
Manaus	69	418	612	432	227
Imbituba	1.227	315	522	337	28
Navegantes	0	3.932	n.a.	n.a.	n.a.
Sub-total Brazil	*435.815*	*502.578*	*528.892*	*518.868*	*535.398*
Buenos Aires	108.550	114.457	108.361	113.418	101.285
Montevideo	77.786	90.351	47.532	63.385	50.148
San Antonio De Este	94	14	11.762	7.918	9.952
Zarate	n.a.	n.a.	1.124	6.494	6.666
Mar del Plata	2.941	1.551	8.787	8.249	6.266
Asuncion	n.a.	n.a.	3.460	4.549	5.129
Puerto Madryn	1.715	1.441	5.618	5.860	4.896
Puerto Deseado	1.702	1.488	5.628	4.717	2.938
Rosario	n.a.	n.a.	6.235	2.032	1.158
Ushuaia	669	93	1.879	1.827	1.012
Baia Blanca	14	14	5.777	3.514	960
sub-total Plate	*193.471*	*209.409*	*206.162*	*221.963*	*190.410*
Grand total (Brazil & Plate)	**629.286**	**711.988**	**735.054**	**740.831**	**725.809**
Share of Brazilian ports	**69,3%**	**70,6%**	**72,0%**	**70,0%**	**73,8%**

Remarks: n.a.: data not available.
Source: Authors own elaboration based on Dataliner/Centronave (2010).

Table 8 gives a better main reefer cargo load ports overview. Nevertheless, South American East Coast ports doesn´t look like the same, but they present infrastructure and operation capital resemblance with a few exceptions[xiv]. The main ports are still the same established in colonial times, located inside city areas and therefore with limited capacity of expansion or renovation.

Table 8 - South American East Coast main ports reefer plugs capacity in December 2010 (not including pre-stacking hinterland area)

	Reefer plugs (in units of sockets) for 20' or 40' reefer containers
Buenos Aires (Argentina) BACTSSA (T5) / EXOLGAN / APM TERMINAL (T4)	2300
Montevideo (Uruguay) - Montecon and TCP	3300
Rio Grande (Brazil) – Tecon	1750
Itajai (Brazil) – Teconvi	1400
Navegantes (Brazil) - Portonave	1200
São Francisco do Sul (Brazil) - TESC	510
Paranagua (Brazil) - TCP	2450
Santos (Brazil) - SBSA / LIBRA / Rodrimar	3500
Rio de Janeiro (Brazil) - Libra	270
Sepetiba (Brazil) - Tecon	400
Vitoria (Brazil) - TVV	70
Salvador (Brazil) - Tecon	550
Suape (Brazil) - Tecon	300
Natal (Brazil) - Codern	200
Mucuripe/Fortaleza (Brazil) – Docas do Ceara	200
Pecem (Brazil) - CTO	890
Belem / Vila do Conde (Brazil)	Not available
Manaus (Brazil)	Not available

Source: Authors own elaboration based on Port terminal operators information on the web pages.

In general, ports and, mainly, terminal operators have improved their capacity and structure to meet reefer cargo in containers requirements. However, these ports problems affecting reefer cargo are not exclusively related to perishable products characteristics, but also to several bottlenecks linked to public ports policy reflected in accesses from land and by water (dredging still limited to geographical conditions) and terminals capacity (considering the fast international trade increase *versus* lead time to build and operate new port areas) improvement requirements.

2.3 Post-panamax vessels operation and respective economies of scale

As mentioned before, carriers all over the world have increase the relation of reefer plugs per TEU in new building bigger vessels, as consequence of reefer cargo containerization. This is a global trend, as being South America one of main reefer areas; the size of vessels calling the region has also increase. Figure 7 shows an interesting chart of ships capacities evolution over the last few decades presented by Hamburg Süd, one of the market leaders in South American East Coast trades.

