Sadržaj osnovne literature:

Dopunska literatura:

- Benford, H. (1983a) A Naval Architect’s Introduction to Engineering Economics (Ann Arbor, Mich.: University of Michigan, College of Engineering) No. 282.

- Čekić, Š., I. Bošnjak, MENADŽMENT U TRANSPORTU I KOMUNIKACIJAMA, Fakultet za saobraćaj i komunikacije Univerziteta u Zagrebu, Fakultet prometnih znanosti Sveučilišta u Zagrebu, Sarajevo, Zagreb, 2000.

- Dundović, Č., POMORSKI SUSTAV I POMORSKA POLITIKA, Pomorski fakultet u Rijeci i Glosa Rijeka, Rijeka, 2003.

Glavan, B., POMORSKI BRODAR – ORGANIZACIJA I POSLOVANJE, Istarska naklada, Pula, 1984.

- Hampton, M.J. (1989) Long and Short Shipping Cycles (Cambridge: Cambridge Academy of Transport), 3rd edition 1991.
- Haws, D. and Hurst, A.A. (1985) The Maritime History of the World, 2 vols (Brighton: Teredo Books Ltd).

- Jones, J.J. and Marlow, P.B. (1986) Quantitative Methods in Maritime Economics (London: Fairplay Publications).

- Stopford, R.M. and Barton, J.R. (1986) ‘Economic problems of shipbuilding and the state’, Journal of Maritime Policy and Management (Swansea), Vol. 13(1), pp. 27–44.

- Volk, B. (1994) The Shipbuilding Cycle-A Phenomenon Explained (Bremen: Institute of Shipping Economics and Logistics).

9 The Geography of Maritime Trade

Such therefore are the advantages of water carriage, it is natural that the first improvements of art and industry should be made where this convenience opens the whole world for a market to the produce of every sort of labor.

(Adam Smith, *Inquiry Into the Wealth of Nations*, 1776)

9.1 THE VALUE ADDED BY SEABORNE TRANSPORT

When Vasco da Gama arrived in India in 1457 and found that he could buy pepper for 3 ducats in Calicut and sell it for 80 ducats in Europe (see Chapter 1), he was doing exactly what traders do today – using sea transport to exploit an interregional arbitrage. It was not just a commercial success. By bringing spices to the European population in far greater volumes than could be transported overland by camel, he made their lives better and, in modern economic jargon, 'added value'. Over the succeeding six centuries, as shipping became more efficient, the opportunities to add value by moving goods around the world increased and sea trade has grown, giving shipping a central role in the globalization of the world economy.

Today cargo moves between more than 3,000 major commercial ports, and to understand the economic mechanisms which drive this complex operation we need to know where goods move and why. Maritime economics is a practical discipline, and there is not much point in being an expert on the economics if we cannot find the ports on a map! So in this chapter we will study the oceans, continents, countries, manufacturing centres and ports which make up the maritime transport matrix. Starting with an overview of the trading world, we will then examine the 'spatial' geography of the Atlantic, Pacific and Indian oceans to get a sense of where the trading centres are located, the goods they trade and the time and cost of moving goods between them.

In this chapter we will review the physical framework within which the shipping industry operates, starting with the oceans, seas and transit times. We will then make a quick tour of the three major oceans, the Atlantic, the Pacific and the Indian, and discuss the economies of the main trading areas within them. In doing this we will refer to a series of maps and in particular four tables: Table 9.1 which contains an overview of regional trade; Table 9.4 which reviews the economies of the Atlantic countries; Table 9.5 which covers the Pacific economies; and Table 9.6 which contains details of the Indian Ocean economies.

9.2 OCEANS, DISTANCES AND TRANSIT TIMES

Location of the major trading economies

Maritime trade is dominated by three economic centres, North America, Europe and Asia, strung out along the 'Westline' we studied in Chapter 1 (see Figure 9.1). The heavy black line in the map shows the shipping route between these three centres which is followed by container-ships and other specialized vessels such as car carriers and chemical tankers, carrying a wide range of merchandise. The lighter lines mark the main routes followed by bulk vessels carrying raw materials such as oil, iron ore, coal, grain and phosphate rock into the three economic centres. Europe, where it all started, lies in the centre of the figure, with North America on the left and Asia on the right. Together they have over 90% of the world's manufacturing industry and much of its technology. Their multinational corporations own most of the world's patents, develop most of the new technology, and one way or another they initiate and direct a large proportion of the investment and trade in raw materials and manufactures[1]. So naturally they also dominate sea trade.

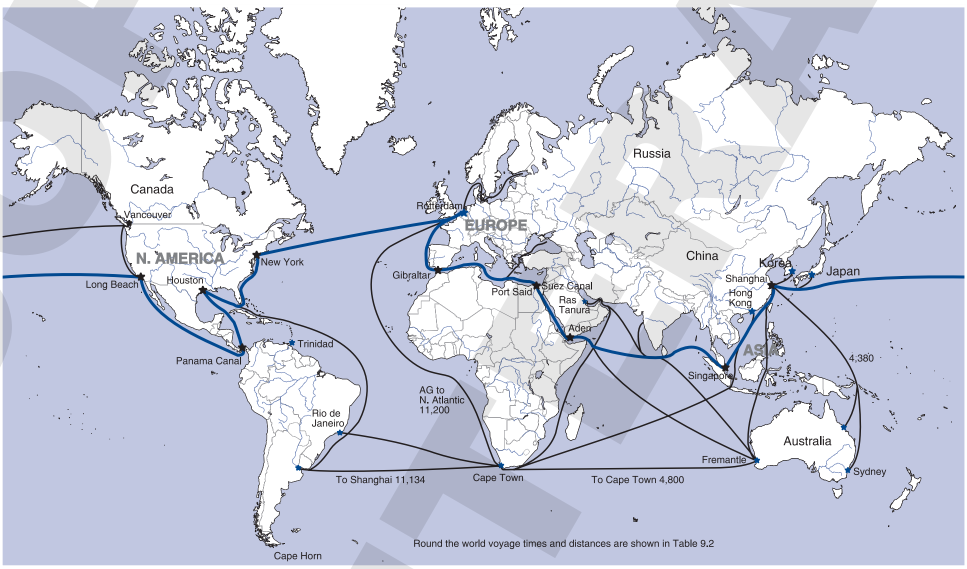


Figure 9.1
The world's major shipping routes, 2007
Source: Martin Stopford 2007

If we take imports as the yardstick, these three areas imported 88% of the 7 billion tons of cargo transported by sea in 2005. The detailed export and import statistics are summarized in Table 9.1, whilst the map in Figure 9.2 shows the share of each region in total imports and exports. This is the physical framework within which the shipping business operates, and analysing the efficient movement of cargo between the points on this map is the business of maritime economists, so we need to study it carefully. But before doing this, a word is needed about regional definitions, a source of endless difficulty for trade analysts. The issue is simple enough – which countries belong in which regions? The problem is that the statistics we use are often based on political groupings which change over time. A recent example is the break-up of the Soviet Union and the transfer of the central European countries into the European Union. In this chapter we will roughly

Table 9.1 International seaborne imports and exports by region, 2005 (million tonnes)

	Exports				Imports				Total Trade[a]	
Region	Oil	Dry	Total	%	Oil	Dry	total	%	mt	%
1. Trade of the Atlantic										
North America[b]	95	503	598	8%	682	442	1,124	16%	1,722	12%
Carib. & Cent. America	169	65	234	3%	73	86	159	2%	393	3%
E. Coast S. America	195	393	588	8%	61	92	153	2%	741	5%
West Africa	198	20	218	3%	8	42	50	1%	268	2%
Northern Africa	166	38	204	3%	57	84	142	2%	346	2%
Western Europe	105	1,065	1,170	16%	543	1,515	2,058	29%	3,228	23%
Russia & E. Europe	177	181	358	5%	14	67	81	1%	439	3%
Other Europe	2	17	19	0%	9	11	20	0%	40	0%
Total Atlantic	285	1,263	3,389	48%	1,447	2,340	3,787	53%	7,176	50%
2. Trade of the Pacific & Indian Oceans										
West Coast	32	120	152	2%	22	35	56	1%	209	1%
Japan	4	186	190	3%	248	585	832	12%	1,022	7%
China[c]	39	478	517	7%	153	584	737	10%	1,254	9%
S. & E. Asia	172	762	934	13%	469	915	1,384	19%	2,318	16%
Total Asia[d]	215	1,426	1,641	23%	870	2,084	2,953	41%	4,594	32%
Oceania (Dev.)	4	2	6	0%	6	6	12	0%	18	0%
Australia & New Zealand	14	604	618	9%	40	48	88	1%	706	5%
M. East (W. Asia)	1,048	73	1,121	16%	19	141	160	2%	1,281	9%
East Africa	-	9	9	0%	6	21	26	0%	36	0%
South Africa	-	172	172	2%	16	24	40	1%	211	1%
Total	1,314	2,406	3,720	52%	979	2,356	3,335	47%	7,055	50%
Total Sea Trade	1,599	3,669	7,109	100%	2,426	4,696	7,122	100%		
Memo: Africa Total	364	239	602	0	87	170	258		860	6%

Source: *Review of Maritime Transport 2006, United Nations Conference on Trade and Development*

[a]Total of imports and exports. Grand total not shown, since it double-counts imports and exports

