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Chapter 3

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3

PRODUCTIVITY OF THE WORLD FLEET, AND SUPPLY AND DEMAND IN WORLD SHIPPING

CHAPTER 3

This chapter provides information on the operational productivity of the world fleet and an analysis of the balance between supply and demand for tonnage and container-carrying capacity. The key indicators are comparisons of cargo generation and fleet ownership, tons of cargo carried per deadweight ton, and analysis of tonnage oversupply in the main shipping market sectors. A special section looks at the impact of slow steaming on the vessel productivity of the active container ship fleet, concluding that the oversupply of tonnage in combination with the reduction of service speed in liner shipping has led to a decline in the productivity of the active fleet by approximately 26 per cent since 2008.

A. OPERATIONAL PRODUCTIVITY

Productivity of major vessel types

Against a decline in world seaborne trade by 4 per cent in 2009 as compared to 2008 (see chapter 1), the world fleet grew by 7 per cent during 2009. Accordingly, the overall fleet productivity in 2009, measured in tons of cargo carried per deadweight ton, decreased further compared to the 2008 figures (see tables 3.1 and 3.2 and fig. 3.1).[1] The global average volume of cargo in tons per carrying capacity dwt decreased, and the average ship was fully loaded only 6.6 times in 2009, compared to 7.3 times in 2008.

Table 3.1. Cargo carried per deadweight ton (dwt) of the total world fleet, selected years

Year	World fleet (millions of dwt, beginning of year)	Total cargo (millions of tons)	Tons carried per dwt
1970	326	2 566	7.9
1980	683	3 704	5.4
1990	658	4 008	6.1
2000	799	5 983	7.5
2006	960	7 682	8.0
2007	1 042	7 984	7.7
2008	1 118	8 210	7.3
2009	1 192	7 874	6.6

Source: Calculated by the UNCTAD secretariat, on the basis of UNCTAD data on seaborne trade (in tons) and IHS Fairplay data on the world fleet (in dwt).

The fundamental reason for the decline in average productivity in recent years continues to be the oversupply of tonnage available (see also chapter 2), which contrasts with the effective decline in world seaborne trade. In spite of the recorded surge in ship scrapping, which was more than three times higher in 2009 than in 2008, many ships had to be laid off, and even the active fleet often had to slow-steam or to take longer but less costly routes, thus reducing the tons carried per dwt.

The productivity of oil tankers in terms of tons carried per dwt decreased by a further 5.6 per cent, from 6.7 in 2008 to 6.33 in 2009; and for dry bulk it decreased by 5.5 per cent, from 5.32 to 5.02 tons. The cargo volumes carried by the residual fleet decreased by a staggering 18.3 per cent, from 10.66 to 8.71 tons per dwt (table 3.2). The residual fleet includes mainly general cargo and container ships; the latter have seen significant slow steaming during the last two years

Slow steaming and container ship fleet productivity[2]

Slow steaming in liner shipping has been increasingly implemented since 2008. This is primarily a consequence of overcapacity, with around 240 new container ships being delivered from March 2007 to March 2009, equivalent to a 10 per cent increase in supply, while demand from containerized trade was reducing by a similar amount. This led to a situation where there were 500 idle container ships in January 2010.[3] Slow steaming was also encouraged by the increase in marine bunker prices, which reached a peak of $700 per ton in July 2008 in Rotterdam, compared with $300 in January 2007 and $400 in early 2010. Reducing speed and adding vessels to services are a means firstly of absorbing the overcapacity and helping to restore rates, and secondly, because of the strong negative relationship between speed and fuel consumption at sea, of saving on bunker costs, even though more ships are deployed.

Given the benefits of savings from reduced bunker consumption and the expectation of a market recovery, slow steaming has been the preferred option of many container ship operators in order to offset the impact of oversupply-triggered low productivity in terms of ton-miles per dwt of the active fleet. The latter is a function of tonnage transported, of the average number of miles performed per vessel, and of the additional capacity in dwt required to maintain a weekly frequency. By stretching the time of rotations, the quality of services is reduced as laden containers spend more time at sea.

