COOL CARGOES, REEFERS AND REFRIGERATED SHIPPING

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I. Introduction

The world's hunger for fresh fruit and perishable foods has resulted in complex global supply chains as maritime transport of cool cargoes is increasingly used to satisfy consumer demand. Global shipping markets have responded swiftly to the economic recession. In August 2009, shipping asset values had collapsed for the global reefer fleet as rates were at their lowest levels in 20 years and a cargo war erupted over crisis-ridden container operators offering "distressed" rates to transport fruit. In addition to these industry specific forces, the ocean transport of perishable cargoes is not immune to marco level economic and policy developments. The political quest to achieve or broaden agricultural trade agreements to include more perishable food has been simultaneously met with both enthusiasm and resistance. Health and safety issues are driving the popularity of consumer trends such as "the 100 mile diet" and an increasing emphasis on organic food products is shifting attention to local farm production.

Do these conflicting pressures and trends spell prosperity or difficulty for the future maritime transport of perishables cargoes? In this paper we explore answers to this question. We begin by describing the composition of cool cargoes, shipping routes and the methods of maritime transport. The structure of the cool cargo transport industry is then reviewed. The analysis covers supply, demand, maritime transport options and competition. The next section touches on regulatory issues that affect the reefer/ refrigerated shipping industry. Finally, conclusions on the composition and the structure of the maritime transportation of cool cargoes - reefers and refrigerated shipping - and their implications for Canada's international trade in perishable goods is presented.

II. Cool Cargoes

A) Definition

Cool cargoes are defined as cargoes that require refrigeration or controlled temperature. In other words, they are perishable cargoes. Cargoes such as: flowers, fruit, meat, fish, dairy products, etc. The controlled temperature is required not only during transportation but also at the warehouses where these cargoes may be held before it reaches the final consumer. Depending on the characteristics of the cool cargo, different cooling characteristics may be required

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* *The views expressed here are those of the authors and are not purported to be those of the Commissioner or the Competition Bureau, Industry Canada.*

B) Volume and Composition of Cool Cargoes

Since the early 1990s the volume of cool cargoes has increased substantially and this volume is expected to double in a few years after the economic recovery. We begin by examining some of these claims and the sources of this increase. *a) Volume:* The volume of cool cargoes traded depends on world exports and imports. Since the two must be equal in equilibrium we look at imports. The volume of cool cargoes imported over the period 1990-2002 is shown in Table 1. The statistics indicate that imports have increased by 73.4% over this period.

Table 1 - Seaborne Refrigerated Imports by Commodity (1990-2002) (million tonnes=mt)

	1990	1995	2000	2002
Total	36.60	48.10	58.36	63.46

Source: Will the Reefer Recovery Last?, Ocean Shipping Consultants Limited, 2005.

Further, the volume of cool cargoes are forecasted to increase. Positive growth rates are expected to continue with an average annual increase of 3.7 percent between 2005 and 2015. Based on this, world cool cargoes are expected to grow from 108.6mt in 2005 to 156.2mt in 2015. A mark already achieved in 2008 according to the latest data from Drewry Shipping.

The actual quantity imported for the period from 1990-2002 by various regions in the world is shown in Table 2. Imports increased for all countries over the period. The major importers of cool cargoes continue to be South and East Asia, North America and Western Europe accounting for 67.7% of total seaborne imports in 2002. However, their relative share has changed in favour of South

Table 2 - Seaborne Refrigerated Imports by Region (1990-2002) (m. tonnes)

	1990	1995	2000	2002
South and East Asia	8.30	13.34	18.01	18.69
North America	8.63	9.65	12.38	12.99
Western Europe	9.90	10.18	10.74	11.31
Transitional Economies	3.16	6.25	6.24	8.91
Carribean/Latin America	1.70	3.01	4.36	4.28
Middle-East Asia	2.55	3.15	3.27	3.72
Africa	2.00	2.06	2.80	3.01
Oceania/Others / NES	0.36	0.46	0.55	0.57
Total	36.60	48.10	58.36	63.46

Source: Will the Reefer Recovery Last?, Ocean Shipping Consultants Limited, 2005.

and East Asia. The major exporters of cool cargoes are the USA, Western Europe, Ecuador, Brazil and China accounting for 41.9% of the total seaborne exports in 2002.

b) Composition: Cool cargoes are commonly categorized into seven classes: meat; fish; bananas; deciduous fruit; citrus fruit; tropical fruit; and dairy. These are shown in Table 3. The statistics reveal that : First, the important cool cargoes are meat, fish and bananas all exceeding 10 million tonnes. Second, the relative shares of tropical fruit and meat in cool cargoes have increased in 2002 compared to 1990. Each of these classes shall be examined.

