12

Container Shipping

Theo Notteboom

12.1 Introduction

The container shipping industry consists of shipping companies with as core activity the transportation of containerized goods over sea via regular liner services. A liner service is "a fleet of ships, with a common ownership or management, which provide a fixed service, at regular intervals, between named ports, and offer transport to any goods in the catchment area served by those ports and ready for transit by their sailing dates" (Stopford 1997: 343). Container liner services are specifically focused on the transport of a limited range of standardized unit loads: the twenty-foot dry-cargo container or TEU and the forty-foot dry-cargo container or FEU. Occasionally, slightly diverging container units are also loaded on container vessels, such as high cube containers, tank and open-top containers and 45-foot containers. The diversity in unit loads in the container shipping industry is low due to the need for uniformity when stacking containers below and on the deck of specialized container vessels.

Container shipping has a dynamic history of only 55 years. The launching of the first container ship, *Ideal X*, by Malcolm McLean in 1956 can be considered as the beginning of the container era. In the early years of container shipping, vessel capacity remained very limited in scale and geographical deployment, and the ships used were simply converted tankers. Shipping companies and other logistics players hesitated to embrace the new technology as it required large capital investments in ships, terminals and inland transport. The first transatlantic container service between the US East Coast and Northern Europe in 1966 marked the start of long-distance containerized trade. The first specialized cellular container ships were delivered in 1968, and soon the containerization process expanded over maritime and inland freight transport systems (Levinson 2006; Rodrigue and Notteboom 2009a). Container shipping developed rapidly because of the adoption of standard container sizes in the mid-1960s and the awareness of industry players of the advantages and cost savings resulting from faster vessel turnaround times in ports, a reduction in the level of damages and associated insurance fees, and integration with inland transport modes such as trucks, barges and

The Blackwell Companion to Maritime Economics, First Edition. Edited by Wayne K. Talley.

trains. The container and the associated maritime and inland transport systems proved to be very instrumental to the consecutive waves of globalization. Hence, emerging worldwide container shipping networks allowed changes in the economic and transport geography, as they significantly shortened the maritime cost distances between production and consumption centers around the world. Container shipping also became an essential driver in reshaping global supply chain practices, allowing global sourcing strategies of multinational enterprises, pull logistics solutions and the development of global production networks. New supply chain practices in turn increased the requirements on container shipping in terms of frequency, schedule reliability/integrity, global coverage of services and rate setting.

This chapter aims to provide a comprehensive overview of current issues in the container shipping industry. Section 12.2 analyzes market growth and the changing geography in container shipments. Sections 12.3 and 12.4 zoom in on, respectively, the capacity management issue and the pricing problem in the container shipping industry. Section 12.5 deals with carriers' search for scale and scope in their operations. A last section discusses the evolving nature of the container shipping networks operated by carriers.

12.2 Growth in the Container Shipping Industry

The shipping industry has witnessed spectacular growth in container trade, fueled by the globalization process and the large-scale adoption of the container. Worldwide container port throughput increased from 36 million TEU in 1980 and 88 million TEU in 1990 to about 535 million TEU in 2008. Around 60% of the world port throughput involves laden containers, about 15% are empty containers. The remainder consists of transshipped containers. Sea–sea transshipment shows the strongest growth: it has more than tripled in the last 15 years (see Table 12.1). World container traffic, the

Table 12.1 World container port throughput and its components for selected years (million TEU)

	Total port handling	*Port-to-port*		*Transshipment*	*Port-to-port*		*Transshipment (%)*
		Full	*Empty*		*Full (%)*	*Empty (%)*	
1990	87.9	57.4	14.6	16.0	100.0	25.4	27.9
1995	145.2	92.1	20.8	32.3	100.0	22.6	35.1
2000	235.4	136.7	36.8	62.1	100.0	26.9	45.4
2005	399.2	231.3	59.7	108.2	100.0	25.8	46.8
2009 (est.)	478.0	275.0	69.0	134.0	100.0	25.1	48.7
2009 vs 1995 (%)	+229	+199	+232	+315			
2009 vs 2005 (%)	+20	+19	+16	+24			

Sources: Drewry (2006), ITMMA/ESPO (2007) and estimates 2009.

absolute number of containers being carried by sea, has grown from 28.7 million TEU in 1990 to 152 million TEU in 2008 – an average annual increase of 9.5%. The ratio of container traffic over container throughput evolved from 3 in 1990 to around 3.5 in 2008; i.e., a container on average is handled (loaded or discharged) 3.5 times between the first port of loading and the last port of discharge. The changing configuration of liner service networks is at the core of the rise in the average number of port handlings per box (see Section 12.6, "Dynamics in Container Shipping Networks").

With the exception of the year 2009 (when there was a decline in world container traffic of about 12% to 478 million TEU), the container shipping business has always witnessed moderate-to-strong year-on-year growth figures. The pace of growth even accelerated in the period 2002–8, partly as a result of the "China effect" in the world economy. The absolute rise of container traffic is the result of the interplay of economic, policy-oriented and technological factors. World trade was facilitated through the mitigation of trade barriers and the introduction of market liberalization and deregulation. Market liberalization also enhanced the development of logistics throughout the world.

The center of gravity of the container business is shifting to Asia. During the last twenty years the transatlantic container trade has gradually lost its dominance to the transpacific and Europe–Far East trades, with large volumes moving from Asia to North America and Europe (Figure 12.1). The container ports in East Asia handled 19.8% of the global container throughput

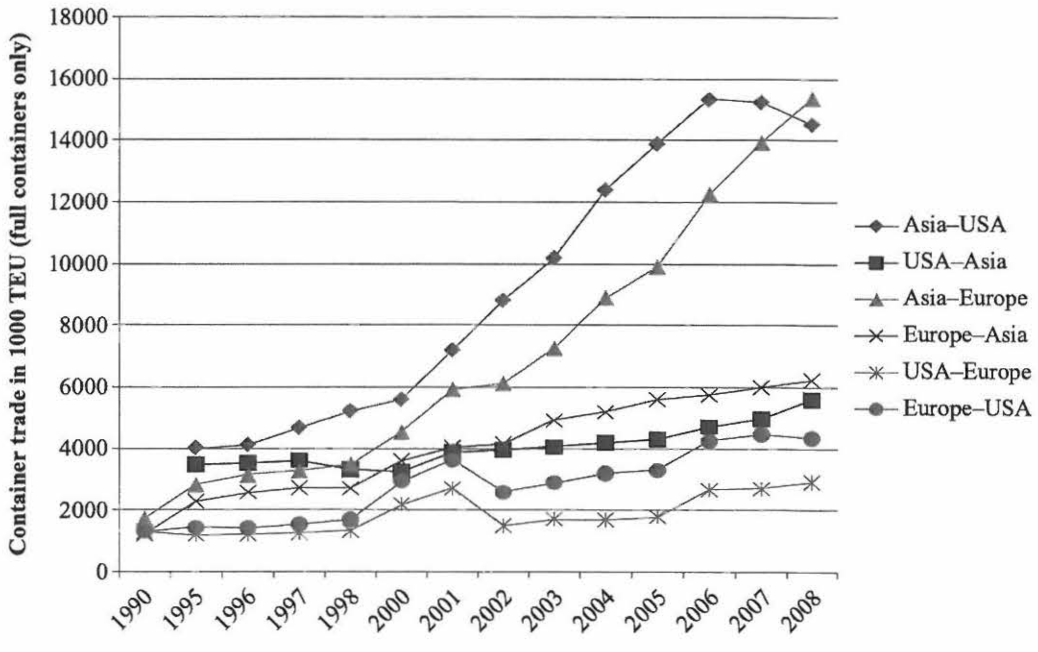

Figure 12.1 Container trade on the main routes, in TEU (full containers).
Source: own elaboration based on data in various reports of Drewry and UNCTAD, *Review of Maritime Transport.*

in 1980. In 2008, their share had increased to about 37%. Ports in Southeast Asia saw a steep rise in their joint market share, from 4.8% in 1980 to around 14% in 2008. In contrast, Western Europe saw its share fall from 30.3% (then the highest in the world) to about 18% in the same period. North America also witnessed its share declining, from 24.5% (then the second-highest in the world) to less than 10%. The dominance of Asia is also reflected in world container port rankings (Table 12.2). In 2009 fourteen of the twenty busiest container ports came from Asia, mainly from China. In the mid-1980s there were only six Asian ports in the top twenty, mainly Japanese load centers. The top twenty container ports represented 46% of the world container port throughput in 2009, the top five an elevated 21.3%.

Table 12.3 provides a list of the main container-handling regions in the world. The share of gateway traffic in total container throughput tends to differ quite significantly between the gateway regions. The Singapore region primarily acts as a sea–sea transshipment platform (that is, it functions mainly as a hub, not as a gateway), whereas the seaport system in the Yangtze Delta, for instance, is a true multi-port gateway region, giving access to vast service areas in the Delta and along the Yangtze River. Moreover, some multi-port gateway regions feature a high density of port terminals in a small geographical space, while other regions cover larger areas with inter-port distances of up to 350 km. The Rhine–Scheldt Delta region in Europe was the main container-handling region in the world till the early 1990s. From that moment on Asia took over the leadership. One out of every ten containers handled worldwide is handled in ports of the Pearl River Delta. The joint cargo throughput of the ten port regions considered constitutes almost half of the world container port handlings. Within the region of East Asia, export-oriented industrialization policies adopted by Hong Kong, Taiwan and South Korea sustained a strong growth in the container throughput handled by these economies from the 1980s. China developed similar strategies in the late 1980s, which resulted in elevated growth, first in the Pearl River Delta and later also in the Yangtze Delta port system and the Bohai Bay region. In recent years Shanghai, Guangzhou, Shenzhen, Qingdao and Ningbo joined Hong Kong and Singapore in the list of busiest container ports in the world. The future could see more Chinese ports entering the ranks of the busiest container ports.

Despite the sustained growth brought about by the containerization process (particularly in relation to Asia), container carriers have always somewhat underperformed financially compared to other players in the logistics industries. The weaker performance is linked to the combination of capital-intensive operations and high risks associated with the revenues.