From the carriers' perspective, slow steaming means stretching out a service by one, two or more weeks, leading to (a) the deployment of more dwt for the same volume of cargo, and (b) a reduction in the number of miles travelled in a year by each vessel. To assess these two components, we analyse a large sample from the Alphaliner[4] database in January 2010 with information on 2,051 container ships of 1,000 TEU and above. We limit our focus to ships of 1,000 TEU and above because slow steaming has mostly been implemented in services using relatively large vessels. The reason is that slow steaming is more likely to occur when services are long enough for fuel consumption savings to be significant enough to offset the additional costs involved in adding (or not laying off) a vessel. At the beginning of 2010, around 80 per cent of services on the Europe–Far East route, 60 per cent of pendulum services, and 42 per cent of trans-Pacific services were under slow steaming, compared

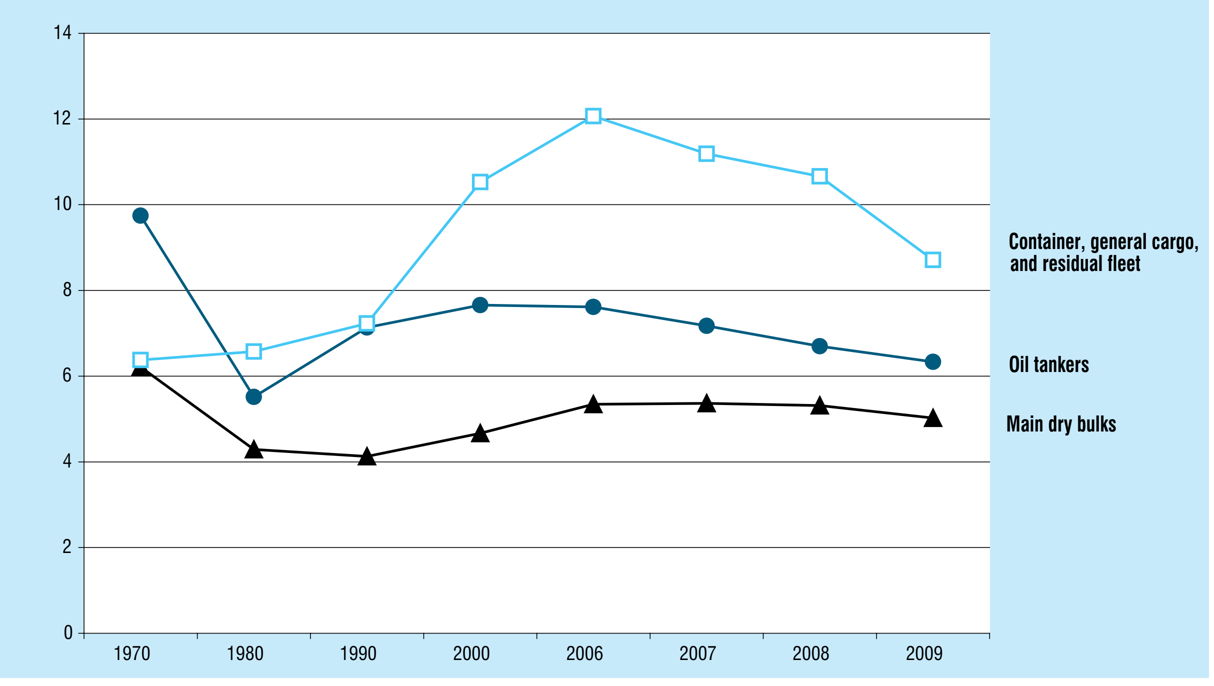
Table 3.2. Estimated productivity of tankers, bulk carriers and the residual fleet,[a] selected years