Table 3 - Seaborne Refrigerated Imports by Commodity (1990-2002) (m. tonnes)

	1990	1995	2000	2002
Meat	7.64	11.13	15.19	16.93
Fish	8.23	9.98	12.50	13.86
Bananas	8.77	11.67	12.99	12.75
Deciduous fruit	4.07	5.62	6.49	7.39
Citrus fruit	4.87	6.10	6.40	6.91
Tropical Fruit	1.47	2.06	3.08	3.76
Dairy	1.54	1.54	1.71	1.86
Total	36.60	48.10	58.36	63.46

Source: ill the Reefer Recovery Last?, Ocean Shipping Consultants Limited, 2005.

Meat - Meat (poultry, bovine, and porcine) is the second fastest growing cool cargo. The five leading exporters and their share of total exports in 2007 are: Brazil (30.3%); US (22.7%); EU (10.8%), Canada (8.3%); and Australia (7.6%). The most important importers are: Russia (20.24%); Japan (17%); US (12.8%); EU (8.5%); and Mexico (8.2%).

Fish - Fish (fresh/chilled and frozen fish, crustaceans, molluscs and cephalopods) is the second most important cool cargo. The five leading exporters and their share of total exports in 2006 were: China (23.1%); Norway (13.58%); Thailand (13.46%); United States (10.26%); and Canada (9.61%). The most important importers are: the European Union (31.1%); Japan (21.5%); United States (21.4%); China (5.5%); South Korea (4.7%); and Hongkong (3.6%).

Bananas - The banana trade is the most important cool cargo in the fruit group. The five leading exporters and their share of total exports in 2005 were: Ecuador (28.5%); Philippines (13.7%); Costa Rica (11.1%); Colombia (9.6%) and Guatemala (7.8%). The most important importers are: the European Union (35.1% excluding Belgium); US (28.5%); and Japan (7.7%). It is not a seasonal trade and involves year-round reefer use.

Deciduous fruit - Deciduous fruit (apples, grapes, pears, peaches & nectarines and plums & sloes) is the second most important cool cargo in the fruit group.

The five leading exporters and their share of total exports in 2005 were: Italy (12.05%); Chile (11.75%); US (10.13%); China (8.4%) and Netherlands (6.25%). The most important importers are: Germany (12.66%); Russia (10.14%); UK (8.2%) and US (6.25%).

Citrus fruit - Citrus fruit (oranges, small citrus, lemons, limes and grapefruit) is the third most important cool cargo in the fruit group. The five leading exporters and their share of total exports in 2003 were: Spain (25%); US (14%); South Africa (11%); Turkey (5%); and Argentina (5%). The most important importers are: Germany (10%); France (9%); Netherlands (8%); Japan (6%); UK (6%); and Russia (6%).

Tropical fruit - Tropical fruit (pineapples, mangoes, avocados and papayas) is the fastest growing cool cargo in the fruit group though in terms of volume it is the smallest fruit group. The five leading exporters and their share of total exports for 2004 were: Costa Rica (24.4%); Mexico (13%); Philippines (6.8%), Brazil (6.3%) and India (6.3%). The most important importers are: US (37.4%), EC (29.5%) and Japan (6%).

Dairy - Dairy (Cheese, butter, non-fat dry milk and whole milk powder) is the least important of the cool cargoes. The five leading exporters and their market share in 2006 were: New Zealand (33.4%); EU (28.8%); Australia (14%); US (8.3%) and Argentina (5.8%). The most important importers are: Russia (17.2%); Mexico (11.3%); Japan (9.6%); Algeria (9.3%); and US (8.7%).

c) Canada: In Canada, statistics on cool cargoes are generally not available, apart for a few ports. Port Metro Vancouver, reported an average growth rate in refrigerated cargo of 5.8% over 2006 to 2008. Canadian exports of refrigerated cargo totalled 733,713 metric tonnes (about 34,000 TEU) and outpaced the total amount of imports by a factor of 2.2 times. The top ten refrigerated exports accounted for 95% of the tonnage (frozen and fresh pork (63%) was more important that the other top ten (french fries, other meat/fish products and fruit) commodities. The most significant export market for refrigerated cargo was Japan accounting for a 42% market share. The top 10 refrigerated imports through Port Metro Vancouver accounted for 87% of the total tonnage (mainly fresh and frozen vegetables, fruit, seafoods and other foods). In 2004, refrigerated containers accounted for 6.5% of the traffic at Vanterm, 10% at Centerm, 2.8% in Deltaport and 12.5% at Fraser Surrey Docks with reefers playing a little or no role. At the Port of Halifax,reefer volumes in 2008 totalled about 23,600 TEUs, which represented 7.2% of overall loaded TEUs handled. The top 10 reefer commodities accounted for 80% of total reefer volume for 2008; the leading commodity was fish (fresh, chilled, frozen). In

2008, the distribution of export and import reefer volumes to overall reefer volumes were: 71% export, and 29% import. The Port of Saint John also handles a sizeable volume of refrigerated cargo destined for Florida, the Caribbean, Central America and South America.

C) Shipping Routes of Cool Cargoes

a) World: The routes are indicated by the arrow from exporting to importing country.

Meat - Brazil ⇛Russia and Japan; US ⇛Russia, Mexico and Japan (*via West Coast*); EU ⇛Russia and Japan.