12.3 Capacity Management in Container Shipping

12.3.1 Asset management and the capital-intensive nature of the industry

Container shipping is a very capital-intensive industry, in which some assets are owned and others leased and there exists a wide variability in cost bases (Brooks 2000). Asset management is a key component of the operational and commercial success of container shipping lines, since they are primarily asset-based. Common asset management

Table 12.2 Top twenty container ports based on throughput in million TEU (1975–2009)

R	*1975*		*1985*		*1995*		*2004*		*2006*		*2008*		*2009*		R
	Port	*mTEU*	*Port*	*mTEU*	*Port*	*mTEU*	*Port*	*mTEU*	*Port*	*mTEU*	*Port*	*mTEU*	*Port*	*mTEU*	
1	Rotterdam	1.08	Rotterdam	2.65	Hong Kong	12.55	Hong Kong	21.93	Singapore	24.79	Singapore	29.92	Singapore	25.87	1
2	New York/NJ	0.95	New York/NJ	2.37	Singapore	11.85	Singapore	21.33	Hong Kong	23.31	Shanghai	27.98	Shanghai	25.00	2
3	Kobe	0.90	Hong Kong	2.29	Kaohsiung	5.23	Shanghai	14.55	Shanghai	21.70	Hong Kong	24.25	Hong Kong	20.93	3
4	Hong Kong	0.80	Kobe	1.52	Rotterdam	4.79	Shenzhen	13.66	Shenzhen	18.46	Shenzhen	21.41	Shenzhen	18.25	4
5	Keelung	0.56	Antwerp	1.35	Busan	4.50	Busan	11.43	Busan	12.04	Busan	13.43	Busan	11.95	5
6	Oakland	0.52	Yokohama	1.33	Hamburg	2.89	Kaohsiung	9.71	Kaohsiung	9.77	Dubai	11.83	Guangzhou	11.19	6
7	Seattle	0.48	Hamburg	1.16	Yokohama	2.76	Rotterdam	8.22	Rotterdam	9.69	Ningbo	11.23	Dubai	11.10	7
8	Bremerhaven	0.41	Keelung	1.16	Los Angeles	2.56	Los Angeles	7.32	Dubai	8.92	Guangzhou	11.00	Ningbo	10.50	8
9	Long Beach	0.39	Busan	1.15	Long Beach	2.39	Hamburg	7.00	Hamburg	8.86	Rotterdam	10.83	Qingdao	10.26	9
10	Melbourne	0.36	Long Beach	1.14	Antwerp	2.33	Dubai	6.42	Los Angeles	8.47	Qingdao	10.32	Rotterdam	9.74	10
11	Tokyo	0.36	Los Angeles	1.10	New York/NJ	2.28	Antwerp	6.06	Qingdao	7.70	Hamburg	9.74	Tianjin	8.70	11
12	Antwerp	0.36	Tokyo	1.00	Tokyo	2.18	Long Beach	5.78	Long Beach	7.29	Kaohsiung	9.68	Kaohsiung	8.58	12
13	Yokohama	0.33	Bremerhaven	0.99	Keelung	2.17	Port Kelang	5.24	Ningbo	7.07	Antwerp	8.66	Antwerp	7.31	13
14	Hamburg	0.30	San Juan	0.88	Dubai	2.07	Qingdao	5.14	Antwerp	7.02	Tianjin	8.50	Port Kelang	7.31	14
15	Sydney Harbour	0.26	Oakland	0.86	Felixstowe	1.90	New York/NJ	4.47	Guangzhou	6.60	Port Kelang	7.97	Hamburg	7.01	15

16	San Juan	0.26	Seattle	0.85	Manila	1.67	Tanjung Pelepas	4.02	Port Kelang	6.33	Los Angeles	7.85	Los Angeles	6.70	16
17	Tilbury	0.23	Bremerhaven	0.83	San Juan	1.59	Ningbo	4.01	Tianjin	5.95	Long Beach	6.49	Tanjung Pelepas	6.02	17
18	Le Havre	0.23	Dunkirk	0.71	Oakland	1.55	Tianjin	3.81	New York/NJ	5.13	Tanjung Pelepas	5.60	Long Beach	5.07	18
19	Kaohsiung	0.23	Baltimore	0.71	Shanghai	1.53	Laem Chabang	3.62	Tanjung Pelepas	4.77	Bremerhaven	5.60	Xiamen	4.68	19
20	Jacksonville	0.21	Jeddah	0.68	Bremerhaven	1.53	Tokyo	3.58	Bremerhaven	4.45	New York/NJ	5.27	Laem Chabang	4.64	20
	Top 20 World total	9.2 24.1	Top 20 World total	24.7 57.4	Top 20 World total	70.3 145.2	Top 20 World total	167.3 354.5	Top 20 World total	208.3 440	Top 20 World total	247.5 535	Top 20 World total	220.8 478	
	Share of top 20	38.3%	Share of top 20	43.1%	Share of top 20	48.4%	Share of top 20	47.2%	Share of top 20	47.3%	Share of top 20	46.3%	Share of top 20	46.2%	
	Share of top 10	26.8%	Share of top 10	28.1%	Share of top 10	35.7%	Share of top 10	34.3%	Share of top 10	33.2%	Share of top 10	32.2%	Share of top 10	32.4%	
	Share of top 5	17.9%	Share of top 5	17.7%	Share of top 5	26.8%	Share of top 5	23.4%	Share of top 5	22.8%	Share of top 5	21.9%	Share of top 5	21.3%	

Source: own elaboration based on the statistics of the respective port authorities.

Table 12.3 The ranking of major container handling regions in the world (in million TEU)

Cluster	*Main container ports*	*Distance*[a] *(km)*	*1985*	R	*1990*	R	*1995*	R	*2000*	R	*2004*	R	*2006*	R	*2007*	R	*2008*	R	*2009*	R	*S*[b] *(%)*
Pearl River Delta	Hong Kong, Shenzhen, Guangzhou, Zhongzhan, Jiuzhou	130	2.34	*3*	5.37	*3*	13.74	*1*	24.26	*1*	40.16	*1*	49.95	*1*	55.98	*1*	58.30	*1*	51.87	*1*	*10.9*
Malacca Straits	Singapore, Port Klang, Tanjung Pelepas	340	1.70	*6*	5.56	*2*	12.98	*2*	20.66	*2*	30.41	*2*	35.88	*2*	40.27	*2*	43.49	*2*	39.20	*2*	*8.2*
Yangtze River Delta	Shanghai, Ningbo	180	0.20	*9*	0.47	*10*	1.69	*9*	6.51	*7*	18.56	*3*	28.78	*3*	35.51	*3*	39.21	*3*	35.50	*3*	*7.4*
Bohai Bay	Dalian, Qingdao, Tianjin	350	0.20	*10*	0.55	*9*	1.68	*10*	4.84	*9*	11.16	*7*	16.86	*5*	20.37	*5*	23.05	*4*	23.51	*4*	*4.9*
Rhine–Scheldt Delta	Rotterdam, Antwerp, Zeebrugge, Amsterdam	105	4.20	*1*	5.62	*1*	7.74	*3*	11.38	*3*	15.59	*4*	18.67	*4*	21.37	*4*	22.08	*5*	19.58	*5*	*4.1*

Korean Twin Hub	Busan, Gwangyang	135	1.16	7	2.35	7	4.50	6	8.18	5	13.28	6	13.79	7	14.53	7	14.30	8	12.79	6	2.7
San Pedro Bay	Los Angeles, Long Beach	10	2.25	4	3.71	4	5.40	4	9.48	4	13.10	5	15.76	6	15.67	6	14.34	7	11.77	7	2.5
Helgoland Bay	Hamburg, Bremerhaven, Wilhelmshaven	95	2.15	5	3.13	6	4.41	7	7.03	6	10.52	8	13.31	8	14.80	8	15.19	6	11.57	8	2.4
Gulf/ Emirates	Dubai	150	0.30	8	0.92	8	2.07	8	3.05	10	6.42	10	8.92	9	10.71	9	11.83	9	11.10	9	2.3
Tokyo Bay	Tokyo, Yokohama, Shimizu	50	2.46	2	3.37	5	5.16	5	5.63	8	6.59	9	7.20	10	7.62	10	7.68	10	6.92	10	1.4
Total of 10 clusters			16.94		31.04		59.37		101.02		165.79		209.12		236.83		249.47		223.81		
Total world port container throughput			57.4		87.9		145.2		235.4		354.5		440		492		535		478		
Share of 10 clusters			29.5%		35.3%		40.9%		42.9%		46.8%		47.5%		48.1%		46.6%		46.8%		

[a] Longest distance between competing ports in the cluster.

[b] Share of cluster in world port throughput.

Source: own elaboration based on the statistics of the respective port authorities.

decisions for shipping lines include management of the equipment to reduce downtime and operating costs, increase the useful service life and residual value of vessels, increase equipment safety and reduce potential liabilities, and reduce costs through better capacity management.

Container shipping lines are particularly challenged to develop an effective asset management program for the fleet they own or operate. Vessel life cycle management includes the procurement, acquisition, deployment and disposal of container vessels. Fleet capacity management is complex, given the inflexible nature of vessel capacity in the short run due to fixed timetables, the seasonality effects in the shipping business and cargo imbalances on trade routes. Lines vie for market share and capacity tends to be added as additional loops (i.e. in large chunks) to already existing services. Lines incur high fixed costs in this process. For example, eight to ten ships are needed to operate one regular liner service on the Europe–Far East trade, and each of the post-Panamax container vessels has a typical newbuilding price of US$100–200 million, depending on the unit capacity of the ship and the market situation in the shipbuilding industry at the time of the vessel order placements. The total slot capacity of the cellular container fleet stood at 12.94 million TEU in October 2009, 9.44 million TEU in 2007, 3.09 million TEU in 1997 and 1.22 million TEU in 1987. Container shipping lines on average charter about 58% of the vessels and 51% of the total capacity from third-party shipowners (Table 12.4). Ship chartering is particularly a common practice for mid-size box ships (i.e. 1,000 to 3,000 TEU).

Container shipping lines also face having to make large investments in their box fleets. The ex-factory prices of new containers typically amount to US$3000–3500 for a 40-foot dry container and around US$2000 for a 20-foot box (*Containerisation International*, various issues). The total slot capacity of the world's container fleet amounted to 13.3 million TEU in April 2008, while the

Table 12.4 Composition of the world cellular container ship fleet in October 2009

Size range (TEU)	*Total*		*Chartered*		*Chartered*	
	Number	*TEU*	*Number*	*TEU*	*% number*	*% TEU*
>7500	267	2,418,951	83	709,663	31.1	29.3
5000–7499	402	2,439,772	163	989,545	40.5	40.6
4000–4999	588	2,656,079	310	1,392,479	52.7	52.4
3000–3999	325	1,106,690	166	567,801	51.1	51.3
2000–2999	717	1,819,329	537	1,368,111	74.9	75.2
1500–1999	568	962,082	388	658,163	68.3	68.4
1000–1499	698	824,213	446	525,257	63.9	63.7
500–999	837	616,408	557	414,579	66.5	67.3
100–499	313	101,472	106	34,529	33.9	34.0
Total	4,715	12,944,996	2,756	6,660,127	58.5	51.4
Average vessel size		2,745		2,417		

Source: based on www.alphaliner.com/.

total box fleet reached 25.36 million TEU (CI online, May 2008). Thus, the number of containers needed to run a regular container service is about twice the joint TEU capacity of the vessels deployed in that liner service. For example, a container carrier operating a regular service between Europe and Asia with eight vessels of 10,000 TEU needs a box fleet of at least 160,000 TEU to support the service. Theofanis and Boile (2009) report that container shipping lines and other transport operators own about 59% of the total global container equipment fleet (compared to 53.6% in 2002), while leasing companies own the remaining 41%.