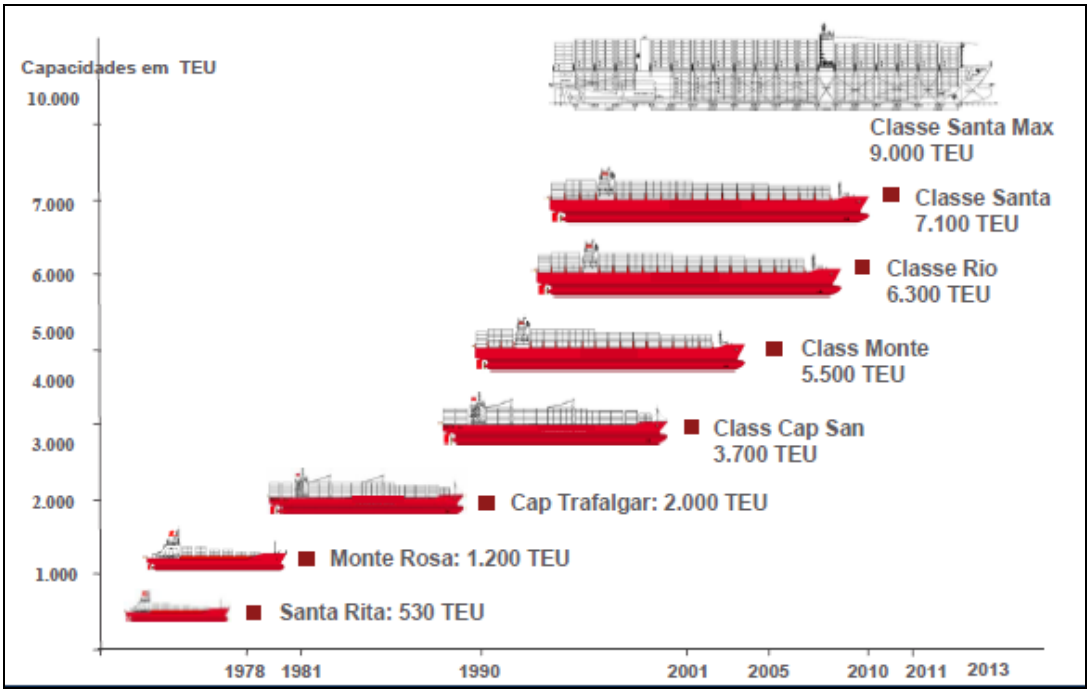


Figure 7 - Hamburg Süd capacity increase by vessels categories. Source: Costa (2011)

It is clear that carriers are looking for operational optimization and economies of scale provided by bigger ships and also the profitability of reefer cargo share as part of the cargo mix. In this regard, Mr. Simon (Hamburg Süd Reefer department Director) interviewed, said:

> *"The shipping line of course benefits from economies of scale, as with larger capacity we need fewer ships for the same weekly services, but the reefer slot is an expensive investment for carriers, as the power consumption on board increases and also the risk exposure of transporting more perishable cargo on the same vessel."*

Nevertheless, these economies of scale have not being reflected as lower freight rate as stated by Veiga (Navitradeship owner) in an interview:

> "In South America, I do not think that freight can reduce through the use of larger vessels with economies of scale. Here in Brazil, Argentina, and Uruguay and also in South American West Coast what really counts is the old law of supply and demand (for space)."

Potentially, rates cuts could be resulted from Freight Forwarders actions regarding their traditional consolidating volumes approach for bargaining volumes and prices. But, this also, as it was identified in the interviews, did not take place (until nowadays, at least). Freight Forwarder participation in reefer business is still low if compared with direct freight market by shippers (3.0% in 2010).

2.4 Shippers and carriers' mergers and acquisitions processes

Another interesting phenomenon in South American reefer market is the remarkable concentration process both at shippers and carriers sides. Statistic data gathered demonstrate that at both sides shipper (demand) and carriers (supply) have consolidated their operation in several mergers and acquisition processes.

In the carriers' side, two aspects are relevant: First, the increase in global container operators' static capacity from 435,000 TEUs in 1980 to 12.9 million of TEUs in 2011, only considering the top 20 container operators worldwide. Second, the top 5 carriers increased concentration, from 44% in 1980 to 52% in 2011.

Specifically in the case of reefer container carriers, one can notice that since 2006 market has been very concentrated, as the top 5 carriers dominated more than 80% of reefer loadings[xv].