[b]Includes Pacific coast

[c]Includes N. Korea & Vietnam

[d]maritime Asia is the sum of Japan, China and Southern & Eastern Asia

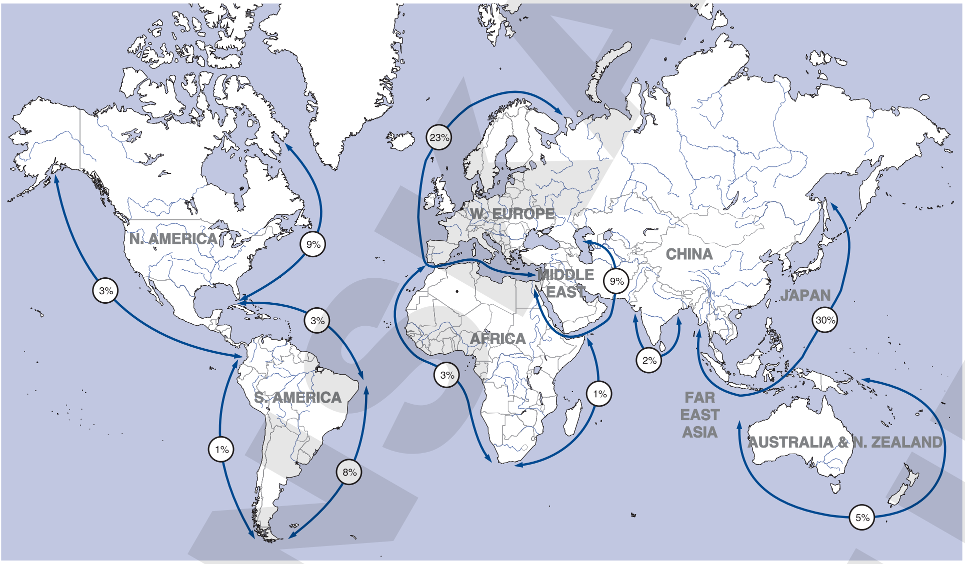


Figure 9.2
World seaborne trade by region, showing the share of maritime imports and exports 2005
Source: United Nations *Monthly Bulletin of Statistics*

divide the world into divisions based on the Atlantic, Pacific and Indian oceans, though the source data does not allow us to split the Pacific and Indian oceans. The 16 regions within these divisions are listed in Table 9.1, and although they do not support the divisional split precisely, they provide a rough idea of the distribution of trade around the world. The countries within the regions are defined further in Tables 9.4–9.6 which also show the area, population and GDP of each country and the region as a whole.

In 2005 trade was split roughly fifty-fifty between the Atlantic, with 7 billion tons of imports and exports, and the Pacific and Indian Oceans, with 7.1 billion tons. Atlantic trade was dominated by two big importers North America (1.1 billion tons) and Europe (2.1 billion tons), which together accounted for 45% of world imports, and the remaining Atlantic regions only 8% (note that North America, which has two coasts, is included in the Atlantic, overstating its importance). Exports were more widely dispersed, with Europe, North America and East Coast South America the most important. In the Pacific the dominant importers with a 41% trade share were Japan which imported 0.8 billion tons, China 0.7 billion tons and the cluster of Asian countries including South East Asia and India which imported 1.4 billion tons. Although the remaining regions, Africa, South America, Oceania, and the Middle East, include some very large land masses, their share of imports was quite small.

Around the world in 80 days

Corporations and traders work on margins and are constantly scouring the regions of the world for cheaper suppliers and new markets where they can sell their products.

Distance, speed and the cost of sea transport all play a part in their calculations, and we will come across these variables time and again in our study of sea trade, ship design, and the market for sea transport. So it makes sense to start with two fundamental issues: how long does it take for cargo to move around the world, and how much does it cost? In fact sea transport is relatively slow, as we can see if we follow the round-the-world voyage shown by the broad line in Figure 9.1. It takes about 80.1 days to circumnavigate the world using a conventional bulk carrier travelling at 13.6 knots and 47 days using a container-ship operating at 23 knots.

The distances and travelling times are shown in Table 9.2. The individual legs of the bulk carrier journey give an idea of the times and distances involved in bulk transport. The voyage starts in Rotterdam and crossing the North Atlantic to New York is 3270 miles and takes 10 days, followed by a 1905 mile voyage to Houston in the US Gulf, taking 5.8 days. Houston to Long Beach is 4346 miles and takes 13 days. Crossing the Pacific to China is the longest single sea leg, with the journey from Long Beach to Shanghai covering 5810 miles and taking 17.8 days. From Shanghai to Singapore is 2210 miles, or 6.8 days steaming, and from there the trip through the busy Malacca Straits to Aden at the mouth of the Red Sea is 3627 miles, taking about 11 days. From Aden it is 8.9 days steaming to Marseilles on the Mediterranean coast of France, and 6.3 days to Rotterdam. The distance is 26,158 nautical miles and the total voyage time is 80.1 days at a cost of $25 per tonne of cargo carried round the world. This cost was calculated by dividing the bulk carrier's total costs on the voyage by the 70,000 tons of cargo it carried. It includes fuel and charter hire, but not canal and port costs (the assumptions for bunkers, ship costs, etc. are given in the footnotes to Table 9.2). If the shipper is in a hurry, a 23 knot container-ship could cut the voyage time to 47 days, but the cost per ton would more than double to $55 dollars due to the

Table 9.2 Round-the-world voyage showing voyage times and total cost per tonne

Trade route		Distance,	Sailing Time (days)		Total Cost $ mill	
From	To	nautical miles[a]	Bulker 13.6kts	Container 23 kts	Bulker[b] 13.6kts	Container[c] 23.0 kts
Rotterdam	New York	3,270	10.0	5.9	0.22	0.32
New York	Houston	1,905	5.8	3.3	0.13	0.18
Houston	Long Beach	4,346	13.3	7.9	0.29	0.43
Long Beach	Shanghai	5,810	17.8	9.4	0.39	0.51
Shanghai	Singapore	2,210	6.8	4.8	0.15	0.26
Singapore	Aden	3,627	11.1	6.6	0.25	0.36
Aden	Marseilles	2,920	8.9	5.3	0.20	0.29
Marseilles	Rotterdam	2,070	6.3	3.8	0.14	0.20
Total		26,158	80.1	47.0	1.78	2.55
Cost: $/tonne for 70,000 tonnes bulk or 48,456 tonnes container cargo					25.3	55.3

[a] A nautical mile is the length of a minute of the arc of a great circle of the globe, 6,080 feet
[b] Based on 74,000 dwt Panamax bulk carrier 2007 built averaging 13.6 knots and burning 33 tons/day heavy fuel oil at $250/tonne and chartered at $13,900/day, the TC rate of a Panamax bulk carrier over the 10 years April 1997 to April 2007
[c] Based on 4,048 TEU containership, 23 knots on 117 tonnes/day of heavy fuel oil at $250/tonne and 12 tonnes carried per TEU in a vessel chartered at $25,000/day

higher bunkers and the greater cost of chartering a container-ship capable of travelling at 23 knots.[2] Broadly speaking, 13.6 knots to 23 knots is the speed range within which merchant ships operate, though to trade efficiently at the opposite ends of this speed band requires significantly different hull and machinery designs. We reviewed these costs in detail in Chapter 6.

The average voyage on this journey is 3270 miles. However, there are some much longer trade routes in the bulk shipping business, a few of which are shown in Figure 9.1 by the light lines. They include oil from the Arabian Gulf to the North Atlantic via the Cape of Good Hope (12,000 miles or 37 days' steaming), grain from the US Gulf to Japan (9400 miles or 28 days' steaming) and iron ore from Brazil to Japan (11,500 miles or 34 days' steaming). But there are many shorter routes, and in 2005 the oil trade averaged 4989 miles and the major dry bulk trades 5100 miles.

Transport demand and logistics

Although at first sight the link between distance and transport demand is quite straightforward, appearances are deceptive. With over 3,000 major ports to consider, the trade matrix has, in principle, 4 million elements. Of course in practice some routes predominate, but even in a relatively simple trade such as oil the range of routes is enormous. For example, the oil tanker distance tables published by British Petroleum run to 150 densely packed pages!

At this point it is useful to introduce *logistics*, a science which deals explicitly with complex transport problems. The term, which is derived from the Greek word *logistikos* meaning 'calculatory' or 'rational', was adopted by the military to describe the science of planning the supply chain which supports combat troops. The term is now also used by commercial organizations to describe the process of rationalizing supply chains to support their commercial operations. Typically this involves integrating transport modes, storage facilities, cargo-handling facilities, information management, and performance measurement and monitoring. Of course this is easy enough to understand when dealing with an individual company and supply chain, but much more complex when operating across a global matrix with millions of elements. As an example, the distance matrix shown in Table 9.3(a) shows the distances between high-volume ports in Asia, Europe and the United States. On the horizontal axis, Asia is represented by Mumbai in India, Singapore (the crossroad port on the Malacca Straits) and Shanghai, which lies close to Japan and Korea, and thus represents a convenient reference point. Western Europe includes Rotterdam in the north-west and Fos, the port of Marseilles, in the Mediterranean. Finally, for the United States we include New York on the East Coast, New Orleans on the Gulf Coast, and Los Angeles on the West Coast. The vertical axis shows 12 ports in exporting areas. First is the Arabian Gulf, followed by Australia, Canada, USA, South America, Africa, the Black Sea and Europe. Although this matrix is a great oversimplification, it still has 90 elements and there is a lot of detail to absorb.

The shortest voyage in Table 9.3(a) is from Algiers to Fos (Marseilles) which is only 400 miles, and the voyage time matrix in Table 9.3(b) shows it takes only 1.3 days. Allowing for two days in port at either end of the voyage, a ship could complete

Table 9.3(a) Distance round voyage (nautical miles)

		ASIA			EUROPE		UNITED STATES		
		India	S'pore	China	N. West	Med	E. Coast	US Gulf	W. Coast
Region	Port	Mumbai		Shanghai	Rotterdam	Fos	N. York	New Orleans	L. Angeles
Arabian Gulf (1)	Ras Tanura	1,352	2,435	5,852	11,170		11,765	12,225	
via Suez	Ras Tanura				6,412			9,543	
Australia	Newcastle	6,095	4,215	4,590	11,620	9,915	9,680	9,088	6,456
Canada	Vancouver	9,512	7,071	5,092	8,917	9,105	6,056	5,472	1,144
US Gulf	N. Orleans	9,541	11,514	10,080	4,880	5,300	1,707		4,346
East Coast South America	N. York	9,541	10,169	10,669	3,270	3,825		1,707	3,780
West Coast South America	L. Angeles	10,308	7,867	5,810	7,747	7,980	1,707	4,346	
Brazil	Rio	7,863	8,863	10,877	5,256	4,900	4,780	5,136	7,245
W.Africa	Lagos	7,188	8,188	10,202	4,310	3,810	4,883	5,749	8,006
N. Africa	Algiers	4,570	6,565	8,805	1,791	410	3,545	5,300	7,705
B. Sea	Odessa	4,230	6,214	8,465	3,508	1,720	5,265	6,740	9,450
Europe	Rotterdam	6,337	8,308	10,590		2,070	3,270	4,880	7,747
Asia	Osaka	5,112	2,671	790	10,985	9,221	9,986	6,348	5,193
									6,671