The large investments in assets and the fixed nature of the liner service schedules, even if the cargo volume is too low to fill the vessel, lie at the core of the risk profile in the container liner shipping industry. High commercial and operational risks are associated with the deployment of a fixed fleet capacity (at least in the short run) within a fixed schedule between a set of ports of call at both ends of a trade route. Unused capacity cannot be stored and used later. Once the large and expensive liner services are set up, the pressure is on to fill the ships with freight. When there is an oversupply of vessels in the market, high fixed costs and product perishability give shipping lines an incentive to fill vessels at a marginal cost-only approach, often leading to direct operational losses on the trades considered.

12.3.2 The drive towards scale enlargement in vessel size

Since the 1990s a great deal of attention has been devoted to larger, more fuel-efficient vessels (see for example Cullinane and Khanna 1999). The average vessel size increased from 1,155 TEU in 1987 to 1,581 TEU ten years later, 2,417 TEU in 2007 and 2,618 TEU in 2009 (UNCTAD 2009). The mid-1970s brought the first ships of over 2,000 TEU capacity. The Panamax vessel of 4,000 to 5,000 TEU was introduced in the early 1990s. In 1989 APL was the first shipping line to deploy a post-Panamax vessel. Maersk Line introduced the *Regina Maersk* (nominal capacity of 6,418 TEU but "stretchable" to about 8,000 TEU) in 1996. Ten years later the Emma Maersk of around 13,500 TEU capacity was the first vessel to move far beyond the 10,000 TEU mark. Given the relentless search for cost savings at sea (through economies of scale), many shipping lines' expansion plans are heavily focused towards large post-Panamax (5000+ TEU) container ships. Whereas 78 of such ships provided a total slot capacity of just 464,000 TEU at the beginning of 2000, these numbers already amounted to 504 units and 3.3 million TEU at the beginning of 2007 and 669 units and nearly 4.9 million TEU at the end of 2009 (Table 12.5). Whereas 5000+ TEU ships provided just 10% of the total cellular fleet capacity at the beginning of 2000, their share increased to 37.5% at the end of 2009. The total fleet in late 2009 counted 39 vessels in the range of 10,000–15,500 TEU, and another 168 vessels of above 10,000 TEU unit capacity were on order. The massive influx of new tonnage and the cascading-down effect triggered by the introduction of large post-Panamax ships on the arterial trade routes invoked a significant increase in average vessel sizes on the main trade routes. For example, the size of a typical container vessel deployed on the Far East–Europe trade increased from 4,500–5,500 TEU in 2000 to about 7,500 TEU in 2010.

Table 12.5 Composition of the cellular container ship fleet for selected dates

Size range (TEU)	*Order book Oct. 2009*		*Oct. 10, 2009*		*Jan. 1, 2007*		*Jan. 1, 2000*		*Jan. 1, 1995*	
	Number	*TEU*	*Number*	*TEU*	*Number*	*TEU*	*Number*	*TEU*	*Number*	*TEU*
>7500	258	2,914,640	267	2,418,951	147	1,250,003	10	80,822	0	0
5000–7499	116	760,150	402	2,439,772	357	2,070,373	68	383,415	0	0
4000–4999	194	869,607	588	2,656,079	346	1,529,854	156	682,428	79	345,351
3000–3999	45	156,020	325	1,106,690	282	956,165	227	770,410	164	541,516
2000–2999	60	156,166	717	1,819,329	648	1,630,850	389	960,443	255	637,502
1500–1999	56	98,357	568	962,082	466	786,591	327	552,003	198	339,511
1000–1499	71	84,439	698	824,213	595	705,600	484	565,073	367	433,533
500–999	65	52,511	837	616,408	722	525,853	539	381,630	336	239,439
100–499	0	0	313	101,472	387	122,944	422	132,484	343	107,046
Total	865	5,091,890	4,715	12,944,996	3,950	9,578,233	2,622	4,508,708	1,742	2,643,898
Average vessel size		5,887		2,745		2,425		1,720		1,518

Source: based on www.alphaliner.com/.

The focus of container carriers on vessel sizes did not lead to a more stable market environment. Consecutive rounds of scale enlargements in vessel size have reduced the slot costs in container trades, but carriers have not reaped the full benefits of economies of scale at sea (see for example Lim 1998). The large container vessels can be deployed efficiently on the major trade lanes, provided they are full. Many carriers have not been able to realize consistent high utilization of available slot capacity on their bigger vessels, which would have offset some of the scale advantages. Unpredictable business cycles and the seasonality on some of the major trade lanes (e.g. demand peak just before Chinese New Year) have more than once resulted in unstable cargo guarantees to shipping lines. Adding post-Panamax capacity gave a short-term competitive edge to the early mover, putting pressure on the followers in the market to upgrade their container fleet and avert a serious unit cost disadvantage. A boomerang effect eventually also hurt the carrier who started the vessel scaling up round.

The economic slowdown since late 2008 has had its consequences on vessel size. There is a common belief that the market will not see an increase in the maximum size of container vessel for at least the next five years. The Emma Maersk class and comparable vessel sizes of MSC (cf. the MSC Beatrice of around 14,000 TEU) are thus expected to form the upper limit in vessel size, at least for the coming years. The crisis has also urged shipping lines to rationalize services and to cascade larger vessels downstream to secondary trade routes. There is also a renewed interest in "baby post-Panamax" ships with unit capacities ranging from 5,000 to 7,500 TEU. These ships are more flexible, since they can be deployed in routes to emerging markets, where port systems typically face draught and berth limitations.

12.3.3 Operational strategies to absorb vessel overcapacity

The container shipping industry goes through consecutive cycles of vessel oversupply and capacity shortages. However, the periods with vessel overcapacity are generally much longer, as shipowners massively order new ships when demand is surging and the peak in demand is near. In recent years, fleet investments have been facilitated by the ease of getting ships financed, low interest rates and super-optimism about future demand. Overcapacity situations are often sustained as a result of a vicious circle which takes many years to dissolve. It is very difficult to absorb overcapacity, for several reasons. First of all, shipyards are not eager to give in to requests of shipowners to cancel orders or delay deliveries. Secondly, oversupply in the market results in a weak second-hand market for ships, low charter prices and low newbuilding prices. Third, shipowners are not eager to reduce capacity by scrapping vessels, as scrap prices are low in a weak market. The four main segments of the shipping sector (shipbuilding, charter market, second-hand market and the scrap market) thus actively reinforce the negative downward spiral.

Overall, crises and overcapacity situations in the container shipping industry are partly the result of exogenous factors, such as a decrease in demand, and partly the result of endogenous factors, such as wrong investment decisions by shipping lines. Many of the overcapacity problems are linked to the failure by the key stakeholders, in the first place the shipowners and providers of ship finance (many without a maritime background), to correctly anticipate the future markets for different ship types and sizes. This observation is in line with the views of Randers and Göluke (2007) on system dynamics in shipping markets. They argue that the turbulence in shipping markets is partly the consequence of the collective action of the members of the shipping community. In principle, one player can exploit the cyclicality for his or her own profit by selling vessels near the peak in freight rates or by not entering the shipping business during extremely good times. But in practice, a common market sentiment means that shipping lines seldom go anti-cyclical. The liner shipping community creates the cyclicality and adds significantly to the volatility of the business environment through investment and allocation decisions. If the container shipping community acted rationally on the available information (on ordering, scrapping, utilization and so on) and better anticipated fluctuations in demand, they could greatly reduce the violent volatility, at least if the regulatory powers would allow them to collect such information and use it. With the outlawing of liner conferences in Europe since October 2008, market-related information about capacity deployment, demand/supply dynamics and pricing of liner services has become more scarce.

The economic crisis which started in late 2008 provides a good example of the difficulties the container shipping industry has in adapting capacity to changing market conditions. Until early 2008, shipyards struggled to satisfy demand for new and bigger container ships. The economic crisis generated a large surplus of cargo capacities, particularly on the Europe–Asia and transpacific routes. World container shipping demand in TEU-mile fell by 12.4% in 2009. As shipyards were still completing the numerous orders from previous years, total slot capacities in the market would have continued climbing, with 15.6% in 2009, if no action had been taken to absorb some of that capacity (Table 12.6). In late 2008, a number of shipping lines started to postpone orders, and older ships were put out of service in large numbers. Since the late summer of 2008, shipyards have been renegotiating price and delivery dates, with various ship-

Table 12.6 Changes in fleet operations, TEU-mile supply

	2006 (%)	*2007 (%)*	*2008 (%)*	*2009 (est.) (%)*
Deliveries of new vessels	14.1	13.1	12.7	15.6
Delayed deliveries from previous years	–	–	–	1.2
Scrapping	–0.3	–0.2	–0.9	–2.0
Newbuilding delivery deferrals	1.0	–0.3	–1.2	–5.0
Newbuilding cancellations	–	–	–	–2.0
Lay–ups/service suspensions	–	–	–	–10.0
Slow-steaming/re-routing	–	–1.9	–5.6	–7.5
Effective supply growth	14.8	10.7	5.0	–9.7
Effective demand growth	12.4	11.3	–0.3	–12.4

Source: own compilation based on figures from Drewry and Goldman Sachs.

ping lines looking for delayed deliveries. The total number of cancellations of container ship orders amounted to 140 ships or 436,000 TEU between the start of the financial crisis in September 2008 and mid-February 2010 (Alphaliner 2010a). The order cancellations represent 6.7% of the container ship order book at October 1, 2008. A limited number of container ship orders were converted into other vessel types by their owners.

Shipping lines also tried to absorb overcapacity by laying up vessels. In mid-April 2009, the worldwide laid-up fleet totaled about 1.3 million TEU or 10.4% of the world container fleet and even reached more than 12% in the fall of 2009. Most of the idled ships were midsize vessels between 1000 and 3000 TEU capacity, while hardly any post-Panamax vessels were laid up. The idle container ship fleet decreased to 9.9% of the world fleet capacity in February 2010 (508 ships totaling 1.3 million TEU; Alphaliner 2010b).