In the shippers' side, the situation does not change much as the top five shippers went from a concentration of 28.5% in 2006 to 45.6% in 2010. There are many factors that could explain the increasing mergers and acquisition processes in Brazil, Argentina and Uruguay and they can be summarized in two typical situations: Small companies, normally owned by families, lost their scale to larger ones, which could practice more competitive prices (like it happened in the fresh fruit[xvi] and frozen juice business[xvii]); or the companies have suffered cash flows problems during the financial crises in 2008/2009 (like it happened very though to the bovine meat and poultry exporters)[xviii] .

On this regard, Mr Simon said that:

> "Yes, I believe this process is ended, at least slowed down and, on the contrary, there might be a trend of re-selling (splitting) these companies merged in the last 10 years, as the buyers prefer to have alternative suppliers instead of one or two very large companies (like in the poultry business). For carriers the impact was huge, as in the past we used to have 10 different shippers in certain market and we could decide the best combination for each shipper volume. Nowadays, we have three or four to make business. This represents a dependence increase for both sides: shippers and carriers. It is still unclear how positive this change could be."

Aschenberger (former Maersk Sealand reefer manager) pointed in his interview:

> "The market is dynamic. There will always be mergers and acquisitions. However, due to globalization and its increased competitiveness, there is a pressure for reducing costs to remain profitable. In this situation, the companies' concentration results to be critical. With larger volumes in less exporting firms hands (due to concentration), it has been a great pressure for reducing freight costs."

2.5 Containerization process

As early mentioned, the migration of cargo from traditional full reefer vessels to the reefer container is a global trend. The containerization process in South American East Coast is considered still not finished. According to Mr. Simon:

> "There still a lot be containerized mainly in the Plate area (Argentina). Fruits (like apples and pear ex Patagoniaxix and Citrus at Up Riverxx areas) are still at 50/50 proportion. And there are also a lot of fish from Falkland Islands, which is still loaded in conventional reefer ships."

Aschenberger added:

> *"*Here in Brazil, we can already understand that there is no more market for such a migration, simply because reefer vessels owners (break-bulk) have not called our ports. All reefer cargo that could have been containerized is already working so."

Rigby (Hamburg Süd executive interviewed) pointed:

> "Containerized reefer cargo is increasing permanently. The aging conventional reefer fleet has permanently lost market during the past 10 years contributing to yearly increases of reefer containerization for example: fish and apples ex Patagonian origin, citric ex Argentina and Uruguay."

Table 9 gives an overview of markets at South American East Coast where the full reefer has still participation.

Table 9 - South American East Coast summary of conventional reefer market and containerization process in progress

Commodity	**Trade**	**Volumes / conversion**
Meat (pork/poultry)	**Brazil to Russia**	In the year 2010, 60,000 tons were moved by vessel with one regular monthly call at Itajai to St Petersburg.
Citrus	**Up River (Argentina) to Europe**	In the year 2010, approximately 235,200 pallets were moved in 11,750x40rh, while other 192,434 pallets in full reefer.
Apples & Pears	**Patagonia (Argentina) to Europe**	In the year 2010, 112,508 pallets were moved in 5,346x40rh (container vessels), while other 187,910 pallets as break bulk (full reefer vessels).
Fish & Seafood	**Falkland Islands to Vigo**	Volumes are estimated to be 150,000 tons per year (approx., 6,000x40rh), still almost 100% in full reefer vessels (mainly to Vigo).

Source: Authors elaboration based on reports published by Mercopress; Patagonia Norte; Federcitrus; Guia Marítimo (2010/2011).

3. CONCLUSIONS: SHIPPERS AND SHIPPING LINES RELATIONSHIP

This paper first important conclusion is that reefer cargo has several trades, flows and transportation requirements, which characterises it as a very specific market niche operated by specialists. The risk of transporting reefer goods is much larger than the general cargo and therefore shipping liners involved have to be more dedicated and specialized, resulting in a more concentrated market.

As it is was previously quoted, oligopoly market operation could be summarized as follows: (1) Reduced number of players; (2) clear barriers of entry; (3) low probability of substitutive services/products in the short term and (4) uncertain and interdependence among agents regarding their pricing policies.

As, especially in Brazil, the containerization process is coming to its end, carriers' efforts are concentrated in their strategic share in the reefer container business. As it was demonstrated, South American reefer market has passed by an important concentration process, leading carriers and shippers to different and more balanced bargain power in their operations.