Table 9.3(b) Days per single voyage (at 13 knots speed)

		ASIA			EUROPE		UNITED STATES		
		India	S'pore	China	N. West	Med	E. Coast	US Gulf	W. Coast
Region	Port	Mumbai		Shanghai	Rotterdam	Fos	N. York	New Orleans	L. Angeles
Arabian Gulf (1)	Ras Tanura	4	8	19	36		38	39	
via Suez	Ras Tanura				21			31	
Australia	Newcastle	20	14	15	37	32	31	29	21
Canada	Vancouver	30	23	16	29	29	19	18	4
US Gulf	N. Orleans	31	37	32	16	17	5	-	14
East Coast South America	N. York	31	33	34	10	12	0	5	12
West Coast South America	L. Angeles	33	25	19	25	26	5	14	0
Brazil	Rio	25	28	35	17	16	15	16	23
W.Africa	Lagos	23	26	33	14	12	16	18	26
N. Africa	Algiers	15	21	28	6	1.3	11	17	25
B. Sea	Odessa	14	20	27	11	6	17	22	30
Europe	Rotterdam	20	27	34	-	7	10	16	25
Asia	Osaka	16	9	3	35	30	32	20	17
					30				

Notes: (1) US Gulf (New Orleans),Distances via Suez Canal AG to Rotterdam 19.7 days; AG to New Orleans 30 days

Table 9.3(c) Number of round voyages a year (350 days trading, 2 days loading, 2 days discharge)

		ASIA			EUROPE		UNITED STATES		
		India	S'pore	China	N. West	Med	E. Coast	US Gulf	W. Coast
Region	Port	Mumbai		Shanghai	Rotterdam	Fos	N. York	New Orleans	L. Angeles
A. Gulf	Ras Tanura	27.6	17.8	8.4	4.6		4.4	4.2	
via Suez	Ras Tanura				7.8			5.4	
Australia	Newcastle	8.1	11.3	10.5	4.5	5.2	5.3	5.6	7.7
Canada	Vancouver	5.4	7.1	9.6	5.7	5.6	8.2	9.0	30.9
US Gulf	N. Orleans	5.4	4.5	5.1	9.9	9.2	23.4	—	11.0
East Coast South America	N. York	5.4	5.1	4.8	14.0	12.3	87.5	23.4	12.4
West Coast South America	L. Angeles	5.0	6.4	8.5	6.5	6.3	23.4	11.0	87.5
Brazil	Rio	6.4	5.8	4.7	9.3	9.9	10.1	9.5	6.9
W.Africa	Lagos	7.0	6.2	5.0	11.1	12.3	9.9	8.6	6.3
N. Africa	Algiers	10.5	7.6	5.8	22.6	52.8	13.1	9.2	6.6
B. Sea	Odessa	11.2	8.0	6.0	13.2	23.3	9.3	7.4	5.4
Europe	Rotterdam	7.8	6.1	4.9	—	20.3	14.0	9.9	6.5
Asia	Osaka	9.5	16.6	38.6	4.7	5.5	5.1	7.8	9.4

52 voyages a year (Table 9.3(c)), spending only 137 days at sea and 211 days in port. This is quite a difference from the longest voyage from Ras Tanura (Saudi Arabia) to New Orleans (the LOOP oil terminal) which is 12,225 miles and takes 39 days for a single voyage. If the ship returns in ballast the round voyage takes 80 days so the ship will complete four voyages a year. No wonder analysts of the demand for oil tankers are very interested in whether the future trade growth will be from Africa to France or from the Middle East to the USA and whether refineries will be built close to the source of the crude! Finally, Table 9.3(c) shows the number of voyages completed per year at 13 knots.

How do you optimize transport logistics across this matrix? The four core variables in the maritime logistics model are distance, ship size, type and speed (see Figure 9.3). *Distance* is crucial because it affects cost and journey time. *Ship size* is important because bigger ships produce economies of scale and have lower unit costs per tonne on any route, but can enter fewer ports due to draft and length-overall constraints. In addition, on short-haul routes their economies are diluted because the ship completes more voyages and spends more time in port. They also deliver

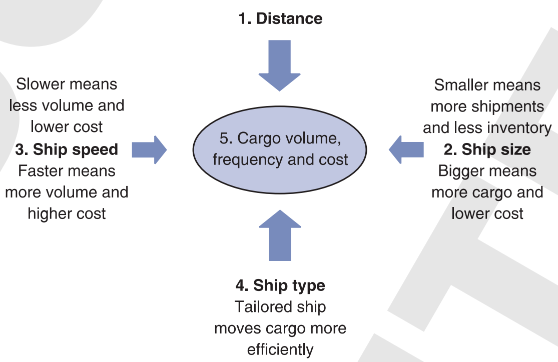


Figure 9.3
Four maritime logistics variables
Source: Martin Stopford, 2007

more cargo, which may be an issue. For example, a 300,000 dwt tanker (we discussed economies of scale in Chapter 2) delivers 1.25 million tons a year on the Arabian Gulf to USA route, but trading between the Arabian Gulf and Mumbai it transports 8.3 million tons a year. *Speed* determines the journey time, the bunker cost and the design of the ship. A 19-day transit from Los Angeles to Shanghai at 13 knots shrinks to 10 days at 24 knots, but fuel costs increase (see the discussion of the cube rule in Section 6.3); the 24 knot ship costs more; but it delivers more cargo by going faster, so there is a capital saving. Finally, ship *type* can affect logistical efficiency. A flexible ship can pick up a backhaul, for example carrying oil to New Orleans then loading a backhaul of grain to Japan. That would give an enormous increase in efficiency. Or a 39,000 dwt chemical parcel tanker with many 3,000 deadweight tanks could replace a fleet of 3,000 dwt vessels, increasing transport efficiency by grouping many small parcels in a big ship. But both these examples require all the links in the logistics chain to fit together, and the more links there are, the harder it is to achieve. Suppose you build the expensive flexible ship and the niche trade you had hoped to use disappears? Finally, it is a simple matter to develop a mathematical model relating the four variables to cargo volume, service frequency and unit cost. With such a model the service operator can develop the ideal logistics solution for the trade, for example using 22 knot, 3,000 TEU containerships on the shorter trades and 8,000 TEU, 24 knot vessels on the longer ones.

That is the theory, but reality is often less clear-cut. An example of the issues which shipping companies face in making these logistics decisions are those faced by liner companies in deciding how to route their Asia to East Coast North America container services. The first option is to ship their containers to West Coast North American ports and complete the journey to destinations on the US East Coast by rail or road. A second option is to sail direct to the US East Coast via the Panama Canal. Third, the carrier could sail direct to the US East Coast via the Suez Canal, with no call in Europe. In making this choice of routeing there are at least ten factors to be taken into account in arriving at the decision.[3] They are: (1) the level of freight rates on the trans-Pacific route and future rates which will depend on demand and capacity changes; (2) vessel size restrictions (the Suez Canal can accommodate post Panamax ships, whereas the Panama Canal cannot); (3) transit times and differences between the alternative routes; (4) Panama and Suez Canal tolls; (5) fuel costs (the Suez route is longer so bunker costs will be higher); (6) possible port disruption, a problem sometimes in certain areas, such as West Coast North America; (7) labour relations, which is related to the previous point; (8) the availability of container-ship capacity (if supply is short the focus will be on minimizing voyage time); (9) inland rail and road transport costs; (10) available capacity in key chokepoints. What this example demonstrates is that from the service operator's viewpoint shipping logistics is not a simple matter of optimizing the physical variables in Figure 9.3, possibly using a mathematical simulation model. That is the easy part. The much harder part is trading off the host of practical considerations which affect the variables in the model. How will canal charges develop? What about the risk of port disruption? Will it be possible to charter the right size of ship cheaply, or could charter rates escalate? These are the real questions which will determine service performance, and on many of them management will be guessing about what will happen. This is why they often fall back on the simple tried and tested practices in preference to optimization models which cannot really cope with these difficult-to-quantify variables. So logistics, like so many aspects of the maritime business, is as much an art as a science.

In summary, sea transport is a low-cost, high-volume business, preoccupied with small incremental savings that produce a competitive advantage – a little bit bigger, shallow draft, better cargo-handling gear, etc. – and it is through these small incremental changes that the market tackles this complex logistic task. This probably explains the technical conservatism which runs through the shipping business and the enthusiasm for; 'Handy' vessels which are cheap and versatile, a concept going back to the Dutch fly-boats of the sixteenth century, and tried and tested logistics solutions. Specialized vessels are all very well, and, as we see in Chapter 14, they have a role and shipping market, but operating specialized vessels usually goes much further than just owning ships. But there are no rules about this. It took a trucker, Malcolm McLean, to break the logistics mould of liner shipping and introduce containerization, a radically different logistics solution (see Chapter 13).

9.3 THE MARITIME TRADING NETWORK

At the heart of the maritime logistics model are the oceans and seas where the merchant ships operate. The Atlantic, the Pacific and the Indian Ocean cover 71% of the globe – 361 million square kilometres of the globe's surface area of 509 million square kilometres.[4] The Pacific is the largest, followed by the Atlantic, then the Indian Ocean. Each has a distinctive character and, as we saw in Figure 9.1, the trading centres are clustered in specific locations around the shores of the three oceans. In this section we will overview the three oceans to identify the main trading areas, the major ports and the distances. To keep the maps simple we focus on the big picture only, including just a few major ports as reference points for measuring distances – in Sections 9.4 – 9.9 we will include more detail about the economies, ports and trade. The distances shown on the maps are measured in days for a bulk carrier travelling at 13 knots.