Year	Oil cargo (millions of tons)	Tanker fleet (millions of dwt, beginning of year)	Tons carried per dwt of tankers	Main dry bulks (millions of tons)	Dry bulk fleet (millions of dwt, beginning of year)	Tons carried per dwt of bulk carriers	All other dry cargoes (millions of tons)	Residual fleet[a] (millions of dwt, beginning of year)	Tons carried per dwt of the residual fleet[a]
1970	1 442	148	9.74	448	72	6.21	676	106	6.38
1980	1 871	339	5.51	796	186	4.29	1 037	158	6.57
1990	1 755	246	7.14	968	235	4.13	1 285	178	7.23
2000	2 163	282	7.66	1 288	276	4.67	2 532	240	10.53
2006	2 698	354	7.62	1 849	346	5.35	3 135	260	12.07
2007	2 747	383	7.17	1 972	368	5.37	3 265	292	11.19
2008	2 732	408	6.70	2 079	391	5.32	3 399	319	10.66
2009	2 649	418	6.33	2 102	418	5.02	3 090	355	8.71

Source: Calculated by the UNCTAD secretariat, based on UNCTAD data on seaborne trade (in tons), and IHS Fairplay data on the world fleet (in dwt).

[a] The residual fleet refers to general cargo, container ships and other vessels included in annex III (b).

Figure 3.1. Tons carried per deadweight ton (dwt) of the world fleet, selected years



Source: UNCTAD calculations.

with only 22 per cent for transatlantic services, which use smaller vessels.

For each vessel, the service on which it is deployed is identified (387 services in total), and from comments on their history, if this service is under slow steaming. In total, 42.9 per cent of vessels and 34.8 per cent of services were under slow steaming in January 2010. The proportion increases with vessel size, reaching 75 per cent for ships of 8,000 TEU and above (table 3.3).

Calculating the impact on the productivity of the deployed fleet, it is estimated that services under slow steaming in 2010 have been stretched by one week

Table 3.3. Impact[a] of slow steaming (2008–2010) on ton-miles per deadweight ton (dwt), by size of container ship

Vessel size ranges in TEU	% of services under slow steaming in 2010	Number of vessels in 2010	Days at sea in 2008	Days at sea in 2010	Miles performed in year (% change)	Capacity deployed in dwt (% change)	Thousands of ton-miles per dwt in 2008	Thousands of ton-miles per dwt in 2010	% change in ton-miles per dwt
1000–2000	11.60%	278	241	266	-10.40%	4.10%	19.0	14.7	-22.50%
2000–3000	15.90%	398	247	268	-8.50%	2.80%	20.9	16.7	-19.90%
3000–5000	33.30%	677	250	276	-10.40%	5.80%	23.3	17.8	-23.80%
5000–8000	59.70%	432	251	292	-16.30%	10.20%	25.3	17.3	-31.70%
8000+	80.00%	266	259	298	-15.10%	15.70%	25.1	16.6	-33.90%
Total	34.80%	2051	250	280	-12.00%	7.00%	22.8	16.9	-26.00%

Source: Cariou, P. (2010) Is slow steaming a sustainable means of reducing liner shipping CO2 emissions? Euromed Management Mare Forum, 14 September 2010, Marseilles.

[a] Assuming a 10 per cent decrease in demand (tons carried) for all vessels.

since 2008, and that, on average, one vessel was added per service under slow steaming. This means that 134 vessels were added to the services operating on slow steaming, corresponding to a 7 per cent increase in capacity. In order to estimate the changes in average miles performed, the days at sea in 2008, as reported in Buhaug et al. (2009: 195), are taken, and then the average days at sea are calculated with one additional week by rotation for services under slow steaming.[5] The average number of days at sea increases from 250 to 280 days, meaning that each vessel performs fewer rotations and port calls in a year. The final impact in ton-miles per dwt, from an initial value in 2008 of around 22.8 tons carried per dwt (Buhaug et al. 2009: 175), is down to 16.9 thousand ton-miles, equivalent to a reduction of 26 per cent. An even higher reduction in productivity applies to larger vessels (-33.9 per cent) (table 3.3).