It is possible to preview that South American perishable goods trade will keep growing in the coming years, especially considering that Brazil has still a lot to growth in as global player in the foodstuff market[xxi] and Argentina has still a significant volume of reefer cargo to containerize in Patagonia and Up River areas. On the other hand, it would be skittish just to say that it will happen in three or five years, as perishable trade market depends very much on economic factors affecting foodstuff international trade and on local infrastructure to support export trade volumes.

This paper aimed to analyze this important niche in maritime freight market, focusing on reefer traffic in South American East Coast. It was concluded that the industry, both sides (shippers and carriers) showed a relevant and recent concentration processes. Therefore from an academic point of view it has accomplished to its explanatory purpose on reefer market at South American East Coast, but is far from is far from exhausting research possibilities in this specialized and demanding niche market.

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REFERENCES

ABEF. Retrieved on January 15th, 2012 from http://www.abef.com.br/ubabef/exibenoticiaubabef.php?notcodigo=2761 .

Dynamic TOP 100, 1999-2011. *AXS – ALPHALINER*. Retrieved on April 25th, 2011 from http://www.axsmarine.com/public/top100/index.php.

Ballou, R.H**.** (1993): **"**Logística Empresarial: Transportes, Administração de Materiais e Distribuição Física," Atlas, São Paulo.

Bowersox, D.J., Closs, D.J., & Cooper, M.B. (2002). *Supply Chain Logistics Management*. New York: McGraw Hill Higher Education.

Business Dictionary. (2011). Retrieved March 03rd, 2011 from http://www.businessdictionary.com/

Dataliner. Banco de dados da Centronave. Retrieved on Februrary 07th , 2012 from http://www.datamar.com.br/DataLiner.aspx 2012).

Costa, G. (2011). *Modalidades de Transporte na Movimentação de Contêineres*. Speech in 8th Seminário Internacional em Logística Agroindustrial on April 18th, 2011 at ESALQ-LOG, Piracicaba-SP. Retrieved April 20, 2011 from http://log.esalq.usp.br/home/pt/seminario.php?sh=2011_2

De Haan, H. (2005). *De Beer's consolidated manual on the transportation of perishable cargo in reefer containers.* Rotterdam: BTM De Beer b.v.

Drewry (2010). *Reefer Shipping Market 2010/11.* London: Drewry Shipping Consultants.

Dynamar (2010). Reefer Analysis: Market Structure Conventional Containers. Dynamar Bv., September, 2010.

Federcitrus (2011). The Argentine Citrus Industry. Retreived on January 20th, 2012 from http://www.federcitrus.org.ar/actividad-citricola-2011.pdf.

Galvão, C. (2009a). *Os portos marítimos na mundialização do capital.* MSc. thesis, Pontifícia Universidade Católica de São Paulo (PUC/SP).

_____. (2009b). Fusões e Aquisições: uma outra forma com a mesma essência. In: Marques, R.M. *O Brasil sob Nova Ordem.* São Paulo: Saraiva.

Guerise, L. C. (2006). Aplicação dos conceitos de logística integrada na exportação de açúcar e suco de laranja pelo Porto de Santos. 148p. MSc thesis. Universidade Católica de Santos, Santos-SP. Programa de Pós-graduação em Gestão de Negócios.

Guia Marítimo. Noticias. Retrieved on December 10th, 2010 from http://www.guiamaritimo.com.br/

Hamburg Süd. (2010). *The Reefer Brochure.* Hamburg, February, 2010.

_____. (2011). *Company History.* Retrieved March 25, 2011 from http://www.hamburgsud.com/group/en/corporatehome/aboutus/history/hamburgsdhistory.html

IATA. Retrieved on April 10th, 2011 from http://www.oie.int/doc/ged/D7762.PDF.

Levinson, M. (2006). *The Box: how the shipping container made world smaller and the world economy bigger.* Princeton: Princeton University Press.

Maersk Line (2006). *The Reefer Seminar by SAMREFOPS* (South America Reefer Operations department). São Paulo, January.

Malchow, G., Schultze, D. (1993). *Güterverkehr über See.* Lüneburg: Stern-Verlag KG.

MMS - Marine Management Surveys (2006). *Reefer Seminar*. São Paulo, January.

Patagonia Norte (2011). Estadística de Embarque. Retrieved on March 23rd, 2012 from http://www.patagonia-norte.com.ar/estadisticas.htm.