The Atlantic maritime area

The main countries of the Atlantic and its associated seas, the Baltic, the Mediterranean, and the Black Sea, are shown in Figure 9.4, whilst the economic statistics of the larger Atlantic economies are presented in Table 9.4. It is well suited to sea trade, being S-shaped and narrow in relation to its length, so the distance between the industrial economies on either side is little more than 3,000 miles or about 10 days' steaming for a 13 knot bulk carrier or 5 days for a fast container-ship. However, the north–south distances are much greater: from Rotterdam to Montevideo or Cape Town is 6,200 miles or about 19 days' steaming for a bulk carrier. Because the continents on either side of the North Atlantic slope gently towards its shores, it is well served by navigable rivers which provide cheap transport into the interior of the continents. In fact the 5.8 million hectares of land which drain into the Atlantic is only 20% less than the 7.1 million hectares draining into the

Figure 9.4
The major countries of the Atlantic
Source: Martin Stopford, 2007

Table 9.4 The economies of the Atlantic trading countries 2005

Country	Size		Economic activity		Country	Size		Economic activity	
	Area m ha	Pop. million	GDP US$bill.	GNP/Cap US$		Area m ha	Pop. million	GDP US$bill.	GNP/Cap US$
1. North America									
Canada	998	32	1,115	34,844	Latvia	7	2	16	6,870
USA	937	297	12,455	42,007	Estonia	5	2	13	8,125
Total	1935	329	13,570	41,309	Lithuania	7	3	26	7,500
2. Caribbean & Central America					Poland	31	38	299	7,832
Mexico	196	103	768	7,456	Total	1786	157	1311	5,333
Guatemala	11	13	32	2,462	6. Mediterranean Sea				
Honduras	11	8	8	1,000	Turkey	78	73	363	4,973
Nicaragua	13	5	5	1,000	Greece	13	11	214	19,455
Costa Rica	5	4	19	4,750	Israel	2	7	123	17,571
Panama	8	3	15	5,000	Syria	19	19	26	1,368
Dominican Rep.	5	28	28	1,000	Cyprus	1			
El Salvador	2	74	17	230	Jordan	9	5	13	2,600
Trinidad & Tobago	1	15	15	1,000		122	115	739	6,426
Jamaica	1	3	10	3,333	7. Black Sea				
Puerto Rico	1	4	8	2,000	Georgia	7	5	6	1,422
Total	267	269	929	3,454	Bulgaria	11	8	27	3,455
3. E. Coast S. America					Romania	24	22	99	4,565
Brazil	851	186	794	4,269	Total	102	81	213	2,637
Venezuela	91	27	139	5,148	8. North Africa				
Colombia	114	46	122	2,652	Egypt	100	74	89	1,203
Uruguay	18	3	17	5,667	Algeria	238	33	102	3,091
Argentina	277	39	5	128	Tunisia	16	10	29	2,900
Total	1793	302	635	2,101	9 West Africa				
4. Western Europe					Morocco	45	30	52	1,733
Germany	36	82	2,782	33,927	Mauritania	103	3	5	1,800
United Kingdom	24	60	2,193	36,550	Senegal	20	12	8	667
France	55	61	2,110	34,590	Guinea	25	9	3	333
Italy	30	57	1,723	30,228	Sierra Leone	7	6	1	124
Spain	50	43	1,124	26,140	Liberia	10	3	1	333
Netherlands	4	16	595	37,188	Cote d'Ivoire	32	18	16	889
Belgium	3	10	365	36,500	Ghana	24	22	11	500
Norway	32	5	284	56,800	Nigeria	92	132	99	750
Denmark	4	5	254	50,800	Cameroon	48	16	17	1,063
Ireland	7	4	196	49,000	Gabon	27	1	8	8,000
Portugal	9	11	173	15,727	Congo	34	58	7	121
Total	256	354	11,799	33,331	Angola	125	16	28	1,750
5. The Baltic Sea					Namibia	235	6	2	333
Sweden	45	9	354	39,333	Total	825	332	258	778
Finland	34	5	193	38,600	10 South Africa	122	45	1,124	24,978
Russia	1708	143	764	5,333	Total Atlantic	7,860	2,107	30,837	14,636

Source: Compiled from various sources, including the United Nations

Regional groupings based on data availability. Not all trading countries are shown

combined Pacific and the Indian oceans. The North Atlantic is particularly well served, with the rivers Rhine and Elbe providing water transport deep into Europe and the St Lawrence and Mississippi deep into North America. The five associated seas, the Baltic, the Mediterranean, the Black Sea, the Gulf of Mexico and the Caribbean, also play an important part in trade, extending the coastline accessible to merchant ships.

In 2005 the Atlantic region had a population of 2.1 billion and $31 trillion GDP (see Table 9.4).

There is heavy maritime traffic in both directions across the North-Atlantic, with smaller North–South liner trades. Containers are now one of the most important trades, but there are also substantial movements of oil and raw materials, with exports of grain, coal, iron ore and forest products from North America. In the east, the Suez Canal provides access to the Indian Ocean, via the Red Sea, and the Panama Canal provides a short cut to the Pacific in the East. The Mediterranean Sea is an important trading area in its own right, and the Black Sea, entered through the Dardanelles, is a busy waterway which carries heavy tanker traffic from Russia and the Caspian. To the north the Baltic Sea gives access to north-eastern Europe, Scandinavia and Russia via the Gulf of Finland, whilst northern Russia can also be reached via the Norwegian Sea. North-western Europe is well endowed with ports, and the Rhine and the Elbe are navigable deep into the continent. These routes will become increasingly important as the trade of Russia and the Baltic states develops. On the other side of the North Atlantic, Hudson's Bay and the Great Lakes provide seagoing vessels seasonal access two thousand miles into North America, and the East Coast is well endowed with ports. In the south the Gulf of Mexico provides excellent sea access, leading to the Panama Canal and on into the Pacific Ocean. The St Lawrence, Mississippi and River Plate are all major trading highways.

The South Atlantic is less busy than the North. We can see from Table 9.1 that East Coast South America accounts for only 5% of world trade, and the west coast of Africa only 2%. Little of this trade moves across the South Atlantic between the two, and most of the ship movements are container services, raw materials for export and through-traffic.

The Pacific maritime area

The Pacific stretches from Balboa on the Panama Canal in the West to Singapore and the Straits of Malacca in the East, and it has a very different maritime character from the Atlantic. A map of the Pacific is shown in Figure 9.5 and some basic economic statistics of the larger countries can be found in Table 9.5. One obvious difference is size. The Pacific is twice as big as the Atlantic, occupying about one-third of the globe, so the distances are much greater. It is 10,300 miles from the Panama Canal in the East to Singapore in the West, and the Chinese coast where many of the busiest ports are located is 8600 miles or 27 days' steaming at 13 knots. But the map is visually misleading as the steaming times show. From Vancouver to Japan is half the steaming time of Balboa to Hong Kong.

The countries of the Pacific which trade by sea cover a smaller area than the countries of the Atlantic (2.7 billion hectares, compared with 7.9 billion hectares). In 2005 they had a similar population (1.9 billion compared with 2.1 billion) and roughly one-third of the GDP ($9.6 trillion compared with $31 trillion). China has half the region's population, with 1.3 billion people. Compared with the United States whose population is 297 million, China is a massive country, though the area of 9.6 million hectares is similar to the USA's 9.4 million hectares. Unlike the North Atlantic (and the Mediterranean in earlier times), the Pacific is not an ocean basin ringed by industrial economies. The 'rim' countries of West Coast America have little of the heavy industry

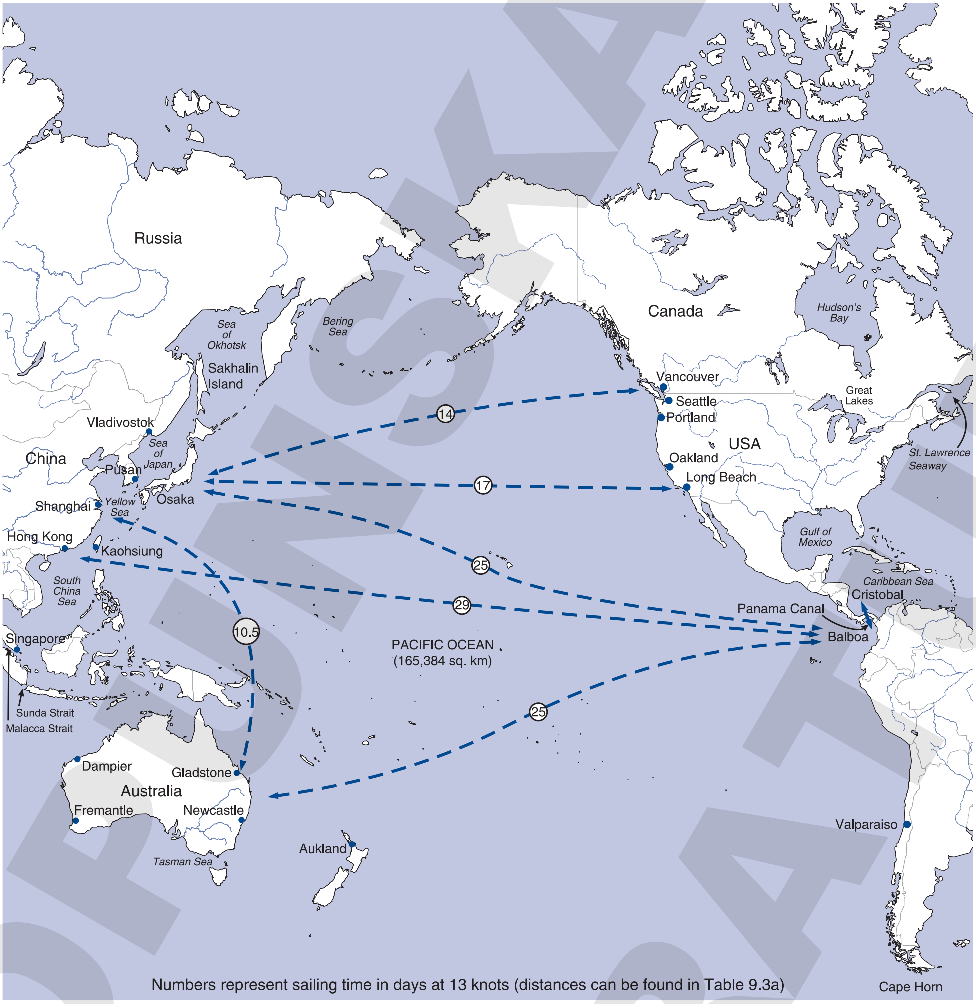


Figure 9.5
The major seas and ports of the Pacific Ocean
Source: Martin Stopford, 2007

which generates bulk trade, and most of the industry is found in a narrow 3,000 mile band stretching from the Sea of Japan in the north, through the South China Sea to the Straits of Malacca in the south (see Figure 9.5). This area, which has as coastal states Japan, South Korea, China, Hong Kong, Indonesia, Malaysia, Taiwan, the Philippines, Vietnam, Thailand and Singapore, generates seaborne inflows of energy, food and raw materials, matched by outflows of manufactured goods such as steel, vehicles, cement and general cargo. It also has the world's busiest concentration of container traffic. It has no geographical name, but for convenience we will refer to it as maritime Asia.