"Normal" slow steaming has container ships move at around 20 to 22 knots, instead of the standard service speeds of around 25 knots. Speeds have been further reduced in recent months with the introduction of extra slow steaming, i.e. ships operating at speeds of around 17 to 19 knots, and sometimes even less. At the end of May 2010, extra slow steaming absorbed 554,000 TEUs, very similar to the magnitude of the currently laid-up capacity.[6]

Slow steaming is an alternative measure that has helped carriers to reduce the need to lay off ships, in order to prevent freight rates from falling further. Slow steaming also helps to reduce CO2 emissions, even considering the emissions from the additional vessels; generally, a 10 per cent reduction in speed for all vessels will reduce emissions by approximately 19 per cent per ton-mile. On the negative side, however, slow steaming not only means longer delivery times for shippers, but also less reliable service schedules. During the last quarter of 2009, only 53 per cent of vessels tracked on major East–West routes were reported to have arrived on time, compared to 60 per cent or above in the previous nine months.[7] In the medium term, vessel technology and shippers' requirements can be expected to encourage service providers to resume higher speeds, to increase the reliability of their vessels' schedules, and to restore productivity to pre-crisis levels.

B. SUPPLY AND DEMAND IN WORLD SHIPPING

The idle fleet, by main vessel types

The combined idle tonnage of large tankers, dry bulk carriers and conventional general cargo ships at the end of 2009 (data for 1 December 2009) stood at 12 million dwt, or 1.3 per cent of the total world merchant fleet (table 3.4). During the first months of 2010 the situation worsened somewhat, reaching 14.4 million dwt on 1 April 2010, corresponding to a 1.5 per cent surplus. The year-on-year development has been positive, as the resumed growth in trade (see chapter 1) has helped to put vessels back into business, in spite of the continued growth in the world fleet.

The tonnage supply of tankers (oil and other tankers of 10,000 dwt and above) increased by 21 million dwt in 2009, to 435 million dwt, as the newbuildings that were delivered outweighed the tonnage that was scrapped, laid up or lost (see table 3.5 and fig. 3.2). The idle tanker fleet in April 2010 stood at 2.2

Table 3.4. Tonnage oversupply in the world merchant fleet, selected years *(end-of-year figures)*

	1990	2000	2004	2005	2006	2007	2008	2009	1 Apr. 2010
					Million dwt				
Merchant fleet, three main vessel types[a]	558.5	586.4	667.0	697.9	773.9	830.7	876.2	930.3	937.5
Idle fleet[b]	62.4	18.4	6.2	7.2	10.1	12.1	19.0	12.0	14.4
Active fleet	496.1	568.0	660.8	690.7	763.7	818.6	857.2	918.3	923.1
					Percentages				
Idle fleet as a percentage of the merchant fleet	11.2	3.1	0.9	1.0	1.3	1.5	2.2	1.3	1.5

Source: Compiled by the UNCTAD secretariat, on the basis of data supplied by *Lloyd's Shipping Economist*, various issues.

a Tankers and dry bulk carriers of 10,000 dwt and above, and conventional general cargo vessels of 5,000 dwt and above.

b Surplus tonnage is defined as tonnage that is not fully utilized because of slow steaming or lay-up status, or because it is lying idle for other reasons.