Porter, M.E.. (2008) *The Five Competitive Forces That Shape Strategy*, *Harvard business Review*, January 2008. Retrieved March, 20, 2011 from http://hbr.org/2008/01/the-five-competitive-forces-that-shape-strategy/ar/1

Robles, L.T. (2001). *A prestação de serviços de logística integrada na indústria automotiva no Brasil: em busca de alianças estratégicas logísticas*. Doctor Degree Business Administration Thesis. Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo. FEA-USP. São Paulo.

Stopford, M. (2009). *Maritime Economics.* New York: Routledge – Taylor & Francis Group, 3rd Edition.

United Nations. (2011). *World Basic Data.* Retrieved March 20,' 2011 from http://www.un.org/esa/population/

Waals, F. (2010). *Dynamar 2010 Reefer Analysis – Market Structure, Conventional, Containers.* Alkmaar: Dynamar B.V.

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[i] Refers to statistic data available on http://www.abef.com.br

[ii] Additional information on poultry exports volumes: In 2011, according to Dataliner/Centronave Brazil Foods has exported 90,000 FEUS, which represents an average of almost 2,000 FEUS per week for more than 130 different countries.

[iii] Statistic data available at <http://www.patagonia-norte.com.ar/estadisticas.htm>

[iv] The International Air Transport Association (IATA) was founded in 1945 with 230 members in 130 countries, representing in 2010 93% of international scheduled traffic.

[v] The cooling down a product main purpose is to avoid four kind of deterioration: First, external physical deterioration which can start by other factors (like inadequate packaging), but worsen, oscillation of temperature. Second, physiological deterioration, which is defined as damage in product functionalities (like mangoes under too low temperature and are injured by chill). Third, chemical deterioration caused by product substances reaction or other used for its conservation. Fourth, the pathological deterioration caused by diseases organisms (fungi and bacteria) that can more easily develop at higher temperatures. (MMS, 2006)

[vi] Typical reefer cargo claims on the carrier are: 1. Temperature deviations (high carriage temperature; chilling; freezing). 2. Humidity and atmosphere management. 3. Service: delay on transit time. 4. Reefer bad functioning. 5. Poor container hygiene, poor container condition (structure). 6. Others: pre-shipment conditions: post harvest, pre-cooling, packaging, stowage (air circulation). MMS - Marine Management Surveyors UK (2006):

[vii] Mr. Henrik Simon is Hamburg Süd Reefer Department Director for South American East Coast since 2003 and Head of Reefer Sales since 1984.

[viii] Levinson (2006) describes containers usage by the US Army and Navy during 1960s and 1970s.

[ix] A liner service can be defined as a regular service with fixed schedules and pre announced transit times between call ports. (MALCHOW, 1993)

[x] Technically, it is possible that reefer equipment (in container or full reefer vessel) can cool down the cargo. But this process can take several days and besides temperature deviation possibilities, the reefer equipment would increase substantially its power consumption.

[xi] Guerise (2006) supported by Ballou (1993); Bowersox *et al*. (2002); Robles (2001).

[xii] Typical suppliers, local companies such as: terminal operators; stevedores; tug boat companies and reefer cold stores.

[xiii] An alternative taken by carriers to reduce this imbalance is reefer containers offer to importers as dry box moving as “NOR” (non-operating reefer). But this is not count as part of reefer import trade.

[xiv] Exception in this case are Rio Grande at Rio Grande do Sul (Brazililan Southern Region), Pecem that is 60 km away from Fortaleza (Brazil) and Suape that is 50 km away from Recife (Brazilian Northeastern Region).
[xv] For a detailed analysis about mergers and acquisitions, see Galvão (2009a, 200b)
[xvi] Univeg group is one example, as they have purchased over 20 different farms.
[xvii] Citrovita purchase by Votorantin Group is another good example.
[xviii] The cases of Sadia taking over by Perdigão (lately named as Brazil Foods) and the Frigorifico Bertin taken by JBS/Friboi group are also illustrative cases.
[xix] Cargo loaded in Baia Blanca and San Antonio De Este in Argentina.
[xx] Cargo loaded in Zarate Port in Argentina.
[xxi] For example, Brazil is not participating in the fresh banana trades, one of the international reefer business main commodities.