Another measure taken to absorb overcapacity involves the suspension of liner services, particularly on the Far East–Europe and transpacific trade routes. Total capacity on the Far East–Europe trade fell by 21% between October 2008 and March 2009. This corresponded to a net withdrawal of 19 liner services on the trade, leaving only 45 services between Europe/Med and the Far East in March 2009 (figures www.alphaliner.com/). Maersk Line suspended several major loops, such as the AE5 and AE8 services. The New World Alliance took out 25% of its capacity, while the CKHY group decreased capacity by about 24%. Senator Lines ceased all its operations from February 2009.

Vessel lay-ups, order cancellations and service suspensions were not the only tools used by shipping lines in an attempt to absorb overcapacity, as suggested by Table 12.6. Many vessels continue to slow steam at around 18 to 19 knots as the longer roundtrip time helps to absorb surplus capacity in the market (because more vessels are needed per loop). Initially, shipping lines introduced slow steaming in 2007 to offset the rise in bunker costs (Notteboom and Vernimmen 2009), but the slow steaming option remained popular even after a steep decline in the bunker price from the peak of US$700 in July 2008 to a low of US$170 per ton in December 2009 (bunker price for IFO 380 grade in Rotterdam obtained from www.bunkerworld.com/). Alphaliner reported that during the second half of 2009, 42 liner services in the world (of which 13 were on the Northern Europe–Asia trade) switched to (super)slow steaming of 14 to 18 knots. In total, 47 additional container vessels between 3,000 and 13,000 TEU had to be deployed on these services in order to guarantee weekly calls in each of the visited ports. Slow steaming absorbed about 300,000 TEU of vessel capacity, or 2.3% of the world container fleet. The cost model used by Notteboom and Vernimmen (2009) shows that the cost savings linked to slow steaming on a liner service between Europe and Asia compensate for the cost increases linked to the deployment of an additional vessel to guarantee a weekly call in each port included in the service. Quite a number of shipping lines are now examining the possibilities of making cost savings by further slowing down ships to about half their usual speeds. A service speed of 14 knots is considered by some the possible future norm for container ships, in contrast to speeds of up to 22–3 knots before slow steaming was introduced. While some container carriers, such as Maersk Line and

CMA CGM, are moving to super slow steaming, others continue to run their services at full speed despite the high fuel price. Some shipowners who have managed to defer newbuilding deliveries are taking advantage of the extra time to modify designs and specify smaller, more fuel-efficient propulsion systems with lower service speeds. Many shipowners, however, are still reluctant to commit to smaller engines, as they fear that at some stage higher speeds will be viable again. Quite a number of shippers are concerned about the higher transit times brought about by slow steaming practices. If super slow steaming becomes the norm, shippers might have to redesign their supply chains to meet the new reality of longer transit times. The future might bring premium-priced high-speed services to carry time-sensitive cargo, but most ships would be operated at a much slower speed to save on bunkers, reduce emissions and absorb part of the overcapacity in the market.

The situation in the charter market is particularly interesting. In late 2009 container ship operators owned around 58% of the global vessel fleet, while the remainder was owned by financiers through chartering contracts (see Table 12.4). Given the current market situation, chartered-in vessels are returned when leases expire and, consequently, taken out of the market. The rental reversion rate for the chartered fleet currently stands at 20–2% of the global container ship market, based on an average tenure of 4.5 to 4.9 years. Given that half of the fleet is chartered in, as much as 1.37 million TEU of available capacity could in theory be removed from the network per annum. That would be about 10% of the entire fleet per annum, which could mitigate expected nominal supply growth in the years to come. However, a certain proportion of the charter expiries are renewed, with daily rates in late 2009 about 75% lower than the average level of 2008. It is also expected that many operators will return chartered fleet when the leases expire, because they have their own newly built deliveries coming to market. Consequently, redelivered vessels are likely to be laid up, since charter owners cannot effectively operate container ships without a network, unlike bulk carriers and tanker vessels. This will have a substantial impact on the balance sheet of those who have provided financing to these charter ships. Therefore, the market could see fewer container ships on trade routes, at least until rates rebound to profitable levels. This brings us to the pricing issue in the container shipping industry.

12.4 Pricing and the Risks Associated with Revenue Streams

12.4.1 The pricing problem in container shipping

The container shipping industry does not face challenges only in the area of capacity management. A combination of poorly differentiated rates (too many customers to negotiate a rate for every cargo) and inflexible capacity causes a pricing problem and explains existing freight rate volatility in the market. Shipping lines are not able to achieve rate stability, as they cannot adjust vessel capacity to meet short-run demand fluctuations (see discussion in the previous section). For most shipments freight accounts for only a very small portion of the shipment's total value, but as carriers cannot influence the size of the final market, they will try to increase their short-run market share by reducing prices. Thus, shipping lines may reduce freight rates without substantially affecting the underlying demand for container freight. The only additional demand can come from low-value products which will only be shipped overseas if freight rates are very low (e.g. waste paper and metal scrap). These "temporary" markets disappear again once the freight rate is above a threshold level that does not allow a profit on trading these products overseas.

The fairly inelastic nature of demand for shipping services constitutes the core problem for the financial performance of container shipping lines. Through their pricing strategies container lines only have a marginal impact on total trade volumes. In a market situation with vessel oversupply, processes of rate erosion unfold as shipping lines try to increase their market shares by lowering the freight rates, without substantially impacting the total demand. Such price competition continues till the freight stabilizes at a low level, just above the "refusal rate," i.e. the lowest rate at which the shipping line is prepared to operate its vessel rather than having it in lay-up. If the freight rate on a specific route fell below the refusal rate then many vessels would be laid up. The resulting reduction in vessel capacity would push rates back up to a level above the refusal rate. When demand starts to pick up, ships are taken out of lay-up. The freight rates move away from the refusal rate once all vessels are out of lay-up and all deployable capacity is operational in the market. It is only then that rates start to increase significantly. Rates will reach their highest level when the utilization of the fleet reaches its upper limits and not enough new capacity is added to the market. At that moment, container shipping lines massively order new vessel capacity, leading to a shockwave of new capacity being brought into the market one-and-a-half to two years later, typically pushing the shipping market back into a period of overcapacity and lower rates. These dynamics in the shipping market combined with the rather inelastic demand force shipping lines to an intense concentration on costs and to seeking negotiated long-term contracts with large shippers with a view to securing cargo. Even though lower rates may allow carriers to take on extra cargo, in most cases, where there remains capacity, they also reduce their profitability. In many cases, shipping lines can earn more money with higher rates and lower utilization than with lower rates and higher utilization.

Evidence on the pricing problem can be found in the way shipping lines reacted to the economic crisis which started to unfold in late 2008. The sudden decline in demand meant that spot container freight rates on many trade routes were reduced to very low levels in early 2009. The global freight rate index developed by Drewry fell from US$2,727 per FEU in July 2008 to US$1,536 per FEU in May 2009. For cargo flows from Asia to Europe the index plunged from US$3,169 per FEU in July 2008 to a low point of US$1,071 in March 2010. Rates bottomed out in February / March 2009 as they could not go much lower. In the second quarter of 2009, vessel capacity reductions on the major trade lanes started to have a positive effect on rates. In April 2009, NOL started to charge US$250 more for a TEU from Asia to Europe. Maersk Line increased its rates for all cargo in the Asia to Europe trade (e.g. +US$250 per TEU/main port, effective 1 April 2009, and +US$300 per TEU/main port, effective 1 July 2009). Also,

Table 12.7 Financial results for a number of major container shipping lines

Shipping line	*Operating losses in H1 2009 (US$ million)*	*Percentage rate shortfall in H1 2009*[a]
Maersk Line	829	8
China Shipping	475	37
COSCO	630	38
Hapag-Lloyd	618	19
OOCL	197	10
NOL/APL	379	15
Hanjin	342	17
ZIM Line	380	33

[a] Shortfall as percentage of average rate (EBIT/Revenue).
Source: own compilation based on Marsoft (2009).

CMA CGM carried through a rate restoration strategy on its main trades for the second quarter of 2009 (westbound: + US$350 per TEU; eastbound: + US$100 per TEU). The increases were a signal that the liner shipping industry was slowly adapting to the volume adjustments. Still, the low rates in early 2009 caused many leading container shipping lines to incur high losses in 2009 (Table 12.7). In the first half of 2009, liner revenues averaged 20% below operating breakeven. In comparison, Goldman Sachs (2009) reports long-term average EBIT margins of +11.8% in the period 1995–2008. Some shipping lines were initially still going fairly strong, especially those with a global coverage of services, such as MSC and CMA CGM. It seems that volumes on other routes, such as South America and Africa, were helping these lines to secure a leadership position in the Asian shipping market. However, the accumulated losses incurred in late 2008 and 2009 started to have their full effect in the autumn of 2009. In early October 2009, CMA CGM had to seek a restructuring of a US$5 billion debt in order to stay afloat. ZIM Line, CSAV and Hapag-Lloyd have entered into far-reaching restructuring programs, and Maersk Line and MSC also faced financial problems.

All-in ocean freight rates continued to climb throughout the rest of 2009 and early 2010. Drewry's global freight rate index increased by 18% between July and September 2009 and by another 6% between September and November. Together with spot rates, contract container freight rates increased significantly, as shippers went into negotiations at a time, in early 2010, when spot freight rates were consistently higher than the year before on most trade routes. Despite increases in freight rates, there is still quite a lot of volatility and vulnerability in the rate restoration process as many vessels are still laid up (see discussion in the previous section), which represents a large latent vessel capacity that could be made operational in a time span of one to six months.