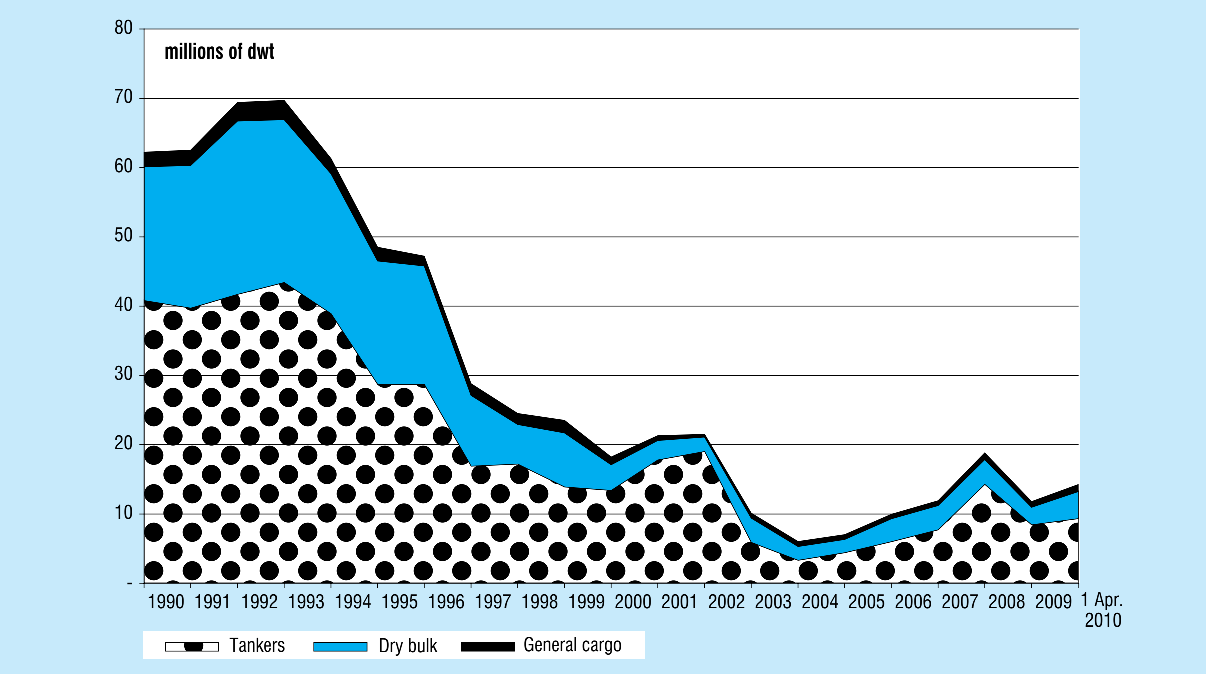
Table 3.5. Analysis of tonnage surplus, by main type of vessel, selected years[a] ***(in millions of dwt or millions of cubic meters)***

	1990	2000	2004	2005	2006	2007	2008	2009	1. Apr. 2010
World tanker fleet (dwt)	266.2	279.4	298.3	312.9	367.4	393.5	414.04	435.25	438.33
Idle tanker fleet (dwt)	40.9	13.5	3.4	4.5	6.1	7.8	14.35	8.51	9.42
Share of idle fleet in tanker fleet (%)	15.4	4.8	1.1	1.4	1.7	2.0	3.47	1.96	2.15
World dry bulk fleet (dwt)	228.7	247.7	325.1	340.0	361.8	393.5	417.62	452.52	458.63
Idle dry bulk fleet (dwt)	19.4	3.8	2.1	2.0	3.4	3.6	3.68	2.64	4.00
Share of idle fleet in dry bulk fleet (%)	8.5	1.5	0.6	0.6	0.9	0.9	0.88	0.58	0.87
World conventional general cargo fleet (dwt)	63.6	59.3	43.6	45.0	44.7	43.8	44.54	42.53	40.54
Idle conventional general cargo fleet (dwt)	2.1	1.1	0.7	0.7	0.6	0.7	0.97	0.83	1.01
Share of idle fleet in general cargo fleet (%)	3.3	1.9	1.6	1.6	1.4	1.6	2.18	1.95	2.49
World ro-ro fleet (dwt)	..	..	..	..	..	..	11.37	10.93	10.21
Idle ro-ro fleet (dwt)	..	..	..	..	..	..	0.89	0.73	0.67
Share of idle fleet in ro-ro fleet (%)	..	..	..	..	..	..	7.83	6.68	6.56
World vehicle carrier fleet (dwt)	..	..	..	..	..	..	11.27	11.20	10.72
Idle vehicle carrier fleet (dwt)	..	..	..	..	..	..	0.24	0.55	0.42
Share of idle fleet in vehicle carrier fleet (%)	..	..	..	..	..	..	2.13	4.91	3.92
World LNG carrier fleet (m^3)	..	..	..	..	..	..	44.43	46.90	49.29
Idle LNG carrier fleet (m^3)	..	..	..	..	..	..	5.87	1.29	0.77
Share of idle fleet in LNG fleet (%)	..	..	..	..	..	..	13.21	2.75	1.56
World LPG carrier fleet (m^3)	..	..	..	..	..	..	11.56	18.50	19.05
Idle LPG carrier fleet (m^3)	..	..	..	..	..	..	0.94	0.10	0.13
Share of idle fleet in LNG fleet (%)	..	..	..	..	..	..	8.13	0.54	0.68