Table 9.5 The economies of the Pacific trading countries 2005

	Size			Economic activity		
Country	Area mill HA	Pop. million	Arable m. ha	GNP US$ bill.	GNP/Cap US$	Steel mt
Asia						
Japan	38	128	5	4,506	35,203	113
China	960	1,305	97	2,229	1,708	342
Korea, Rep.	10	48	2	788	16,417	48
Indonesia	190	221	22	287	1,299	3
Hong Kong	0	7	0	178	25,429	0
Thailand	51	64	20	177	2,766	1
Malaysia	33	25	5	130	5,200	1
Singapore	0	4	0	117	29,250	1
Philippines	30	83	8	98	1,181	1
Vietnam	33	83	6	52	N/A	0
Korea, PDR	12	22	2		N/A	7
Other	198		5			0
Total Asia	1556	1990	172	8562	4,303	517
Oceania						
Australia	771	20	47	701	35,050	6
New Zealand	27	4	0	109	27,250	1
Papua New Guinea	46	6	0	5	833	0
Other Oceania	9		1			0
Total	854	30	48	815	27,167	7
West Coast South America						
Ecuador	28	13	3	36	2,769	0
Bolivia	110	9	2	9	1,000	0
Peru	129	28	4	78	2,786	0
Chile	76	16	4	115	7,188	1
Total	342	66	13	238	3,606	1
Total Pacific	2752	2086	234	9,615	4,609	525

Compiled from various sources

Regional groupings based on data availability. Not all trading countries are shown

Finally, nestling in the South-west corner of the Pacific (Figure 9.5), about 3,000 miles from the South China Sea, is the region known as Oceania. This grouping includes Australia, New Zealand, Papua New Guinea and various small islands. Because Oceania has only 30 million inhabitants (less than some Chinese provinces) and is rich in natural resources it is one of the principal suppliers of raw materials and energy to maritime Asia, with major exports of iron ore, coal, bauxite, grain forest products and gas. In 2005 Oceania exported 618 mt of cargo and imported 88 mt. Iron ore (241 mt), coal (233 mt) and grain (22 mt) are the major exports, though wool, meat and a range of other primary commodities are also traded.

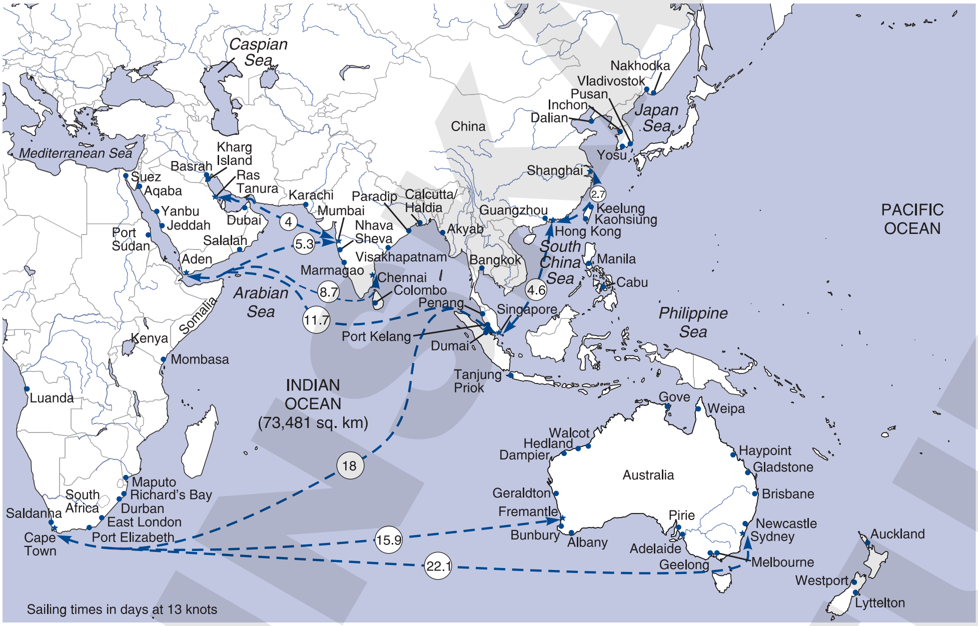


Figure 9.6
The major seas and ports of the Indian Ocean.
Note: Sailing times in days at 13 knots.
Source: Martin Stopford, 2007

The Indian Ocean maritime area

The Indian Ocean is bounded by India, Pakistan and Iran to the north, eastern Africa to the west, Antarctica to the south, and Australia and Indonesia to the east (Figure 9.6). The eastern boundary with the Pacific is generally drawn through Malaya, Indonesia, Australia and the South East Cape of Tasmania to Antarctica. The six seas of the Indian Ocean, which have a long history in seaborne trade, are the Red Sea, the Arabian Gulf, the Arabian Sea (between Arabia and India), the Bay of Bengal (between India and the Thai peninsula), the Timor Sea, and the Arafura Sea (between Australia and Indonesia).

The countries of the Indian Ocean have a land area of 4.3 billion hectares, which is 56% bigger than the Pacific (excluding North America). However, the Indian Ocean itself is more compact than the Pacific and distances on the East–West routes fall midway between the Atlantic and the Pacific. From Singapore to Aden at the entrance to the Red Sea is 3600 miles via the Malacca Straits and takes 12 days at 13 knots, whilst the Cape of Good Hope is 5600 miles and takes 18 days.

Starting at the bottom left of Figure 9.6, the East African coast has few deep sea ports. This stretch of coastline runs from South Africa up to the Red Sea, and includes

Table 9.6 The economies of the Indian Ocean trading countries, 2005

	Size			Economic activity		
Country	Area mill HA	Pop. million	Arable m. ha	GNP US$ bill.	GNP/Cap US$	Steel mt
S. Asia						
India	329	1,095	170	785	717	38
Pakistan	80	156	21	111	712	1
Sri Lanka	7	20	2	23	1,150	—
Bangladesh	14	142	9	60	423	0
Bhutan	5	1	0	1	1,000	—
Other	2		0			—
Total	515	1,414	213	980	693	14
Middle East						
Saudi Arabia	215	25	2	310	12,400	4
Iran	165	68	15	196	2,882	9
Kuwait	2	3	0	75	25,000	—
Yemen, Rep.	53	21	2	14	667	—
Qatar	1	0	0	7	18,450	1
Iraq	44		5			—
Oman	21	3	0		0	—
UAE	8	5	0		0	—
Other M.East	0		0			—
Total	510	129	25	624	4,825	14
East Africa						
Sudan	251	36	13	28	n/a	—
Mauritius	0	1	1	6	6,000	—
Somalia	64	1	1	8	8,000	—
Kenya	58	34	2	18	529	—
Madagascar	59	19	3	5	263	—
Djibouti	2	1	N/A	1	1000	—
Mozambique	80	20	3	7	350	—
Total	514	112	23	73	652	—
Total Indian Ocean	4359	1,751	322	2,730	1,559	258
Pacific & Indian Ocean Total	7,111	3,837	556	12,345		

Source: Compiled from various sources

Regional groupings based on data availability. Not all trading countries are shown

Mozambique, Tanzania, Kenya and Somalia. These countries have an area the size of South Asia, a population of 112 million, and a GDP of $73 billion (Table 9.6). Despite their size, none of these countries have strong economies or rich reserves of primary commodities, so the volume of trade is very small – only 9 mt of exports and 23.9 mt of imports in 2005. The only ports of any size are Maputo, Beira, Dar es Salaam, Mombasa, and Mogadishu. The volume of cargo through these ports is small, the facilities are primitive, and they have little impact on the shipping market as a whole, other than as a continuing source of work for small general cargo ships.

Moving east, we come to the Red Sea, a busy highway for traffic through the Suez Canal linking the Mediterranean and the Arabian Gulf. This is a remote location, 12,000 miles from the USA and 6,000 miles from Asia, flanked by Egypt and Sudan to the west and Saudi Arabia to the east. Turning right past the entrance to the Gulf we come to Pakistan, India, Bangladesh, Myanmar (Burma) and various smaller countries. These densely populated countries have an area of 0.5 billion hectares and a population of 1.1 billion. They produce 254 mt of cereals, much the same as the USA as well as 229 mt of coal and 57 mt of iron ore. However, most of these commodities never enter trade, and India's GDP of $785 billion in 2005 was relatively low, about the same as South Korea's $788 billion. About half of the import volume is crude oil and oil products, since domestic reserves are very limited. There are sizable exports of iron ore from India.

India has 11 major sea ports: Kandla, Mumbai, Nhava Sheva, Marmagao, New Mangalore, and Kochi on the west coast, and Kolkata-Haldia, Paradip, Vishakhapatnam, Chennai, and Tuticorin on the east coast. The volume of trade is moderate and Mumbai, Vishakhapatnam, Chennai, and Marmagao are the most important ports in terms of cargo tonnage. Bulk cargo is dominated by iron ore exports from Marmagao, crude oil imports and oil products exports.