Another aspect of the pricing problem relates to the existence of large cargo imbalances on a number of trade routes. In recent years, the flow of full containers between Asia and the USA has been about three times higher than the trade flows in the opposite shipping direction (Figure 12.2). The imbalance in cargo flows on the Europe–Asia route is evolving in a similar way, thereby escalating the associated volume of empty containers to be repositioned from consumption to production regions (see Theofanis and Boilé 2009 for an in-depth discussion). The existing imbalances between westbound and eastbound trade flows or between northbound and southbound container volumes spurred container shipping lines to generate the

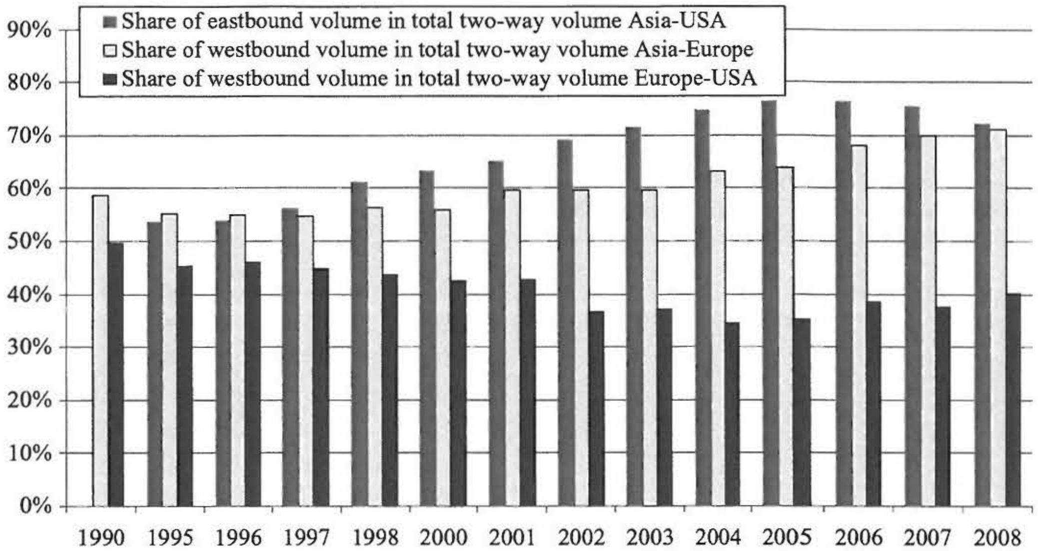

Figure 12.2 Traffic imbalances on the main routes, based on volumes in TEU (full containers).
Source: own elaboration based on data in various reports of Drewry and UNCTAD, *Review of Maritime Transport.*

bulk of their revenues on the full leg, leading to large differences in freight rates between sailing directions. Shipping lines have developed a range of organizational strategies to reposition their empty containers (Lopez 2003), for example the spot organization of the repositioning flows, and the adoption of different renewable contracts to frame the externalization of the repositioning problem, often using leasing companies to absorb some of the associated risks. The trade imbalance and container repositioning issues also affect shippers in their ability to access equipment. In order to guarantee space, shippers may double-book their container loads, which leads to missed bookings for shipping lines. Container liner companies have reacted by imposing additional surcharges in the form of "no-show" fees.

12.4.2 The economics of additional price items and surcharges

The container shipping industry is characterized by specific and complex pricing practices, partly to seek protection from freight rate instability. Base freight rates or Freight All Kinds (FAK) rates are applicable in most trades. These freight rates are lump sum rates for a container on a specific origin–destination relation irrespective of its contents and irrespective of the quantity of cargo stuffed into the box by the shipper himself. On top of these base freight rates, liner companies charge separately for additional items. The most common surcharges include fuel surcharges (Bunker Adjustment Factor or BAF), surcharges related to the exchange rate risk (Currency Adjustment Factor or CAF), port congestion surcharges, terminal handling charges (THCs) and various container-equipment related surcharges (e.g. demurrage, detention, and equipment handover charges, equipment imbalance surcharge, and charges for the special equipment needed for handling open-top containers, heavy lift, etc.). Table 12.8 provides an empirical example of the relative importance of the base freight rate compared to the total out-of-pocket costs and time costs for a shipment from Shanghai to Brussels.

Fuel surcharges are aimed at passing (part of) the fuel costs on to the customer through variable charges. The use of fuel surcharges has always been a source of contention in shipping circles, particularly in times of high fuel prices. Shippers' organizations argue that the way fuel surcharges are determined is opaque, without uniformity, and involves a significant element of revenue making. In contrast, shipping lines underline that the increase in bunker prices, especially in the short term, is only partially compensated through surcharges to the freight rates and that it still affects their earnings negatively. Empirical research by Notteboom and Cariou (2011) related to data for mid-2008 and early 2009 and by Meyrick and Associates (2008) shows that fuel surcharges are mainly used by shipping lines for revenue-making purposes and go beyond mere cost recovery. The analysis of Cariou and Wolff (2006) of the causal relationship between the fuel surcharges imposed by members of the Far Eastern Freight Conference and bunker prices on the Europe–Far East container trade concluded that from 2000 to 2004 a causality can be established and that an increase in fuel price by 1 would lead to an increase in the Bunker Adjustment Factor by 1.5. Time lags can be observed between changes in the bunker price and corresponding changes in fuel surcharges. For example, the economic slowdown since late 2008 initially put a strong downward pressure on the fuel price with a positive impact on vessel operating costs. A number of shipping lines kept the fuel surcharges artificially high for some time to generate some revenue out of the container business. But in early 2009 lines started to quote all-in prices rather than split ocean rates from currency, bunker and terminal handling surcharges.

The Currency Adjustment Factor (CAF) is typically expressed as a percentage of the basic freight rate. This surcharge ensures that shipping lines enjoy a more or less stable income in the currency of their own country.

Terminal Handling Charges (THCs) are a tariff charged by the shipping line to the shipper which is intended to cover (part or all of) the terminal handling costs, and which the shipping line pays to the terminal operator (Dynamar 2003). THCs vary within a port by trade route and are a negotiable item for large customers. The origin of THCs is to be found in the development of a common formula in 1989 by the Council of European and Japanese National Shipping Association (CENSA). The basic principle was to distribute all cost components of the terminal handling operation on an 80/20 basis, with the shipping lines being responsible for the 20 percent. The use of THCs is widely accepted in Europe and North America, and THCs are also found in ports in the Far East (China and Vietnam) and Israel. In many countries, though (including Indonesia, Malaysia and Hong Kong), a resistance exists against the level and/or the application of THCs. Shippers' councils and individual shippers argue that THCs are used as a source of income rather

Table 12.8 Breakdown of transport costs Shanghai–Brussels for a 40-foot container with a cargo load value of 85,000 euro (market prices of February 2007)

	Shanghai–Brussels
Value container content (euro)	85000
Time variables	**Days**
Transit time to Shanghai (by barge)	0
Dwell time Shanghai	3
Transit time Shanghai–Antwerp	28
Dwell time Antwerp	5
End-haulage (including pickup and delivery)	0.5
Total transit time	**36.5**
Transport and handling costs	**Euro**
Pre-haulage Shanghai (by barge)	0
Typical freight rate Shanghai–Antwerp	1641
THC Shanghai	56
THC Antwerp (per container)	112
BAF	367
CAF	141
ISPS surcharge Antwerp (per container)	15
Delivery order (20 euro/BL)	20
Customs clearance fee (IM4)	75
Administration fee (25 euro/BL)	25
Dwell time charges Antwerp – import containers	0
End-haulage by truck (including handling): Antwerp–Brussels (60 km)	215
Total transport and handling costs	**2667**
Time costs goods	**Euro**
Opportunity cost capital (6% per year)	510
Depreciation cost (economic/technical – 10% per year)	850
Damage and loss costs (5% per year)	425
Insurance (2% per year)	170
Leasing costs container (0.65 euro/day)	24
Total time costs goods	**1979**
Total costs	**4645**
% of value of goods	**5.5**

Source: own elaboration based on data of an Antwerp-based freight forwarding company.

than cost recovery and that they were only introduced to compensate for declining rates. Shipping lines underline that THCs are certainly not a profit centre and that THC levels have not been increased for years, despite inflation. In a recent study, the European Commission (2009) analyzed the impact of the end of the liner conference block exemption on the THCs applied by all container carriers in most ports. The study revealed that THCs are an insignificant part of the pricing mix when freight rates are high, but during a freight rate collapse, as in early 2009, they constitute a much higher percentage of the total port-to-port price. After the abolition of liner conferences in Europe, THCs were simplified and restructured on a country basis rather than a port basis. Similarly to how they deal with fuel surcharges, individual shipping companies follow different approaches on what they include in THCs.

Freight rates can vary greatly depending on the economic characteristics (e.g. cargo availability, imbalances, competitive situation among shipping lines) and technological characteristics (e.g. maximum allowable vessel size) of the trade route concerned. Figure 12.3 gives an example of applicable freight rates (including fuel surcharges and CAF) for the shipment of an FEU from a major North European container port to a large number of overseas destinations. It can be concluded that there is no straightforward relation between price and sailing distance. Many destinations in West Africa and East Africa are relatively expensive given the market risks involved (cargo availability and port congestion), the imbalance in container flows (southbound volumes are much higher than northbound traffic), the market structure, which has relatively few suppliers of regular container services, and the limitations in terms of vessel scale. Rates to the Far East were very low in comparison, because of the scale economies in vessels deployed, the imbalance between westbound and eastbound trade flows

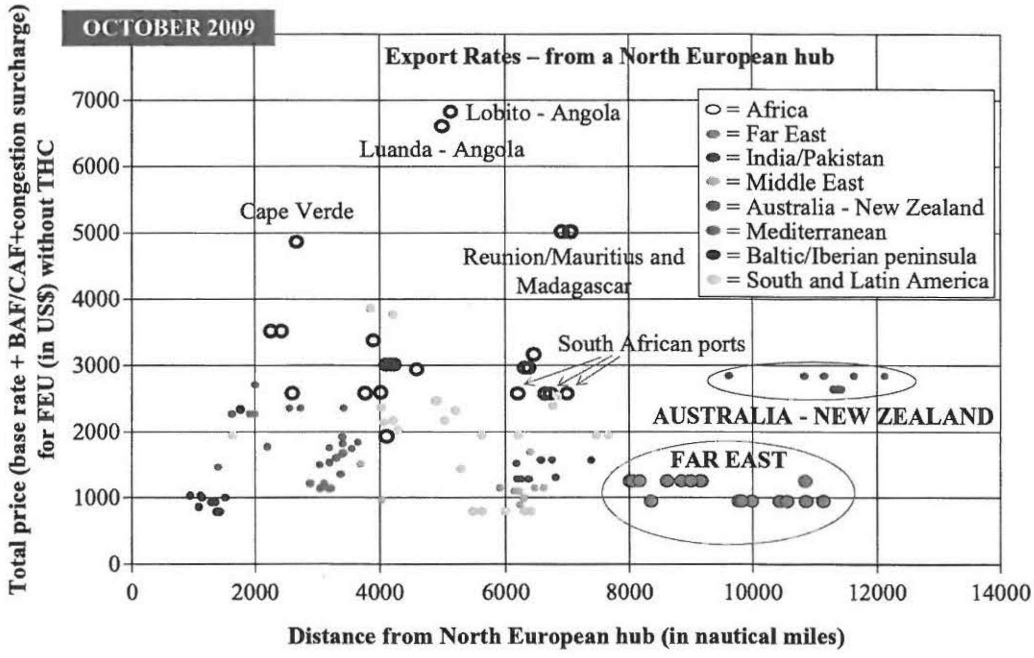

Figure 12.3 Container rates (including BAF and CAF) from a North European container port to a series of overseas destinations, in October 2009, in US$.
Source: own elaboration based on company data.

which makes it very cheap to ship cargo to Asia, and the large number of competing firms on this route.