Fish - China ⇛US (*West Coast*) and UK; Norway ⇛US and EU; Thailand ⇛China and UK; US ⇛Japan (*via West Coast*).

Banana trade - Dominican Republic, Ecuador and Peru (via Panama) ⇛ Western Europe; Ecuador, Peru, Columbia and Honduras ⇛ US (West Coast); Dominican Republic ⇛ US (East coast); and Ecuador and Peru ⇛ Japan.

Deciduous fruit - Italy ⇛ Germany, Russia and UK; Chile (via Panama) ⇛ US (East Coast), Germany, UK and Russia; Chile ⇛ US (West Coast); US ⇛UK; China ⇛ Russia and UK.

Citrus fruit - Spain ⇛ Germany, France and Netherlands; US ⇛Japan (*via West Coast*) and Germany; South Africa ⇛Germany, France, Netherlands and Japan; Argentina ⇛ Netherlands.

Tropical fruit - Costa Rica ⇛USA and EU; Mexico ⇛USA, EU and Japan (*via West Coast*).

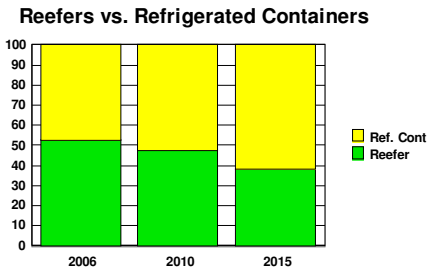
Dairy - New Zealand ⇛Mexico (*West Coast*), Algeria, Russia, US (*via West Coast*) and Japan; EU ⇛Russia, Japan and Mexico; Australia ⇛Mexico, Russia and Japan.

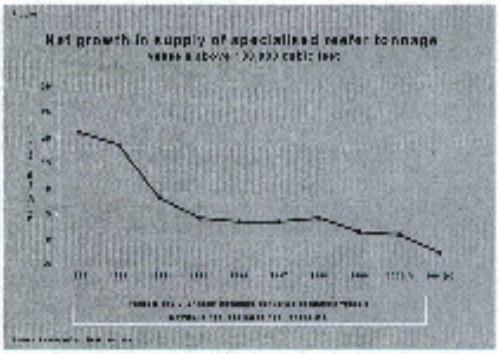
b) Canada: With a location close to the sea, shippers in Atlantic Canada and British Columbia are in a position to use marine transport. However, to contiguous countries such as USA and Mexico most cool cargoes travel overland.

This was confirmed in a 2007 recent shippers survey which indicated that none used marine transport to Mexico (Vercruz on the Gulf and Manzanillo on the Pacific). To non-contiguous countries, such as Asia and Europe, according to one study shipping lines move refrigerated containers through Tacoma and through Montreal, respectively.

By land, the most important interstate highways that connect Canada with US

and Mexico are: I-35, I-29 and I-94. They link North America's No. 1 busiest border crossing site, at Detroit and Windsor and its No. 2 busiest border site, at Laredo, Texas and Nuevo Laredo, Mexico. The Nogales, Arizona-Nogales, Sonora border crossing accounts for about half of all Mexican produce entering the United States.[1]





D) Transportation of Cool Cargoes

Reefers or refrigerated containers (which is examined in greater detail in the next section) is used for the transportation of cool cargoes. As of 2007, the transportation of cool cargoes was nearly equally divided between reefer and refrigerated container. But this is expected to change. The forecasted modal split of cool cargoes between reefers and refrigerated containers is shown in the chart. The chart indicates a gradual shift of cool cargoes from reefers (47.8%, 42.5% and 38.5%) to refrigerated containers (52.2%, 57.5% and 61.5%) for the years 2006, 2009 and 2015. A shift that is expected to continue according to Drewry Shipping Consultants in light of several factors for several reasons.

First, there has been a long run decline in the number of reefers on the orderbooks. This can be seen in the chart which shows the declining net growth in supply of specialized reefer tonnage. As indicated by one authority "Unless we see a more substantial new building programme of specialised reefer vessels, the industry will shrink to a limited number of vessels on a restricted number of trade routes."[2]

Second , there has been an increase in service and competition from conventional containers. According to one source "The leading container carriers are sharpening their competitive edge by developing reefer logistics,

offering a seamless plantation-to-supermarket shelf service that is outflanking the port-to-port services of the conventional reefer operators."[3] The competitive struggle between the two will continue and some analysts predict that the reefer industry is facing a shakeout, particularly of smaller players.

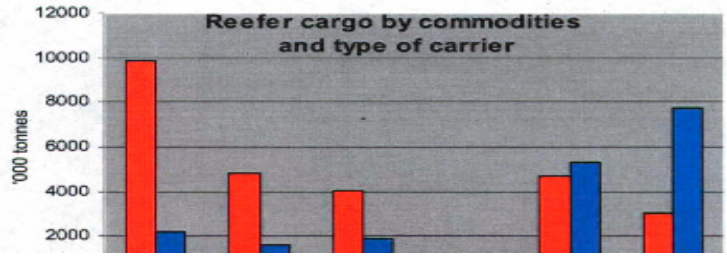
Third, there has been a dramatic increase in container capacity during the last few years and with that an increase in refrigerated container capacity. This can be seen in Table 4.