Source: Compiled by the UNCTAD secretariat, on the basis of data from *Lloyd's Shipping Economist*, various issues.

a End-of-year figures, except for 1990 and 2000, which are annual averages. This table excludes tankers and dry bulk carriers of less than 10,000 dwt and conventional general cargo/unitized vessels of less than 5,000 dwt.

Figure 3.2. Trends in surplus capacity, by main vessel types, selected years



Source: Compiled by the UNCTAD secretariat, on the basis of data from *Lloyd's Shipping Economist,* various issues.

per cent of total capacity. The supply of large dry bulk vessels increased by 35 million dwt to 453 million dwt by December 2009, then reaching 459 million dwt by April 2010. The overtonnage for this type of vessel was only 4 million dwt in April 2010, equivalent to 0.9 per cent of the dry bulk fleet.

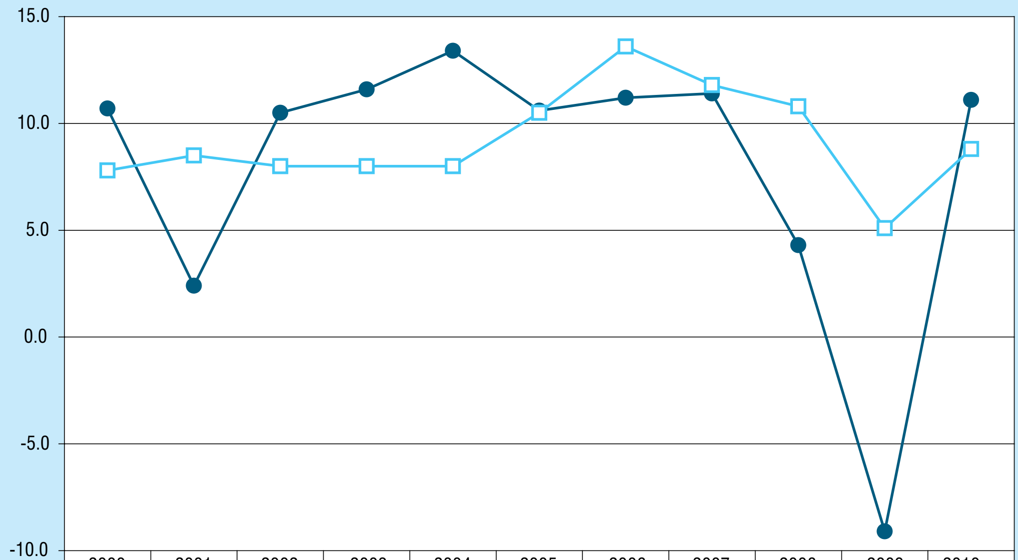
For the conventional general cargo fleet of vessels of 5,000 dwt and above, overcapacity reached 2.5 per cent of the world fleet of this sector in April 2010. The idle fleet of ro-ro vessels stood at 6.6 per cent, and the idle fleet of vehicle carriers stood at 3.9 per cent. Gas carriers (carrying LNG and LPG) have seen a significant improvement in their idle fleet situation since 2008. Demand for transport increased in 2009, for example because of production by new gas fields, however there were fewer new deliveries than in 2008 (table 3.5).

Demand and supply in container shipping

The resumption of manufacturing activity and global trade in containerized goods led to a recovery of demand for liner shipping services in early 2010 (see also chapter 1). In 2009, however, the market was particularly bad for container shipping, as demand plummeted by 9 per cent while supply grew by 5.1 per cent (fig. 3.3), the difference between these two figures being a staggering 14.1 percentage points. For the first time since 2005, demand is now forecast to grow faster than supply (in 2010).