12.5 In Search of Scale and Scope

12.5.1 Scale increases via operational agreements and mergers and acquisitions

Shipping lines are viewing market mass as one of the most effective ways of coping with a trade environment that is characterized by intense pricing pressure. Operational cooperation between container shipping companies comes in many forms, ranging from slot-chartering and vessel-sharing agreements to strategic alliances. The container shipping industry has also been marked by several waves of mergers and acquisitions (M&A). Trade agreements in the form of liner conferences were very common till these forms of cooperation were outlawed by the European Commission in October 2008.

The first strategic alliances between shipping lines date back to the mid-1990s, a period that coincided with the introduction of the first 6000+ TEU vessels on the Europe–Far East trade. In 1997, about 70 percent of the services on the main east–west trades were supplied by the four main strategic alliances. The main incentives for shipping lines to engage in strategic alliances relate to the need for critical mass in the scale of operation and to the need to spread the risks associated with investments in large post-Panamax vessels (Ryoo and Thanopoulou 1999; Slack, Comtois and McCalla 2002). The alliance partnerships evolved as a result of mergers and acquisitions and the market entry and exit of liner shipping companies (Figure 12.4). Strategic alliances provide their members easy access to more loops or services with relatively low cost implications and allow them to share terminals and to cooperate in many areas at sea and ashore, thereby achieving costs savings in the end. Parola and Musso (2007) rightly point out that an individual company will not opt for alliance membership once it reaches a scale that allows it, by itself, to benefit from the same economies of scale and scope that strategic alliances offer. A number of shipping lines stay out of alliances for reasons of commercial independence and flexibility (e.g. Evergreen). McLellan (2006) argues that the formerly strong ties between members of strategic alliances are getting looser. Alliance members engage increasingly in vessel-sharing agreements with outside carriers. Individual shipping lines show an increased level of pragmatism when setting up partnerships with other carriers on specific trade routes.

The shipping business has been subject to several waves of mergers and acquisitions. Yap (2010) reports that the number of acquisitions rose from three in 1993 to thirteen in 1998 before peaking at eighteen in 2006. The main M&A events include the merger between P&O Container Line and Nedlloyd in 1997, the merger between CMA and CGM in 1999 and the take-over by Maersk of Sea-Land in 1999 and P&O Nedlloyd in 2005. Shipping lines opt for mergers and acquisitions in order to obtain a larger size, to secure growth and to benefit from scale advantages. Other motives for mergers and acquisitions in liner shipping relate to gaining instant access to markets and distribution networks, obtaining access

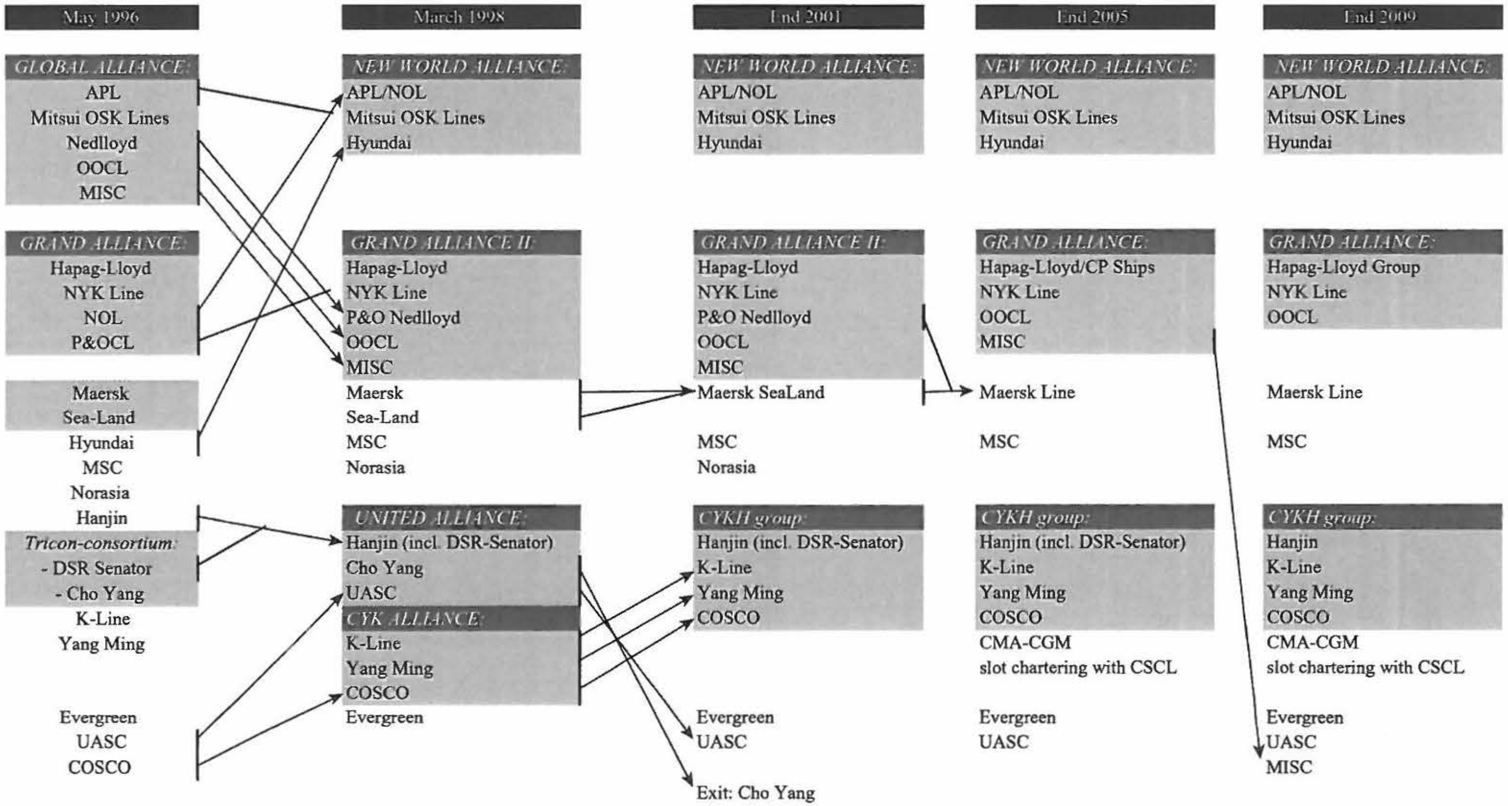

Figure 12.4 Evolution in strategic alliance configuration in liner shipping.
Source: updated from Notteboom (2004).

to new technologies or diversifying the asset base. Acquisitions typically feature some pitfalls, certainly in the highly international maritime industry: cultural differences, overestimated synergies and high expenses with respect to the integration of departments. Still, acquisitions make sense in liner shipping as the maritime industry is mature and the barriers to entry are relatively high (because of the investment volumes required and the need to develop a customer base). Through a series of major acquisitions (besides Sea-Land and P&O Nedlloyd there was Safmarine in 1999), Maersk Line was able to increase its market share substantially and to make strategic adjustments to secure its competitive advantage on key trade routes. Fusillo (2002) argued that a large fleet capacity enabled Maersk Line to use excess capacity as a form of entry deterrence by saturating the market and reducing profit opportunities for competing carriers. In contrast to Maersk Line, MSC reached the number two position in the world ranking of container lines by organic or internal growth. MSC was only involved in two minor take-overs: Kenya National in 1997 and Lauro in 1989.

The liner shipping industry has witnessed a concentration trend in slot capacity control, mainly as a result of M&A activity (Table 12.9). The top twenty carriers controlled about 83% of the world's container vessel capacity in late 2009, compared to 56% in 1990 and 26% in 1980. The top three lines (Maersk Line, MSC and CMA-CGM) alone supplied about a third of the global fleet capacity. These carriers generally operated as independent entities (Slack and Frémont 2009) instead of engaging in various forms of cooperation such as strategic alliances. In particular, the mainline vessels of these carriers are supported by a network of feeder ships and dedicated container-handling facilities and a truly global service coverage. Sys (2010) used a range of concentration measures to examine the oligopolistic nature of the container shipping industry. The results show that the industry is confronted with increased concentration and has shifted from a formally collusive market towards a tacitly collusive market. The degree of oligopoly formation is strongly dependent on the trade lane. Fusillo (2006) noted that the size distribution of liner shipping companies is increasingly skewed to the right, which would imply that large companies capture efficiencies not attainable by smaller shipping lines, enabling them to become even larger. It also indicates that individual firm cost structures in the industry are heterogeneous; the larger firms benefit from the most competitive cost structures through scale economies in vessel size and lower port costs per unit handled through their large bargaining power vis-à-vis terminal operators and port authorities.

The economic crisis of late 2008 had an impact on the market structure. While there was no major M&A activity in liner shipping between October 2008 and early 2010, a wave of acquisitions and mergers appears inevitable in the medium term. CMA CGM and Maersk Line set up a new vessel-sharing agreement on the Asia–Europe trade. This can be considered a first step towards a capacity consolidation on the trade. The driving forces for a further consolidation in the liner business relate to the poor financial results of shipping lines, which could see some shipping lines default, and to the objective of many shipping lines to push down costs by increasing the scale of operations. The crisis seems to have increased the diversity among the shipping

Table 12.9 Slot capacities of the fleets operated by the top twenty container lines (in TEU)

	January 1980		*September 1995*		*January 2000*		*November 2005*		*March 2007*		*February 2010*	
1	Sea-Land	70,000	Sea-Land	196,708	A.P. Moller–Maersk	620,324	Maersk Line	1,620,587	Maersk Line	1,758,857	Maersk Line	2,061,607
2	Hapag-Lloyd	41,000	Maersk	186,040	Evergreen	317,292	MSC	733,471	MSC	1,081,005	MSC	1,536,244
3	OCL	31,400	Evergreen	181,982	P&O Nedlloyd	280,794	CMA/CGM Group	485,250	CMA CGM Group	746,185	CMA CGM Group	1,042,308
4	Maersk	25,600	COSCO	169,795	Hanjin/DSR Senator	244,636	Evergreen Group	458,490	Evergreen Group	566,271	Evergreen Group	554,316
5	NYK Line	24,000	NYK Line	137,018	MSC	224,620	Hapag Lloyd/CP Ships	413,281	Hapag-Lloyd	467,030	APL	548,788
6	Evergreen	23,600	Nedlloyd	119,599	NOL/APL	207,992	China Shipping	334,337	CSCL	417,337	Hapag-Lloyd	495,894
7	OOCL	22,800	Mitsui OSK Lines	118,208	COSCO	198,841	NOL/APL	331,639	COSCO	391,527	COSCO	453,922
8	ZIM	21,100	P&OCL	98,893	NYK Line	166,206	Hanjin/Senator	315,153	NYK	353,832	CSCL	438,176
9	US Line	20,900	Hanjin Shipping	92,332	CP Ships–Americana	141,419	COSCO	311,644	Hanjin/Senator	345,037	Hanjin Shipping	428,436
10	APL	20,000	MSC	88,955	ZIM	136,075	NYK Line	303,799	APL	342,899	NYK	407,300
11	Mitsui OSK Lines	19,800	APL	81,547	Mitsui OSK Lines	132,618	OOCL	236,789	OOCL	303,864	CSAV Group	348,746