The Suez and Panama canals

Finally, we must consider those two great works of engineering which provide short cuts between the oceans, the Suez Canal and the Panama Canal. The Suez Canal, which opened in 1869, links the Red Sea at Suez with the Mediterranean at Port Said, providing a much shorter route between the North Atlantic and the Indian Ocean than the alternative route round the Cape of Good Hope. For example, the Suez Canal reduces the transit distance from Rotterdam to Mumbai by 42%, and to Singapore by around 30%. Other examples of the saving in distance are shown in Table 9.7. It can accommodate vessels with beam up to 64 metres and draft up to 16.2 metres, which in practice means tankers up to 150,000 dwt fully loaded and 370,000 dwt in ballast. The canal is 100 miles long and transit takes 13–15 hours. Tolls are charged in US dollars based on the Suez Canal net tonnage of the ship, with separate rates for laden and ballast voyages (the Suez Canal net tonnage of a vessel roughly corresponds to the cargo carrying below deck space, though it is not directly comparable with the gross or deadweight tonnage. It is calculated by either the classification society

Table 9.7 Distances saved by using Suez Canal (miles)

	By Cape	By Canal	Saving
Rotterdam to:			%
Mumbai	10,800	6,300	42%
Kuwait	11,300	6,500	42%
Melbourne	12,200	11,000	10%
Calcutta	11,700	7,900	32%
Singapore	11,800	8,300	30%
Marseilles to:			
Mumbai	10,400	4,600	56%
Melbourne	11,900	9,400	21%
New York to:			
Mumbai	11,800	8,200	31%
Singapore	12,500	10,200	18%
Ras Tanura	11,765	9,543	19%

or an official trade organization which issues a Suez Canal Special Tonnage Certificate).

The Panama Canal, an even more challenging engineering feat, was opened in 1914, shortening the distance from the Atlantic to Pacific by 7,000–9,000 miles. It runs 83 kilometres from the Atlantic at Cristobal to the Pacific at Balboa, through a mountain range. Ships entering from the Atlantic sail down a channel to Gatun Locks where the ship is lifted to Gatun Lake. After crossing this lake the ship enters Gaillard Cut and runs about 8 miles to Pedro Miguel where another lock lowers it to a small lake. Across this lake at Mira Flores two more locks lower the vessel to the Pacific Ocean. A vessel of medium size can pass through the canal in about 9 hours and a transit booking system allows transit slots to be reserved. Although the nominal draft restriction is 11.28 metres (37 feet), the water level varies from 35 feet during droughts to 39 feet during wet spells. This means that a 65,000 dwt Panamax beam bulk carrier with a 43 foot draft cannot transit the canal fully loaded – the average bulk carrier with a draft of 37 feet is 40,000 dwt. Bigger ships often load part cargoes. The transit charges for the Panama Canal are based on a fixed tariff per (Panama Canal) net ton for vessels transiting laden and in ballast. In September 2007 work started on an eight-year project to develop the canal locks to accommodate vessels 427 metres long, 55 metres wide and 18.3 metres deep.

9.4 EUROPE'S SEABORNE TRADE

Europe, still one of the world's biggest trading regions, splits into three main areas which are defined in Table 9.4 as Western Europe, the Baltic Sea and the Mediterranean Sea. Western Europe accounts for 23% of world imports and exports, whilst Russia and Eastern Europe account for another 3% (see Table 9.1). This makes its trade twice the size of that of North America. Over the last 40 years exports have grown more consistently than imports which stagnated in the early 1970s, fell in the early 1980s and then resumed low growth (Figure 9.7).

In 2005 Europe imported 2.1 billion tonnes of cargo and exported 1.2 billion tonnes, explaining why European companies play a leading part in the shipping industry, owning 42% of the world fleet. Europe's importance in trade is explained

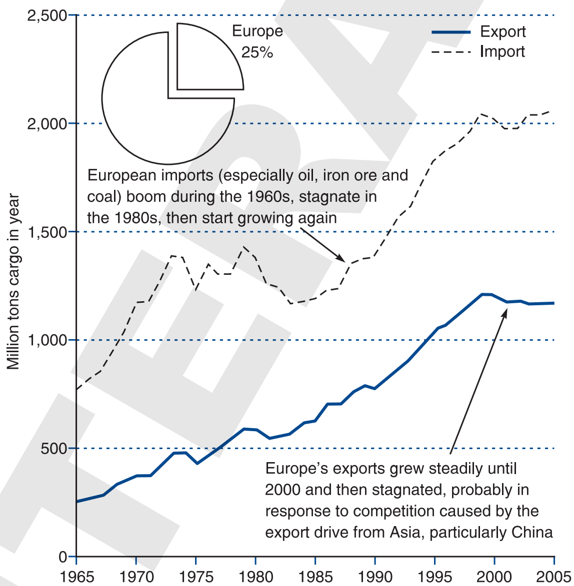
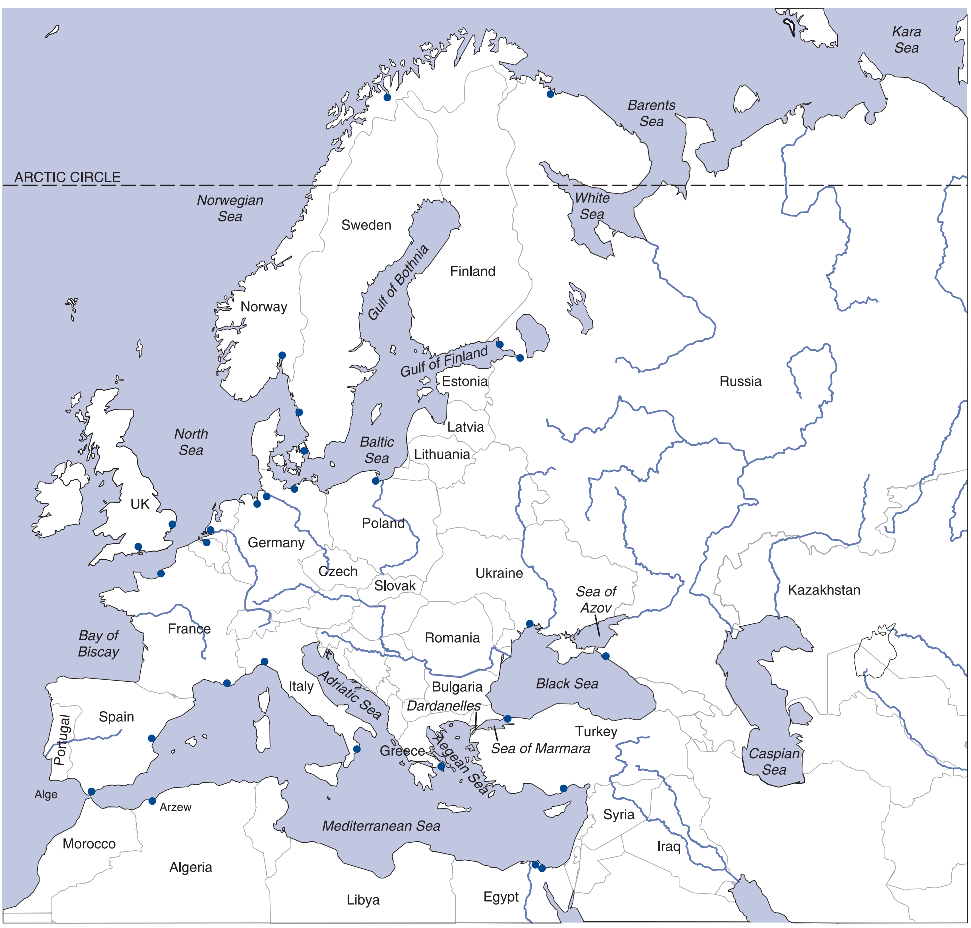


Figure 9.7
Europe's seaborne trade
Source: United Nations and UNCTAD

by its developed economy and large population which stretches its domestic resources, with the result that the region relies heavily on trade. The population of 353 million (excluding the Baltic, Mediterranean and Black Sea countries) produced a GDP of $11.8 trillion in 2005. The cereals crop is typically about 260 mt, slightly less than North America. Through intensive agriculture and protectionist policies the European Union region has achieved self-sufficiency, with a small exportable surplus. Although Europe was originally well endowed with all the major raw materials except bauxite, reserves are now depleted and expensive to produce.

Europe is very effective as a maritime area, with water on all sides except the border with Russia, as Figure 9.8 clearly shows. The west coast faces the Atlantic Ocean, with the Baltic Sea to the north, the Mediterranean Sea to the south and the Black Sea to the east. With so much water, maritime transport plays a major part in its economy; the economic data for these areas can be found in Table 9.4. Starting in the far north-east corner



of Figure 9.8, we find the north coast of Russia and Scandinavia. Narvik, the most northerly port, exports iron ore, and the opening of Russian oil trade in the 1990s gave Murmansk a new significance. Russia and eastern Europe, only account for about 3% of seaborne trade, but this is an important area of development and change. The opening up of the countries in this region to the global economy and free trade flows was a tremendously important development, given its geographical size and resource base.

Moving south, the Baltic ports handle the trade of Finland, Russia, the Baltic States (Latvia, Lithuania and Estonia), Poland, northern Germany and Sweden. The break-up of the Soviet Union changed the pattern of trade with these states, and the Gulf of Finland in the north Baltic gives sea access to the Russian ports. Forest products, oil, coal and general cargo are shipped through the ports of St Petersburg, Ventspils, Primorsk, Gdansk, Rostock, Świnoujście, Stockholm and Malmö. Moving south, Hamburg and Bremen, located on the rivers Elbe and Weser, serve Germany and its hinterland. These are important bulk ports, handling grain, fertilizers, steel and motor cars, but in recent years their real prominence has been in the container trade.

Europe's north-west coast is one of the busiest shipping areas in the world, with major ports at Hamburg, Bremen, Antwerp, Rotterdam and Le Havre. The Rhine, which is navigable by 2,000 ton barges for 800 km from Basel, enters the North Sea at Rotterdam. The Rhine handles over 500 mt of cargo a year, and Rotterdam is Europe's largest port. It is located on the New Rotterdam Waterway and the New Meuse, and the port itself is subdivided into three main areas, Maasvlakte at the entrance, Europoort and Botlek. Each contains a network of deep water specialist terminals, handling oil, grain, coal, forest products, motor vehicles, and petrochemicals. This is also the principal route for containers moving into Europe. In 2006 Hamburg handled 8.1 million TEU of containers, Bremerhaven 3.7 million TEU, Rotterdam handled 9.6 million TEU, while nearby Antwerp handled 6.5 million TEU. Le Havre is France's main northern port, handling 2.1 million TEU of containers, while the United Kingdom is served by Felixstowe, Southampton and Tilbury.