Table 4 - TEU Capacity of World Container Fleet

Year	1992	2001	07/2007	% Change ('92-'01)	% Change ('01-'07)
TEU	3,447,218	6,985,546	11,198,471	102.6	60.3

Fourth, there have been developments and improvements in refrigerated container technology, this enables containers to capture a greater share of the market from reefers. Further, the characteristics of some products enable them to be now transported by refrigerated containers.

Certain factors work in the opposite direction or slow this shift. First, breakbulk cargoes and pallet reefers have been gradually driven to smaller ports and a number of smaller ports have developed to capture these niche markets. Examples of the latter are Philadelphia and Wilmington on the East Coast, Hueneme and San Diego on the West Coast and Corpus Christ in the Gulf Coast. These ports "have invested significant sums in advanced on-dock cold storage and even controlled atmosphere preservation technology. Their goal is to maintain the cold chain even as goods are in motion."[4]



Second, certain cool cargoes have traditionally used reefers whereas others have used refrigerated containers. For example, the world wide share of reefer used for bananas is 79% whereas the world wide shares of refrigerated containers

used for dairy, meat and deciduous fruit is 86%, 79% and 40%. This is shown in the diagram.

III. The Structure of the Reefer Industry

A) Definition

A 'reefer container' is a refrigerated container used in intermodal freight transport for transportation of temperature sensitive cargo.[5] It has an integral refrigeration unit as part of it. There are three systems of refrigeration based on the use of: electricity; liquid; and gas. Electricity used for the container is obtained from one of two sources: land based sites at the quay or transport vehicles (ships or trailers). It is the most common refrigerated system for cool cargoes. Liquid used for the container is water contained in the refrigeration unit which is cooled. It is a system that is preferable where there is no ventilation. But because of its expense its use has been declining. Gas used to cool containers is contained in the refrigeration unit. The gas used is liquid carbon dioxide (CO_2). "This cryogenic concept was developed in response to rising fuel costs, and was an attempt to find an alternative to the standard mechanical refrigeration systems requiring maintenance, fuel and creating emissions. The CO_2 can keep the container's cargo frozen solid as long as 30 days."[6] It is a system that is likely to gain wider acceptance because it is cheaper, greener, free of mechanical failure or the need for power. It can also be accommodated on any part on the ship. Its use on railcars has proven that it is safe and reliable. The common standard size for reefer containers are: 20f, 40f, and 40f high cube. There are also containers used for perishable commodities that are insulated where the refrigeration is not integral to it.

The word 'reefer' is derived from a contraction of the English words 'refrigerated ship' or 'refrigerator ship'. A 'reefer ship' is a ship used in the transport of perishable commodities. It is generally understood to mean a fully refrigerated ship i.e., where all the cargo space is refrigerated. If only some of the cargo space is refrigerated, the ship is a 'partial reefer'. One source describes it as follows: "Reefer ships are effectively large refrigerators, heavily insulated and shuttered with bright metal that prevents taint and is easy to clean. They are ships that tend to be divided into many more spaces than conventional dry cargo ships, with several decks and even locker spaces, so that different commodities can be separated and carried, if required, at different temperatures.

Below the decks a reefer ship resembles a large modern warehouse, and cargo is usually carried and handled in palletized form, moved about on conveyors or by electric fork lift trucks."[7] If a reefer carries products at different temperatures they are referred to as 'polythermes'.

There are two types of reefer ships: sidedoor vessels and conventional vessels. The first has sidedoors that are lowered to the quay and serve as loading and discharging ramps for the forklifts. At the sidedoors, in the rear, there is a double pallet elevator which can carry the cargo to various decks. The second has hatches and cranes/derricks for the handling of palletized and loose cargo. A large reefer ship typically offers about 500, 000 cubic feet of refrigerated space and is capable of loading 250 containers on deck. Some reefers have as little as 90, 000 cubic feet. In other words, it can carry the cargo of about 40 to 250 trucks depending on its size.

A 'refrigerated container ship' is basically a container ship that transports refrigerated containers (i.e., where the refrigeration is part of the container) on the deck. The deck usually contains outlets for electricity to which the refrigerated containers can be plugged.

B) Structure of the Reefer/Refrigerated Container Industry

a) Supply of Reefers/Refrigerated Containers: The supply of containers like other commodities is based on price, availability of raw materials, technology, etc. The yearly production of reefer containers is shown in Table 5 for the period 1990-2006. Four basic types of reefer containers were produced: 20ft, 40ft, 40ft high cube and others. In terms of quantity: 10,000, 2,000, 141,000 and 2,000 were produced for 2006 (or a total of 155,000). The statistics indicate a gradual shift to the 40ft high cube, a decline in the 40ft and about the same production of the 20ft. It also indicates that the number of 40ft high cube production is fourteen times more than the number of 20ft containers.