12	Farrell Lines	16,400	ZIM	79,738	CMA/CGM	122,848	CSAV Group	230,699	K-Line	283,076	OOCL	342,512
13	NOL	14,800	K-Line	75,528	K-Line	112,884	K Line	228,612	MOL	281,447	MOL	336,971
14	Trans Freight Line	13,900	DSR-Senator	75,497	Hapag-Lloyd	102,769	Mitsui OSK Lines	220,122	Yang Ming Line	253,104	K Line	325,071
15	CGM	12,700	Hapag-Lloyd	71,688	Hyundai	102,314	ZIM	201,263	CSAV Group	250,436	ZIM	310,568
16	Yang Ming	12,700	NOL	63,469	OOCL	101,044	Yang Ming	185,639	ZIM	248,922	Yang Ming Line	308,664
17	Nedlloyd	11,700	Yang Ming	60,034	Yang Ming	93,348	Hamburg-Süd	185,355	Hamburg-Süd Group	222,907	Hamburg-Süd Group	302,056
18	Columbus Line	11,200	Hyundai	59,195	China Shipping	86,335	Hyundai	148,681	HMM	168,966	Hyundai M.M.	283,550
19	Safmarine	11,100	OOCL	55,811	UASC	74,989	Pacific Int'l Lines	134,292	PIL	146,174	UASC	202,099
20	Ben Line	10,300	CMA	46,026	Wan Hai	70,755	Wan Hai Lines	106,505	Wan Hai Lines	116,439	PIL	189,281
Slop capacity of top 20		435,000		2,058,063		3,538,103		7,185,608		8,745,315		10,916,509
C4-index (%)		38.6		35.7		41.4		45.9		47.5		47.6
Share of top 5 in top 20 (%)		44.1		42.3		47.7		56.3		57.6		57.2
Share of top 10 in top 20 (%)		69.1		67.5		71.7		73.9		74.0		73.0

Source: compiled from BRS Alphaliner, ASX Alphaliner and *Containerisation International.*

lines' long-term strategies. MSC, Evergreen and Hapag-Lloyd are among the shipping lines concentrating on the core business of liner shipping. The concept is to invest capital in liner shipping and to demand a return on that capital. While MSC and Evergreen are also present in the terminal business and have some presence in inland logistics, Hapag-Lloyd limits itself to operating ships. APL and OOCL on the other hand are trying to reinvent themselves as logistics service providers competing directly with established logistics service providers such as Kuehne & Nagel and DHL. They have become logistics providers by cutting their sea freight prices, but it allows them to control the cargo for the line. Japanese and Korean lines increasingly rely on their role within large shipping conglomerates. For example, NYK and MOL have only 40 percent of their business in liner shipping. By being involved in many sectors, these conglomerates spread risk. Finally, the A.P. Moller group (of which Maersk Line is a subsidiary) and CMA CGM continue to rely heavily on vertical integration; they have involvements in container shipping, terminal operations and inland logistics. The A.P. Moller group in particular has gone beyond container logistics and has involvements in supermarkets and the oil business.

12.5.2 Extending the scope of operations

The operating scale of the top-tier shipping lines gives them enormous bargaining power vis-à-vis terminal operators. Over the past decades, the largest container lines have shown a keen interest in developing dedicated terminal capacity in an effort to better control costs and operational performance, and as a measure to remedy against poor vessel schedule integrity (see Notteboom 2006 and Vernimmen, Dullaert and Engelen 2007 for a discussion of schedule unreliability). Maersk Line's parent company, A.P. Moller–Maersk, operates a large number of container terminals in Europe (and abroad) through its subsidiary APM Terminals. CMA CGM, MSC, Evergreen, Cosco and Hanjin are among the shipping lines that fully or partly control terminal capacity around the world. Global terminal operators such as Hutchison Port Holdings, PSA and DP World are increasingly hedging the risks by setting up dedicated terminal joint ventures in cooperation with shipping lines and strategic alliances. Terminal operators also seek long-term contracts with shipping lines using gain sharing clauses. The above developments have given rise to a growing complexity in terminal ownership structures and partnership arrangements.

The scope extension of a number of shipping lines goes beyond terminal operations to include inland transport and logistics (see for example Cariou 2001; Frémont and Soppé 2007; Graham 1998). The deployment of larger vessels, the formation of strategic alliances and waves of M&A have resulted in lower costs at sea, shifting the cost burden to landside operations. Notteboom (2009) estimated that the cost per FEU-km for a post-Panamax vessel between Shanghai and Europe amounts to €0.12, while inland haulage from North European ports usually ranges from €1.5 to €4 per FEU-km for trucks and €0.5 to €1.5 euro per FEU-km for barges (excluding handling costs and pre- and end-haul by truck). The observed price difference per FEU-km makes clear that cost savings in land operations potentially have a large impact on total transport costs. Shipping lines develop door-to-door services based on the principle of carrier haulage in an attempt to get a stronger grip on the routing of inland container flows. Carrier haulage is said to have a positive influence on the modal split in port-based inland transportation, as it provides shipping lines with a better overview of the flows so that intermodal bundling options come into play. If the inland leg is based on merchant haulage then the carrier often loses control of and information on its boxes.

A number of shipping lines try to enhance network integration through structural or *ad hoc* coordination with independent inland transport operators and logistics service providers. They do not own inland transport equipment. Instead they tend to use trustworthy independent inland operators' services on a (long-term) contract basis. Other shipping lines combine a strategy of selective investments in key supporting activities (e.g. agency services or distribution centers) with subcontracting of less critical services. With only a few exceptions, the management of pure logistics services is done by subsidiaries that share the same mother company as the shipping line but operate independently of liner shipping operations, and as such also ship cargo on competitor lines (Heaver 2002). A last group of shipping lines is increasingly active in the management of hinterland flows. The focus is now on the efficient synchronization of inland distribution capacities with port capacities.

Shipping lines can offer their own rail, barge and truck services through subsidiary companies or through strategic partnerships with major third-party operators. Maersk Line is actively involved in rail services through its sister company European Rail Services (ERS). Since 2001, CMA CGM has operated container shuttle trains in France, Benelux and Germany through its subsidiary Rail Link. The large majority of shipping lines, however, buy slot capacity from third-party rail operators. Only a few container lines offer their own inland barge services (e.g. CMA CGM via River Shuttle Containers in Europe). Shipping lines are exploring ways to integrate deep-sea operations and inland depots. Following the extended gate principle as described in Rodrigue and Notteboom (2009b), a number of shipping lines push export containers from an inland location to the ocean terminal, initiated by the shipping line, yet prioritized according to available inland transport capacity and the ETA of the mother vessel. A similar concept can be applied to push import containers from the deep-sea terminal to an inland location, from where final delivery to the receiver will be initiated at a later stage.

Shipping lines face significant challenges if they wish to further optimize inland logistics. Competition with the merchant haulage option remains fierce. Customers often consider land transport part of the "normal" service provision of a shipping line, for which no additional financial remuneration is required. Shipping lines are also challenged to monitor container flows with a view to managing the empty repositioning problem from the global to the local level. The logistics requirements of customers (e.g. late bookings, peaks in equipment demand) typically lead to money-wasting peaks in inland logistics costs. Given the mounting challenges in inland logistics, shipping lines that do succeed in achieving a better management of inland logistics can secure an important cost advantage over their rivals.

12.6 Dynamics in Container Shipping Networks

Liner shipping networks are developed to meet the growing demand in global supply chains in terms of frequency, direct accessibility and transit times. Shippers demand direct services between their preferred ports of loading and discharge. The demand side thus exerts a strong pressure on the service schedules, port rotations and feeder linkages. Shipping lines, however, have to design their liner services and networks to optimize ship utilization and benefit the most from scale economies in vessel size. Their objective is to optimize their shipping networks by rationalizing coverage of ports, shipping routes and transit time (Lirn, Thanopoulou, Beynon and Beresford 2004; Zohil and Prijon 1999). Shipping lines may direct flows along paths that are optimal for the system, the lowest cost for the entire network being achieved by indirect routing via hubs and the amalgamation of flows. However, the more efficient the network from the carrier's point of view, the less convenient that network could be for shippers' needs (Notteboom 2006). When designing their networks, shipping lines thus implicitly have to make a trade-off between the requirements of the customers and operational cost considerations. A higher demand for service segmentation adds to the growing complexity of the networks.

As a result, liner shipping networks feature a great diversity in types of liner services and a great complexity in the way end-to-end services, line-bundling services and pendulum services are connected to form extensive shipping networks. Maersk Line, MSC and CMA-CGM operate truly global liner service networks, with a strong presence also on secondary routes. Maersk Line, especially, has created a balanced global coverage of liner services. The networks of CMA-CGM and MSC differ from the general scheme of traffic circulation by incorporating a network of specific hubs (many of these are not among the world's biggest container ports) and a more selective serving of secondary markets such as Africa (where MSC has a strong presence), the Caribbean and the East Mediterranean. Notwithstanding the demand pull for global services, a large number of individual carriers remain regionally based. Asian carriers such as APL, Hanjin, NYK, China Shipping and HMM mainly focus on intra-Asian trade, transpacific trade and the Europe–Far East route, partly because of their huge dependence on export flows generated by their Asian home bases. MOL and Evergreen are among the few exceptions frequenting secondary routes such as Africa and South America. Profound differences exist in service network design among shipping lines. Some carriers have clearly opted for a truly global coverage; others are somewhat stuck in a triad-based service network forcing them to develop a strong focus on cost bases.

Most liner services are line-bundling itineraries connecting two to five ports of call scheduled in each of the main markets. The establishment of global networks has given rise to hub port development at the crossing points of trade lanes. Intermediate hubs have emerged since the mid-1990s within many global port systems: Freeport (Bahamas), Salalah (Oman), Tanjung Pelepas (Malaysia), and Gioia Tauro, Algeciras, Taranto, Cagliari, Damietta and Malta in the Mediterranean, to name but a few. The role of intermediate hubs in maritime hub-and-spoke systems has been extensively discussed (see for instance Baird 2006; Fagerholt 2004; Guy 2003; McCalla, Slack and Comtois 2005). The hubs have a range of common characteristics in terms of nautical accessibility, proximity to main shipping lanes, and ownership, in whole or in part, by carriers or multinational terminal operators. Most of these intermediate hubs are located along the global beltway or equatorial round-the-world route (i.e. the Caribbean, Southeast and East Asia, the Middle East and the Mediterranean). These nodes multiply shipping options and improve connectivity within the network through their pivotal role in regional hub-and-spoke networks and in cargo relay and interlining operations between the carriers' east–west services and other inter- and intra-regional services. Container ports in Northern Europe, North America and mainland China mainly act as gateways to the respective hinterlands.