The ports of Mediterranean Europe serve the industrial areas in eastern Spain and the industrial belt running from Marseilles through to Trieste in Northern Italy. Marseilles, Genoa and Trieste are all important ports, handling grain, iron ore, oil, minor bulks and containers. The biggest container terminals are at Algeciras in southern Spain (3.2 million TEU in 2006) and Genoa in Italy (1.4 million TEU in 2006). Ten countries occupy the eastern and southern coasts of the Mediterranean (see Table 9.4), with GDP of about $1 trillion and a population of 238 million. This is a growing area for trade, with exports of oil, minerals and containers. Finally, the Black Sea provides sea access to southern Russia, Georgia, Ukraine, Bulgaria and Romania. It has a busy export trade for oil shipped from Russia and Kazakhstan.

In conclusion, western Europe is a major influence on the shipping market, still generating a large volume of seaborne trade. With the maturing of the economy the growth has moved from raw material imports to a more balanced trade in manufactures and semi-manufactures.

9.5 NORTH AMERICA'S SEABORNE TRADE

North America, which includes Canada and the USA, accounted for 12% of world seaborne trade in 2005, and its import trade grew from 294 mt in 1965 to 1124 mt in 2005, whilst exports are lower, increasing from 232 mt to 598 mt (Figure 9.9). It is the world's largest economic region, with a population of 329 million and a GDP in excess of $13.6 trillion, a quarter of the world's GDP. With a total area of 1.9 million hectares, it is eight times the size of western Europe. In 2006 the USA produced 100 mt of steel, 329 mt of cereals, 368 mt of oil, 951 mt of coal, 509 billion cubic metres of natural gas and 55 mt of iron ore. As one of the world's richest areas, the North American market for manufactures has grown rapidly and imports of motor vehicles and a wide array of containerized consumer goods have increasingly been supplied by Europe and the Far East.

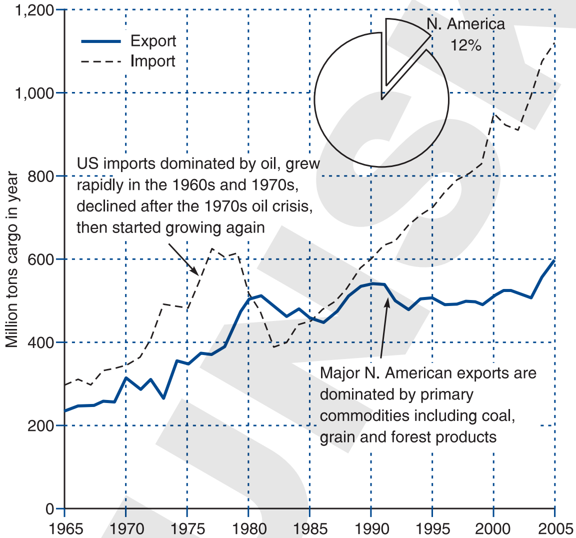
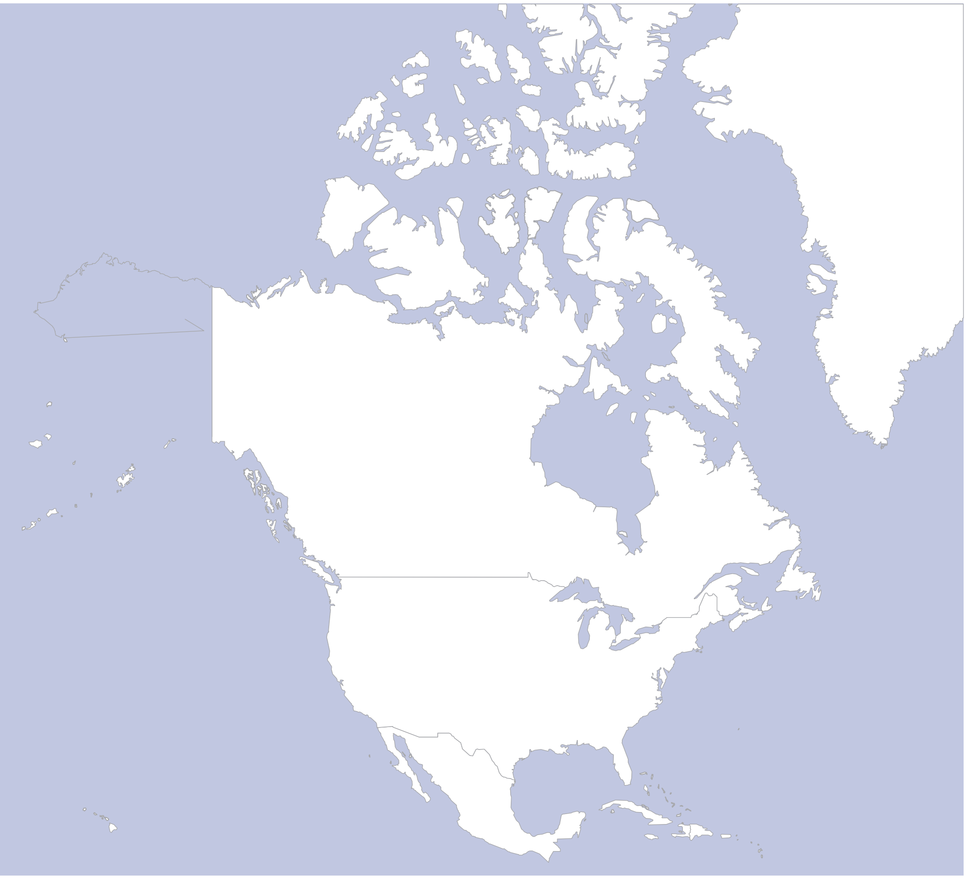


Figure 9.9
North America's seaborne trade
Source: United Nations and UNCTAD

Geographically North America falls into three areas – a hilly eastern strip where much of the heavy industry is located around the coal and iron ore fields near Chicago and Pittsburgh; a flat central area given over to farming, particularly grain; and a mountainous West, with the Rocky Mountains dividing the Pacific coast from the rest of North America (Figure 9.10). The central area and East Coast are served by two major waterways, the Great Lakes and the Mississippi-Missouri. In the north the St Lawrence Seaway, which stretches from Montreal to Lake Erie, gives access from the North Atlantic 2340 miles (3766 km) into the heartland of Canada and USA. In addition to providing an export route for grain, the lakes provide local transport for the heavy industrial belt of Pittsburgh, Chicago and Detroit. However, the locks can only handle vessels of about 32,000 dwt[5] and the navigation season is limited by ice to the period from April to early December; so much of the bulk cargo is transhipped at ports in the St Lawrence. The Mississippi and its tributaries give the central area, including most of the grain belt, water access to the US Gulf. The river system carried 615 mt of cargo in 2005, of which 150 mt was in foreign trade. Two intracoastal waterways link the US Gulf with the East Coast, extending from Boston, Massachusetts, to Key West, Florida, with many sections in tidal water or in open sea.[6]

Depletion of domestic oil reserves means that crude oil and products are the most important import, along with containers. Dry bulk exports include coal, grain, forest products, sulphur and various minor bulks such as steel scrap. North America is the world's largest grain exporter, with production from two grain belts running through the US Midwest and the Canadian Prairies, and the grain is exported through the Gulf, the Great Lakes or the Pacific Coast. Coal, mainly from Appalachian coalfields on the East Coast and Canadian coalfields in the west, is exported through ports such as Norfolk and Hampton Roads or US Gulf in the East and Vancouver in the West. Forest products are mainly shipped from the north-western ports, particularly Vancouver and Seattle, using container-ships or open hatch bulk carriers.

The locations of the main North American ports are shown in Figure 9.10. In the far north-east the port of Churchill in Hudson Bay lies close to Canada's western grain



production, though the shipping season is limited by ice to July–October. Moving south, several important bulk ports are located in the Great Lakes and Thunder Bay and Duluth at the head of the Great Lakes handle grain exports and steel products. At the mouth of the St Lawrence Sept-Isles and Baie-Comeau are navigable all year and handle grain trans-shipment, iron ore and a wide range of other trades. To the south are Boston, New York, with its New Jersey container terminal, Philadelphia, Baltimore, Hampton Roads, Morehead City, Charleston and Savannah. Since this is a busy industrial area, all these ports have frequent container services. The largest in 2005 were New York (4.8 million TEU), Hampton Roads (2.0 million TEU) and Charleston (2.0 million TEU). The main bulk export volume is coal, shipped from Hampton Roads and Baltimore. All these ports have draft restrictions which mainly limit access to vessels of 60,000–80,000 dwt, thus excluding the largest bulk carriers and tankers.

Heading south from Jacksonville, we turn right into the US Gulf and come to Tampa, a cruise and container port, with some bulk trades such as steel. Beyond Tampa a string of oil and chemical terminals stretches along the Gulf, starting with the Louisiana Offshore Oil Port (LOOP) off New Orleans, Houston, Galveston and Corpus Christi. For historical reasons the US refinery and gas distribution systems centre on this area where imported oil is refined and distributed through a network of barge and pipeline services. The LOOP is located off the Louisiana coast near Port Fourchon and is the only deep water oil terminal in the USA capable of handling VLCCs, though lightering areas offshore allow VLCCs to be used in the trade and discharged into smaller tankers for delivery to the other more restricted terminals in the Gulf. Lightering is a way of delivering cargo in ships too big to access local terminals. The cargo is transferred from the large ships to smaller ships or barges which can access local terminals, usually in designated offshore zones. The LOOP handles about 1.2 million barrels a day, and connects by pipeline to 35% of the US refining capability. The Gulf is also an important export route for bulk cargoes. The Mississippi provides water transport deep into the continent carrying exports of coal and grain. Eleven grain export elevators capable of loading seagoing ships are strung along the river as far inland as Baton Rouge. Houston, the largest Gulf port, handles oil, grain, containers and chemicals.