Table 5 - Yearly Production of Reefer Containers ('000)

Year	20Ft	40Ft	40Ft High Cube	Other	Total	Growth	Replacement	Fleet at end of Year
1990	11.5	17.0	14.5	4.0	47.0	35.0	8.0	294.0
1995	12.5	17.0	50.5	1.0	81.0	60.0	20.0	526.0
2000	9.5	2.5	88.0	1.0	101.0	31.0	70.0	848.0
2005	9.5	2.5	158.0	3.4	173.4	126.0	46.00	1,276.0
2006	10.0	2.0	141.00	2.0	155.0	95.5	59.5	1,371.5

Source: *World Cargo News*, June 2006.

Though 155,000 reefer containers were produced, the increase in total supply was only 95,000 containers as 59,500 went to replace containers that were phased out or had to be replaced. The total fleet of containers at the end of 2006 was 1.37million. In terms of TEUs, this is between 1.3 million and 3 million TEUs since the 1.37 million does not make any adjustment for the size of the container. The statistics also indicate that total production of containers has increased from 1990-2006. In 2006, production of reefer boxes dipped after a four-year period of growth.

b) Demand for Reefers/Refrigerated Containers: The demand for reefer and refrigerated shipping container services is a derived demand. It is driven by demand for perishable products which depends on several factors, price of the perishable products at home and world markets, cost of shipping services and related services, income in other countries, tariffs, exchange rates, etc. Advances in transportation technology and container refrigeration are also largely responsible for the increase in demand and the shift to perishable products from non-perishable products. The reasons behind the recent increase in international trade for perishable products and subsequent demand for refrigerated shipping services is rising income, prosperity and economic growth in East Asia and the transitional economies together with trade liberalizing measures.

Ocean Shipping Consultants states "Since 2002, demand has been strong in both the container and conventional reefer sectors, ... This has been driven by demand growth in existing commodity sectors, the extension of the market to new sectors previously handled by air (such as tropical fruits, broccoli, asparagus and cut flowers), and the saturation of container shipping capacity caused by the strength of growth in the dry cargo market. Conventional reefer operators have thus benefited from the supply constraints in the container shipping industry."[8] The reefer trades are expected to expand by 14% to 25% from 2002 to 2010 and a further 6%-12% to 2015. The refrigerated trades in shipping containers is expected to expand by 64% to 85% from 2002 to 2010 and a further 35%-44% to 2015. These figures may be slightly reduced due to the current recession.

c) Reefers vs. Refrigerated Container Ships: The use of reefers can be traced to the early 1900s. The use of refrigerated containers for the use of transportation of cool cargoes is of more recent origin. They can be traced to the development of container ships in the mid 1970s.

The transportation services of the two are differentiated by the advantages

offered by one versus the other and the cost of one versus the other. One company describes it as follows: "Specialized reefer vessels offer a number of advantages compared to reefer containers. With up to 90 total air changes per hour, the specialized reefer vessels have an incomparable ability to reduce hold temperatures. One can adjust both CO_2 levels and humidity as well as monitoring the temperature of the cargo itself. Specialized reefer vessels have computers installed on the bridge or in the engine room that constantly monitor and control all refrigerated sections in the vessel. Moreover, specialized reefer vessels also offer a cost advantage when transporting large volumes and excellent flexibility in a seasonal market."[9] In addition, reefer ships have the advantage of being able to call at ports with shallow channels. Further, the need for specialized equipment at origin and destination is less (the reefer being the equipment) which results in keeping perishable cargo in better condition.

The total capacity of reefers and refrigerated containers is estimated to be more than 1.343 million cubic feet. According to Drewry Shipping Consultants "the existing container fleet provides 1.05 million TEUs of reefer capacity, offering approximately 1,052 million cubic feet of reefer capacity. The specialised reefer fleet provides 291 million cubic feet of under-deck capacity equalling 22 percent of overall reefer capacity."[10]

C) Major Companies in the Reefer and Refrigerated Container Shipping

In 'reefer' shipping, the six important companies are: 1. Seatrade Chartering; 2. NYK Lauritzen Cool AB; 3. Alpha Reefer Transport; 4. Eastwind; 5. Star Reefers; and 6. Green Reefers. These six companies operate about 450 ships. The market share of these companies in 2005 was roughly 30%, 13%, 9%, 7%, 7% and 6%, respectively. In other words, they account for about 72% of the market. Besides these major companies, the other notable companies are: United Reefers (British Pool); Munchmeyer Petersen Steamship; and Baltic Reefers. They operate about 86 ships (i.e., 35, 30 and 21).[11] A brief description of these companies is provided in the footnote.[12]

In refrigerated 'container' shipping, the six important companies are: 1. Maersk Sealand; 2. P&O Nedlloyd; 3. Evergreen; 4. CMA CGM; 5. MSC; and 6. Cosco. These six companies operated about 1390 container ships (in service as of November 2006). The market share of the refrigerated container capacity of these companies in 2006 was roughly 19.9%, 11.6%, 7.5%, 7%, 6.7% and 4.1%, respectively. In other words, they account for about 56.8% of the market. Besides these major companies, there are other numerous smaller companies each of which accounts for between 3% to 4% such as: K Line, CP Ships, Hanjin, APL, China Shipping, NYK, Hapag-Lloyd, MOL, CSAV, OOCL

and Hamburg Sud.[13] These shipping companies are among the top twenty container lines and account for about 80% of total container capacity.