Two developments undermine the position of pure transshipment hubs (Rodrigue and Notteboom 2010). First of all, the insertion of hubs often represents a temporary phase in connecting a region to global shipping networks. Once traffic volumes for the gateway ports are sufficient, hubs are bypassed and become redundant (see also Wilmsmeier and Notteboom 2010). Secondly, transshipment cargo can easily be moved to new hub terminals that emerge along the long-distance shipping lanes. The combination of these factors means that seaports which are able to combine a transshipment function with gateway cargo obtain a less vulnerable and thus more sustainable position in shipping networks.

In channeling gateway and transshipment flows through their shipping networks, container carriers aim for control over key terminals in the network (see discussion earlier in this chapter). Decisions on the desired port hierarchy are guided by strategic, commercial and operational considerations. Shipping lines rarely opt for the same port hierarchy, in the sense that a terminal can be a regional hub for one shipping line and a secondary feeder port for another operator.

While some expect a further concentration of cargo and ships on equatorial round-the-world services (linked to the expansion of the Panama Canal), the global shipping landscape exhibits an increasing complexity linked to a hierarchical set of networks reflecting differing cost/efficiency levels in the market. At one end of the spectrum, we find high-order service networks featuring slow-steaming large vessels, few ports of call and a strong port hierarchy within multi-layered feeder subsystems that involve north–south and regional routes. Different services dovetail to provide smooth connections and operations at the main hubs which are under the control of the carrier. At the other extreme lower-order networks support an increasing segmentation in liner service networks.

12.7 Summary

The highly dynamic container shipping industry is one of the youngest market segments in shipping. The establishment of world-embracing liner shipping networks has facilitated globalization processes and associated global production and logistics practices. At the same time, the economic and logistic actors exert an ever-larger demand pull on the capacity, connectivity, coverage and reliability of the liner shipping networks. Container carriers operate in a market characterized by moderate-to-strong growth (at least till 2009) with Asian economies representing an ever-larger share in the global container volumes. Still, the financial performance of many container shipping lines is rather poor compared to other logistics market players. The core of the problem lies in a combination of the capital-intensive operations and high risks associated with the revenues due to a combination of volatile markets and inflexible capacity in the short run. On top of this, the pricing strategies of container lines have only a marginal impact on total trade volumes. The specificities of the market have urged shipping lines to develop capacity management strategies aimed at reducing the cost per TEU carried, but also to develop vertical integration strategies with a view to extending their control over the inland segment. Larger companies have expanded their control of the market.

Exogenous shocks in demand in combination with the endogenous vessel order strategies of shipping lines mean that the container shipping industry regularly faces long periods of vessel oversupply and rate erosion. Capacity management proves to be a very difficult issue in periods of shrinking demand, as the carriers which decide to cut capacity might see other shipping lines free-riding on the resulting rate restoration. The economic crisis challenges shipping lines to carry out a comprehensive review of their business models. Recent declines in global trade and container flows were unprecedented. Shipping lines incurred massive losses and have no other option than to seek recovery in total revenue streams up to a level where carriers may achieve mid-cycle margins and returns. Rate restoration will remain vulnerable as long as deferred deliveries and idle ships are not fully absorbed by growth in demand. The shipping industry not only needs to find a solution to bridge the current situation, but should also develop appropriate strategies to cope with different potential scenarios.

References

Alphaliner (2010a) Weekly Newsletter 2010(8).

Alphaliner (2010b) Weekly Newsletter 2010(7).

Baird, A. (2006) Optimising the container transshipment hub location in northern Europe. *Journal of Transport Geography* 14(3): 195–214.

Brooks, M. (2000) *Sea Change in Liner Shipping: Regulation and Managerial Decision-Making in a Global Industry*. Oxford: Pergamon.

Cariou, P. (2001) Vertical integration within the logistic chain: does regulation play rational? The case for dedicated container terminals. *Trasporti Europei* 7: 37–41.

Cariou, P. and F.-C. Wolff (2006) An analysis of Bunker Adjustment Factor and freight rates in the Europe/Far East market 2000–2004. *Maritime Economics and Logistics* 8(2): 187–201.

Cullinane, K. and M. Khanna (1999) Economies of scale in large container ships. *Journal of Transport Economics and Policy* 33(2): 185–208.

Drewry (2006) The Drewry Container Market Quarterly.

Dynamar (2003) Terminal handling charges: a bone of contention. Dynamar report, Alkmaar.

European Commission (2009) Terminal handling charges during and after the liner conference era. Competition Reports, European Commission, Brussels.

Fagerholt, K. (2004) Designing optimal routes in a liner shipping problem. *Maritime Policy and Management* 31(4): 259–68.

Frémont, A. and M. Soppé (2007) Northern European range: shipping line concentration and port hierarchy. In J. Wang, T. Notteboom, D. Olivier and B. Slack (eds.), *Ports, Cities, and*

Global Supply Chains, pp. 105–20. Aldershot, Hants: Ashgate.

Fusillo, M. (2002) Excess capacity and entry deterrence: the case of ocean liner shipping markets. *Maritime Economics and Logistics* 5(2): 100–15.

Fusillo, M. (2006) Some notes on structure and stability in liner shipping. *Maritime Policy and Management* 33(5): 463–75.

Goldman Sachs (2009) Containerships: big bounce off the bottom. What next? Goldman Sachs Asia, Singapore.

Graham, M. G. (1998) Stability and competition in intermodal container shipping: finding a balance. *Maritime Policy and Management* 25: 129–47.

Guy, E. (2003) Shipping line networks and the integration of South America trades. *Maritime Policy and Management* 30(3): 231–42.

Heaver, T. (2002) The evolving roles of shipping lines in international logistics. *International Journal of Maritime Economics* 4: 210–30.

ITMMA/ESPO (2007) Market report on the European seaport industry. *Annual Report 2006–2007*, pp. 15–91. Brussels: European Sea Ports Organization.

Levinson, M. (2006) *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*. Princeton, NJ: Princeton University Press.

Lim, S.-M. (1998) Economies of scale in container shipping. *Maritime Policy and Management* 25: 361–73.

Lirn, T. C., H. A. Thanopoulou, M. J. Beynon and A. K. C. Beresford (2004) An application of AHP on transshipment port selection: a global perspective. *Maritime Economics and Logistics* 6: 70–91.

Lopez, E. (2003) How do ocean carriers organize the empty containers reposition activity in the USA? *Maritime Policy and Management* 30(4): 339–55.

Marsoft (2009) Containership Market Outlook. Marsoft, Singapore.

McCalla, R., B. Slack and C. Comtois (2005) The Caribbean basin: adjusting to global trends in containerization. *Maritime Policy and Management* 32(3): 245–61.

McLellan, R. (2006) Liner shipping development trends. *Maritime Policy and Management* 33(5): 519–25.

Meyrick and Associates (2008) Review of BAFs – Transatlantic and Europe/Far East trades. Report for the European Shippers' Council, Melbourne.

Notteboom, T. (2004) Container shipping and ports: an overview. *Review of Network Economics* 3(2): 86–106.

Notteboom, T. (2006) The time factor in liner shipping services. *Maritime Economics and Logistics* 8(1): 19–39.

Notteboom, T. (2009) The relationship between seaports and the intermodal hinterland in light of global supply chains: European challenges. In OECD/International Transport Forum, *Port Competition and Hinterland Connections*, pp. 25–75. Round Table 143. Paris: OECD Publishing.

Notteboom, T. and P. Cariou (2011) Are Bunker Adjustment Factors aimed at revenue-making or cost recovery? Empirical evidence on pricing strategies of shipping lines. In K. Cullinane (ed.), *International Handbook of Maritime Economics*, pp. 223–55. Cheltenham: Edward Elgar.

Notteboom, T. and B. Vernimmen (2009) The effect of high fuel costs on liner service configuration in container shipping. *Journal of Transport Geography* 17(5): 325–37.

Parola, F. and E. Musso (2007) Market structures and competitive strategies: the carrier–stevedore arm-wrestling in northern European ports. *Maritime Policy and Management* 34(3): 259–78.

Randers, J. and J. Göluke (2007) Forecasting turning points in shipping freight rates: lessons from 30 years of practical effort. *System Dynamics Review* 23(2/3), 253–84.

Rodrigue, J.-P. and T. Notteboom (2009a) The future of containerization: perspectives from maritime and inland freight distribution. *Geo Journal* 74: 7–22.

Rodrigue, J.-P. and T. Notteboom (2009b) The terminalization of supply chains: reassessing port–hinterland logistical relationships. *Maritime Policy and Management* 36(2): 165–83.

Rodrigue, J.-P. and T. Notteboom (2010) Foreland-based regionalization: integrating intermediate hubs with port hinterlands. *Research in Transportation Economics* 27(1): 19–29. Special issue: *The Port and Maritime Industries in the Post-2008 World: Challenges and Opportunities*.

Ryoo, D. K. and H. A. Thanopoulou (1999) Liner alliances in the globalisation era: a strategic tool for Asian container carriers. *Maritime Policy and Management* 26: 349–67.

Slack, B., C. Comtois and R. J. McCalla (2002) Strategic alliances in the container shipping industry: a global perspective. *Maritime Policy and Management* 29: 65–75.

Slack, B. and A. Frémont (2009) Fifty years of organisational change in container shipping: regional shift and the role of family firms. *GeoJournal* 74: 23–34.

Stopford, M. (1997) *Maritime Economics*. London: Routledge.

Sys, C. (2010) Is the container liner shipping industry an oligopoly? *Transport Policy* 16: 259–70.

Theofanis, S. and M. Boile (2009) Empty marine container logistics: facts, issues and management strategies. *GeoJournal* 74: 51–65.

UNCTAD (2009) *Review of Maritime Transport, 2009*. Geneva: UNCTAD.

Vernimmen, B., W. Dullaert and S. Engelen (2007) Schedule unreliability in liner shipping: origins and consequences for the hinterland supply chain. *Maritime Economics and Logistics* 9(3): 193–213.

Wilmsmeier, G. and T. Notteboom (2011) Determinants of liner shipping network configuration: a two-region comparison. *GeoJournal* 76(3): 213–28.

Yap, W. Y. (2010) *Container Shipping Services and Their Impact on Container Port Competitiveness*. Antwerp: University Press Antwerp.

Zohil, J. and M. Prijon (1999) The MED rule: the interdependence of container throughput and transshipment volumes in the Mediterranean ports. *Maritime Policy and Management* 26: 175–93.