A market segment of particular interest to many developing countries is containerized trade in refrigerated cargo, such as fruit, vegetables, meat and fish. Until the mid-1990s, the majority of this trade was transported in specialized reefer vessels. Since then, the entire growth in this market has been taken over by container shipping, installing slots for reefer containers on new container ships. At the beginning of 2010, the capacity to carry reefer cargo in containers stood at 2,898 million cubic feet, which was 9.5 times greater than the capacity on specialized reefer ships.[8] The export of refrigerated cargo by container benefits from the global liner shipping networks and better door-to-door transport services. At the same time, it obliges ports and exporters to invest in the necessary equipment. Over the last decade, exporters have benefited from the increased competition between containerized and specialized reefer transport providers. As the reefer fleet is getting older and vessels are being phased out, this market segment will become almost fully containerized.

Figure 3.3. Growth of demand and supply in container shipping, 2000–2010[a] *(annual growth rates)*



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010a
Demand	10.7	2.4	10.5	11.6	13.4	10.6	11.2	11.4	4.3	-9.1	11.1
Supply	7.8	8.5	8.0	8.0	8.0	10.5	13.6	11.8	10.8	5.1	8.8

Source: Compiled by the UNCTAD secretariat, on the basis of data from *Clarkson Container Intelligence Monthly*, various issues.

[a] Total container-carrying fleet, including multi-purpose vessels and other vessels with some container-carrying capacity. The data for 2010 are forecasted figures.

C. COMPARISON OF INTERNATIONAL TRADE AND FLEETS

In 2009, China overtook Germany as the second-largest trading nation (measured in United States dollars, imports plus exports), accounting for 8.83 per cent of world trade. China has also overtaken Germany as the third-largest owner of shipping tonnage, with 8.96 per cent of dwt in January 2010 (see chapter 2). It is arguable whether or not these two developments are linked. Both countries are important traders in manufactured goods, and both countries have large-scale shipowners, but the fleets of these shipowners do not only carry German or Chinese exports and imports, indeed they mostly carry trade between third countries (table 3.6).

The world's largest trader continues to be the United States, which generated 10.65 per cent of world trade in 2009 while owning only 3.54 per cent of world tonnage; 1.0 per cent of the world's cargo-carrying tonnage used the flag of the United States. Japan is the fourth-largest trading nation (4.53 per cent), and the country has an even more important share in the controlled fleet (15.73 per cent), but only a minor proportion of its controlled fleet flies the national flag.

France, Italy, the Netherlands and the United Kingdom each account for a similar share of world trade (between 3.2 and 4.2 per cent each), however their shares in the control or registration of ships vary widely: 2.9 per cent of the world's tonnage is registered in the United Kingdom (including the Isle of Man) compared to only 0.57 per cent registered in the Netherlands, and owners from the United Kingdom control 2.7 per cent of the world's tonnage compared to only 0.63 per cent controlled by owners from France. Two Latin American countries are among the major trading nations, namely Mexico and Brazil, with a 1.9 and 1.15 per cent share of world trade respectively. Of these two countries, only Brazil figures among the major shipowning countries. Mexico trades mostly by land with its northern neighbours, which may be one of the explanations for why, historically, it has had a relatively smaller nationally owned fleet.

Table 3.6. Maritime engagement of 25 major trading nations, 2009 data (trade) and beginning of 2010 data (fleet)