D) Consolidation in the Reefer Industry

Two major mergers have occurred in the reefer industry in the last few years. They were Lauritzen Cool AB in 2000; and NYK LauritzenCool AB in 2005. The former was formed from a merger of Reefers and Cool Carriers and the latter was formed from a merger of NYK (part of NYK Group) and Lauritzen Cool AB (a subsidiary of Lauritzen and Lauritzen Reefer division). The merger was considered by the European Commission but was not opposed.[14] Analysts in the reefer industry, believe that consolidation is expected to occur in the future which implies that the big companies will become bigger. This raises the question whether such consolidation will raise an antitrust issue. First, the decision of the European Commission will be reviewed. Second, if one or two mergers occur in the reefer industry among any of the largest six companies will it raise antitrust concern?

European Commission - NYK/Lauritzen Cool/LauCool JV:

In July 2005, the EC received notification of a proposed concentration by which NYK Reefers Limited and J. Laurtizen A/S would acquire joint control of Lauritzen Cool AB. In its determination, the Commission began by considering the relevant product and geographic market followed by the competitive assessment. Central to this matter was the issue of demand and supply substitutability of reefer service vs refrigerator containers. In determining the issue, the Commission considered whether the market should be segmented by product, vessel size, port terminal size, geographic corridors between different regions, price difference between reefers and refrigerated containerized, etc. It stated "The exact market definition can be left open as the concentration does not lead to competition concerns under the narrowest plausible market definition of specialized bulk reefer transport services (with a possible separate market for the transport of bananas) in geographic corridors from each exporting region to Northern Europe and the Mediterranean respectively."

In its competitive assessment, the Commission considered the markets in which the operations of the two companies overlapped horizontally. It found that regardless of the market definition, the market share was not high except for the Australia-New Zealand - Mediterranean corridor in the reefer market. In examining this market and geographic corridor, it found that refrigerated containers provide an important external competitive constraint on the reefer market and the market share of the two companies was not high in the overall market (refers and refrigerated containers). Further, there were important

competitors active in the overall market and the barriers to competition were not high. Given these facts, the Commission came to the conclusion that the merger or concentration by the parties did not lead to any competition concerns. For the above reasons, the Commission decided not to oppose the notified proposal.

Future Consolidation: In light of the above, apart from consolidation involving a merger with the largest reefer company, consolidation among some of the other firms should not raise any antitrust concern. This is because the four firm concentration ratio is unlikely to exceed 1500 for the reefer industry and because of the substitutability between reefers and refrigerated containers. However, as is often the case, generalities can be misleading if on any particular corridor, the merged companies creates a near monopoly. Each specific merger would then have to be examined to determine if it raises any competition concerns.

IV. Regulations

In this section, some of the major regulatory barriers to cool cargoes in Canada will be examined with a brief description of how they affect transportation costs.

A) Regulatory Barriers:

a) Shipping - *The Canada Shipping Act* and *Coastwise Trading Act* requires the movements of goods within Canada or its territorial waters by ship or any other mode must be done using Canadian registered conveyances. Licences for foreign flagged vessels are provided for in certain situations where no Canadian ship exists (unlike the *Jones Act*). The same regulatory barriers that apply to container shipping also apply to reefers. Regarding refrigerated containers, the CBSA's tariff 9801.10 of the *Customs Act* restricted the use of international marine containers to 30 duty free days, which resulted in inefficient use. Regulations on international marine containers in Canada until recently had not kept pace with the developments that have occurred on other fronts and in some other countries.

b) Food and Drug - One of the regulatory barriers that have attracted attention are phytosanitary barriers in agricultural exports, a form of backdoor protectionism hidden behind the veil of science and public safety. This issue gained prominence after the recent mad cow and avian flu problems. Even when the matter was resolved, countries placed restrictions on what exactly could henceforth be imported. This resulted in a fall in the amount that could be exported, raising cost and making exports less competitive. Examples are restrictions imposed by Japan, South Korea and other Asian governments on bone-in-beef shipments and beef from cows more than 20 months old. To add to these concerns, a July 2009 Independent Listeriosis Investigative Review report concluded that because of globalization, the incidence of foodborne

illness is increasing. Foodborne illness is now the largest class of emerging infectious disease in Canada. While international standards set by the WTO such as the *Phytosanitary Measures Agreement* exist, it still permits countries to set their own standards. There are however restrictions on this, imposed by the *Technical Barriers to Trade Agreement* (TBT). Nevertheless, these loopholes have yet to be dealt with.[14]

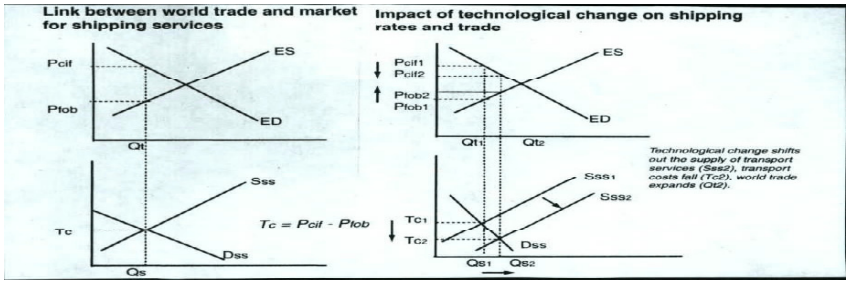
c) Environmental **-** The 'green revolution' is leading to regulatory initiatives that could act as regulatory barriers, if it has differential impacts between countries competing in the export of cool cargoes. For example, the emission of CO_2 used in refrigerated containers into the atmosphere and the environmental impact of aquaculture. Environmental concerns that apply to cool cargoes and ocean shipping in general also apply here (such as destruction of habitat, depletion of wild stock caught for feed, and concern about the invasion of alien species).

d) Customs and Security **-** One source states the "Most dangerous 'pest' at the U.S. - Mexico border might be duelling laws and agencies."[15] The above remark applies more to road than maritime transportation . However, the general sentiment regardless of mode is the complexity and web of security and handling regulations; the lack of harmonization of health and security regulations in and between countries; and the duplication and overlap. Not surprisingly, this has led to statements of frustration such as "The big picture – an appropriate balance between security and trade efficiency based on an assessment of risk – seems to have been lost. ...The situation is not sustainable. We can't go on forever, layering one new program on top of another, further driving up the cost of transportation and harming Canadian competitiveness."[16] Another example, is the recent increase in Animal and Plant Health Inspection Service fees on imported agricultural commodities by 14% due to a decline in cross-border traffic. The CTA chief David Bradley said "This increase and the rationale for the increase are both ludicrous."

e) Tariffs/Quotas/Tariff-rate Quotas - Promoting free trade in agriculture has always been a contentious and controversial issue. At the Uruguay Round Agreement little was done to reduce some of the extremely high tariffs on agricultural products and the matter was not resolved at the Doha Round Agreement. The problems continue, examples include the US antidumping duties on shrimp and EU import tariff on bananas. In early 2008, the WTO ruled in favour of US multinationals in Latin America that EU's import tariff ($254.90 per metric ton) on bananas is illegal. It made a similar ruling in favour of Ecuador in November 2007. Agricultural trade distortions impose huge costs on the global economy. Developed countries should provide duty and quota-free access to their markets for all not just some commodities. The

special safeguard mechanism and protection of fruit and vegetables and poultry continues. In addition, use of specific rather than ad valorem tax duties create distortions.

B) Effect of Regulatory Barriers on Trade and Transportation Services:
The above regulatory barriers have the effect of raising transportation costs (see diagram). It acts like a tariff, lowering the exporter's price (P_{fob}) and raising importer's price (P_{cif}). As a result, the quantity traded on world markets falls to Q_t from Q_w. (i.e., quantity where ES and ED intersect not labelled in diagram). See diagram. A reduction in the difference between the export and import price or reducing regulatory barriers would increase the quantity traded and with it transportation services, since the supply curve for transportation services (S_{ss}) is
assumed proportional to trade being a derived demand. As a result, the S_{ss} curve would shift to the right, reducing transportation costs (P_{cif} -P_{fob}) and increasing the demand for it.[17]



Source: See Reference 1 in Bibliography
Examples of reducing regulatory barriers are avoiding duplication of custom and security, adopting uniform food and drug regulations, etc. It has a effect similar to improvements in technological change in refrigeration, improved infrastructure for cool cargoes, etc. That is it shifts the S_{ss} to the right, lowering transportation costs, increasing the demand for transportation services and with it world trade.

V. Concluding Remarks

Interest in transportation of 'cool cargoes' has been stimulated by the world's hunger for fresh fruit and perishable foods. This is reflected in fundamental shifts that are occurring in international refrigerated shipping. Business is growing, new markets are opening, price is falling where modal shifts occur, segments of industry are under stress and producer associations are being

supplanted by retail titans. Names such as Del Monte, Top Bananas, Chiquita, etc. have become synonymous with the type of cool cargo. This can be seen in the following facts.
The volume of cool cargoes imported/exported over the period 1990-2002 has increased by 73.4% and before the recession was expected to grow from 108.6 million tonnes in 2005 to 156.2 million tonnes in 2015. Drewry Shipping indicates that in 2008 reefer trade stood at 156 million tonnes and growth will return in 2010. Of the seven classes of cool cargoes , meat, fish and bananas all exceed 10 million tonnes and the relative share of tropical fruit and meat have increased the most between 1990-2002. With this increase, the demand for transportation of cool cargoes, being a derived demand has increased. To keep up with the demand, the supply of refrigerated containers has also increased from 848,000 refrigerated containers in 2000 to 1,371,500 in 2006. With this prosperity (if the current financial crisis is short lived), the structure of the industry -specialized reefer vs refrigerated container - is expected to change with the former continuing to lose out to the latter.