Country/territory	Percentage share of world merchandise trade, in terms of value			Percentage share of world fleet (flag), in terms of dwt			Percentage share of world fleet (ownership), in terms of dwt		
	2008	2009	Change, in percentage points	1 Jan. 2009	1 Jan. 2010	Change, in percentage points	1 Jan. 2009	1 Jan. 2010	Change, in percentage points
United States	10.68	10.65	-0.04	1.00	1.00	-0.00	3.62	3.54	-0.07
China	7.91	8.83	0.92	3.35	3.54	0.18	8.40	8.96	0.56
Germany	8.22	8.18	-0.04	1.51	1.38	-0.13	9.50	8.91	-0.59
Japan	4.78	4.53	-0.25	1.29	1.39	0.09	15.68	15.73	0.04
France	4.04	4.10	0.06	0.66	0.69	0.03	0.59	0.63	0.04
Netherlands	3.72	3.76	0.04	0.57	0.57	-0.00	0.76	0.76	-0.00
United Kingdom	3.36	3.32	-0.04	2.73	2.89	0.16	2.80	2.66	-0.14
Italy	3.37	3.25	-0.12	1.21	1.35	0.14	1.79	1.93	0.14
Belgium	2.91	2.88	-0.04	0.56	0.52	-0.04	1.22	1.08	-0.14
Republic of Korea	2.64	2.74	0.09	1.90	1.63	-0.26	4.22	3.85	-0.37
China, Hong Kong	2.32	2.66	0.35	5.38	5.84	0.46	3.05	2.95	-0.10
Canada	2.70	2.58	-0.11	0.29	0.27	-0.02	1.55	1.57	0.01
Singapore	2.03	2.06	0.03	5.10	4.83	-0.27	2.55	2.80	0.24
Russian Federation	2.61	2.06	-0.55	0.60	0.57	-0.03	1.66	1.67	0.01
Spain	2.06	2.02	-0.05	0.23	0.20	-0.03	0.40	0.45	0.05
Mexico	1.85	1.90	0.05	0.14	0.14	0.00	..	..	..
India	1.45	1.61	0.16	1.28	1.17	-0.11	1.56	1.47	-0.09
China, Taiwan Province of	1.53	1.51	-0.02	0.36	0.31	-0.05	2.70	2.53	-0.17
Switzerland	1.19	1.31	0.13	0.08	0.08	-0.00	0.35	0.34	-0.01
Australia	1.19	1.28	0.08	0.18	0.17	-0.01	..	..	..
Saudi Arabia	1.27	1.27	0.00	0.14	0.18	0.04	1.35	1.13	-0.22
Thailand	1.08	1.15	0.07	0.35	0.29	-0.06	0.37	0.33	-0.04
Brazil	1.14	1.15	0.01	0.29	0.27	-0.02	0.43	0.66	0.24
Malaysia	1.15	1.13	-0.03	0.79	0.80	0.01	1.05	1.07	0.02
Poland	1.15	1.12	-0.03	0.01	0.01	-0.00	..	..	..
Total	76.37	77.05	0.68	30.00	30.09	0.09	65.58	65.01	-0.57

Source: Compiled by the UNCTAD secretariat, on the basis of data supplied by the *UNCTAD Handbook of Statistics* (trade) and IHS Fairplay (fleet registration and ownership).

Note: ThE United Kingdom fleet in this table includes Isle of Man.

ENDNOTES

1 The figures on the productivity of the world fleet are indicative estimates only. While the data on the world fleet include ships that are employed in cabotage trades, the UNCTAD estimates of seaborne trade do not include cabotage. It is not always possible to assign the specific vessel type to a given traded commodity.

2 This section is based on Cariou, P. (2010) Is slow steaming a sustainable means of reducing liner shipping CO2 emissions? Euromed Management Mare Forum, 14 September 2010, Marseilles.

3 Alphaliner (2010). See http://www.alphaliner.com.

4 ibid.

5 Buhaug O, Corbett J, Endresen O, Eyring V, Faber J, Hanayama S, Lee D, Lindstad H, Mjelde A., Palsson C, Wanquing W, Winebrake J and Yoshida K (2009). *Second IMO Greenhouse Gas Study*. International Maritime Organization. London.

6 Dynamar (2010). *DynaLiners:* 11. 4 June. Source of data: AXS Marine (2010). *Alphaliner.*

7 International Association of Ports and Harbours (2010). *Ports and Harbours*. May. Source of data: Drewry Shipping Consultants.

8 Clarkson Research Services (2010). *Container Intelligence Monthly*. April.