2009 was a very bad year in the container shipping industry: annual container volume fell by about 12 percent compared to 2008. As a result container lines have reduced service by laying-up ships, dropping ports and slowing down their vessel's speed. As a result export ocean shipping capacity and container scarcity are limiting some North American exporter's ability to meet foreign demand. While exporters of chilled and frozen cargo also appear to be getting the equipment they need North American export container capacity challenges may create some market opportunities for the more specialized reefer fleet.Consolidation is also expected to change the structure. This, however, is unlikely to raise any antitrust concern generally from this perspective for reasons found in the European Commission’s assessment of two mergers.

The current regulatory framework - shipping laws, food and drug regulations, environmental regulations, customs and security regulations and tariff and quotas - has implications for the future growth of the cool cargo industry in the world and in Canada. It has an effect of raising transportation and compliance costs which lead to a fall in quantity traded in world markets. At the moment the most serious regulatory barriers are the food and drug regulations, unnecessary duplication of custom and security regulations, and tariffs/quotas. If we are interested in promoting world trade in cool cargoes and lower prices, the barriers to the free flow of cool cargoes should be eliminated (even though the success with agricultural free trade agreements has not been encouraging).

Further research in this sub-segment of trade and transportation would require. The publication of data on this sector; the consideration of developing specialized facilities at ports to handle cool cargoes or supply chains or the consideration of whether certain ports should specialize in this sub-segment, like the US; the removal of regulations that act as a barrier to trade; and the consideration of Canada acting as a facilitator in promoting agricultural free trade agreements.

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Footnotes

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2. Id.
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4. Seideman, T., Breakbulk: a Segment Surviviesfor Persihable Products, The IRTA Report, August 2003.
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7. See Refrigerated cargo ships/reefers, www.globalsecurity.org/military/systems/ship/break-bulk-reefer.htm
8. Will the Reefer Recovery Last?, Ocean Shipping Consultants Limited, 2005.
9. www.greenreefers.no
10. Reefer Shipping 2006/07, Annual Report, Drewry Shipping Consultants.
11. See Wikipedia, the free encyclopedia, www.en.wikipedia.org/wiki/Reefer_(ship)
12. Seatrade Chartering (a Netherlands company) operates a fleet of more than 150 ships of 55 million cubic feet. It basically carriers cargo to US, Chile and Australia. The main cargoes are: fruit, frozen orange juice concentrate, beef, and other perishables. NYK Lauritzen Cool AB (a Denmark company) operates a fleet of 70 to 80 vessels. Its total revenue in 2006 was US $74 m. It basically carriers cargo to South America and South Africa. The main cargoes are: banana, deciduous and citrus fruit and meat. Alpha Reefer Transport (a Germany company) operates 46 ships world wide. Its total revenue in 2006 was 115.7 m.(LTL). It basically carries cargo to US, Chile and Australia. The main cargoes are: fish, poultry, fruits, bananas and vegetables. Star Reefers (a Norwegian company) operates 41 vessels with a capacity 21 mcf. Its total revenue in 2006 was US $220.7 m. It basically carriers cargo to South America, Africa and Pacific. The main cargoes are bananas, citrus and deciduous fruit. Green Reefers (a Norwegian company) operates 45 vessels with a capacity of 12.8 mcf. Its total revenue in 2006 was US $158 m. It basically carriers cargo to North Europe, US and Brazil. The main cargoes are fish, juice, fruits and meat.
13. Dr. Wild, I.Y, Temperature Distribution Inside Ocean Reefer Containers, Nov. 13-14, 2006.
14. Field, Alan, Back Door protectionism?, Pacific Shipper's Cool Cargoes, Fall 2006, pp. 34-38. One source stated "China is the most arbitrary and unpredictable U.S. market for agricultural exports. ... 'They may switch on' a restriction one day, and 'then they switch it off when to want to import it again. You never quite know where China is going to come out'."
15. Cross-border Regulatory web complicates produce delivery, Pacific Shipper's Cool Cargoes, Fall 2007, p. 42.
16. See "Trucking Alliance Tells Commons Committee How Industry Being Hit by Economic Conditions", www.ontruck.ca
17. See Reference 1 in Bibliography.
18. Case No COMP/M.3798 - NYK/Lauritzen Cool/LauCool JV Notification of 14/07/2005 pursuant to Article 4 of Council Regulation No 139/2004, Brussels 19/08/2005.