Access to the West Coast of North America from the US Gulf requires a lengthy detour through the Panama Canal, and it has a very different maritime character. It is divided from the rest of the continent by the Rocky Mountains, with no major navigable rivers, so inland cargo mainly travels by rail or road. In the far north Valdez, the USA's most northerly ice-free port, is the export terminal for Alaskan crude oil, whilst Anchorage handles general cargo. Further south, Prince Rupert handles moderate quantities of Canadian grain exports, with the main traffic going through the port of Vancouver, located on the mainland opposite Vancouver island and handling about 80 million tons of cargo a year, mainly Canadian exports of coal, grain, forest products, potash and other minerals such as sulphur and 2.2 million containers in 2006. There are major coal-handling terminals at Roberts Bank and Neptune Terminals, and many smaller specialist terminals. Seattle, located 100 miles to the south, fulfils a similar function for the United States, with major exports of grain and forest products. It also has a large container terminal with shipments of 2 million boxes in 2006 as does Tacoma, a few miles to the south, which also lifted 2 million TEU in 2006. The fourth major port in this northern area is Portland, which handles grain and some container traffic. Further south, California's ports of Oakland, San Francisco and Los Angeles (Long Beach) all serve this thriving West Coast economy. There is some bulk cargo and oil into San Francisco and Los Angeles, but the main trade is container traffic. Oakland shipped over 2.4 million TEU in 2006. The main ports of California are San Francisco and Los Angeles, which service the rapidly growing economy of the south-western United States. These ports have facilities for handling imports of crude oil, vehicles and steel, and there are also major container terminals in Los Angeles and Long Beach. Both ports handled over 7 million containers a year, placing them in the top 20 container ports world-wide in 2006.

9.6 SOUTH AMERICA'S SEABORNE TRADE

South America has a very different trading pattern from North America. It is still mainly a primary producing region, generating about 974 mt of exports and 368 mt of imports each year, as shown by the graph in Figure 9.11. Over the last 40 years exports have followed a volatile path upwards, more than doubling between 1985 and 2005, whilst since the early 1970s imports have grown slowly. Broadly speaking, the region falls into three parts: the Caribbean and Central America; East Coast South America; and West Coast South America. Each has a very different character. The countries are shown in Figure 9.12 and their economic data in Table 9.4.

The Caribbean and Central America region starts with Mexico in the north, takes in the Caribbean islands and stretches down the coast-line to Belize, Honduras, Nicaragua, Costa Rica and Panama. The population of 269 million in 2005 and GDP of about $0.92 trillion, less than one-tenth the size of North America, is spread among many islands and the coastal states ringing the southern shores of the Gulf of Mexico.

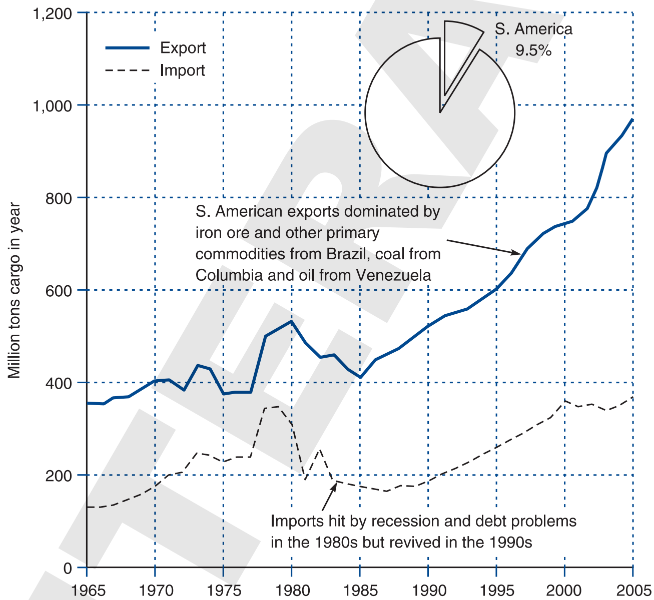


Figure 9.11
South America's seaborne trade
Source: United Nations and UNCTAD

Figure 9.12
The main countries and ports of South America
Source: United Nations and UNCTAD

The main export trade is Mexico's oil mainly to the US Gulf and to a lesser extent Europe. Its oilfields were developed in the 1970s and 1980s and are now maturing. The oil is shipped principally from the port of Coatzacoalcos on the southern Gulf, which is the focal point for the seven major oilfields of Mexico. Other Caribbean exports are bauxite from Jamaica, crude oil imported by refineries in Trinidad and Tobago and Netherlands Antilles for refining and on shipment to the United States, sugar from Cuba and bananas.

Like North America, South America is split in two by a high mountain range, the Andes, which runs from north to south along the western coast, splitting it into two regions, East Coast South America and West Coast South America. Using the UNCTAD regional definitions, East Coast South America stretches along the Atlantic coast from Venezuela, Guyana and Surinam in the north through Brazil to Argentina in the south. With an area of 1.8 billion hectares and a population of

302 million, it is the same size as North America and drains into the Atlantic through three major river systems, the Orinoco, the Amazon and the River Plate. It is, however, a much smaller economy. South America's GDP of $0.6 trillion is only 5% of North America's. With so much space and so little economic activity, we would expect primary exports to predominate, and this is exactly what has happened. The trade of this very long coastline is dominated by exports of raw materials and semi-manufactures.

In 2005 East Coast South America exported 558 mt of cargo and imported 153 mt. Dry cargo exports of 393 mt were made up of iron ore from Brazil and Venezuela, and smaller quantities of coal, crude fertilizers, forest products, minor ores and crude minerals such as salt. A declining trend in oil exports was largely offset by a moderate increase in dry cargo. Brazil is the world's leading exporter of iron ore, and during the 1960s and 1970s developed iron ore deposits served by deep-water export terminals. Iron ore exports have grown from 7 mt in 1963 to 249 mt in 2006, accounting for over one-third of the global iron ore trade. The main iron ore export ports are Tubarão, Ponta do Uba, Sepetiba Bay and Ponta da Madeira. The area is well served by liner services linking it to North America, western Europe and Asia.

West Coast South America forms a thin coastal strip running from Columbia and Ecuador in the north, through Peru to Chile, which occupies over half its length. Its area is only 342 million hectares (see Table 9.5) with a population in 2005 of 66 million and GDP of $238 billion (about the same as Denmark), so it is much smaller than East Coast South America. The ports on this coast are relatively small, with few major primary commodity exports, so the volume of trade is restricted to servicing the local semi-industrial economy. In 2005 the region exported 152 mt of cargo and imported 56 mt. The main container ports are at Guayaquil, the principal port of Ecuador, Callao, the principal port of Peru, and Valparaiso and San Antonio, the principal ports of Chile. The biggest export is coal from Columbia, which has the largest coalmining operation in Latin America, El Cerrejón Norte. The mine is connected by a 150 km railway to Puerto Bolivar on Columbia's Caribbean coast, and unit trains are used to transport crushed coal from the mine to the port, which can handle 150,000 dwt ships.

9.7 ASIA'S SEABORNE TRADE

Geographically Asia stretches from Japan in the north down to Indonesia in the south and to India and Pakistan in the west (see Figure 9.13). Economically these countries cluster into four groups. The first consists of Japan and its near neighbour, South Korea. They are mature industrial economies, each supporting a major concentration of maritime activity, including two-thirds of the world's shipbuilding capacity. Second, China has a long coastline stretching from Dalian to Shenzen. Third, we have Thailand, Cambodia, Vietnam, Singapore and the Malacca Straits leading to the Indian Ocean (note that India and Myanmar are also included in the trade statistics in Figure 9.14). Finally, on the southern side of the China Sea are the heavily populated

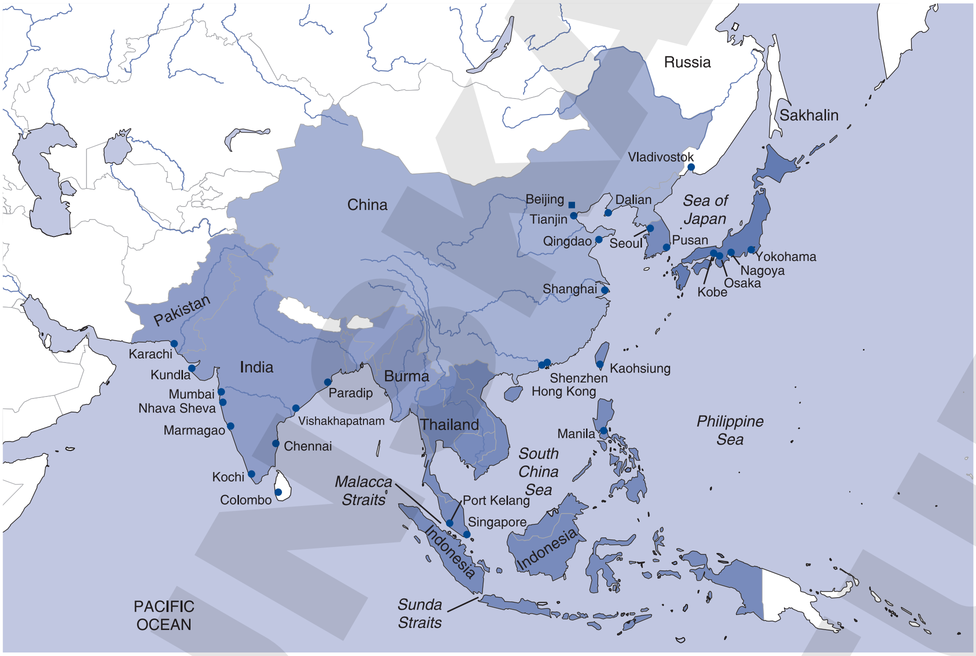


Figure 9.13
The main seas and ports of South and East Asia
Source: United Nations and UNCTAD

islands of Malaysia, Indonesia, and the Philippines. Taken together, Asia is the world's largest seaborne trading area, importing 2.9 billion tons of cargo in 2005 and exporting 1.6 billion tons, 50% more than western Europe. It is also growing rapidly (see Figure 9.14). The region covers 1.6 billion hectares, two-thirds of which is China, and in 2005 had a population of 2 billion and GDP of $8.6 trillion, of which half was Japan.

Between 1990 and 2005 Asia's exports trebled and imports doubled. The region is clearly moving through the material-intensive stages of the trade development cycle, a fact which becomes more apparent as we review the individual economies. The graphs of imports and exports in Figure 9.14 split the region into three parts – Japan, China and southern and eastern Asia. All three are net importers of energy, food and raw materials, with corresponding outflows of manufactured goods such as steel, vehicles, cement and general cargo.

Japan

In 2005 Japan was the biggest economy in Asia with GDP of $4.5 billion, though China, still half this size, was catching up. Its seaborne imports of 832 million tons were also the largest, though again China was not far behind. Supporting this trade is an extensive

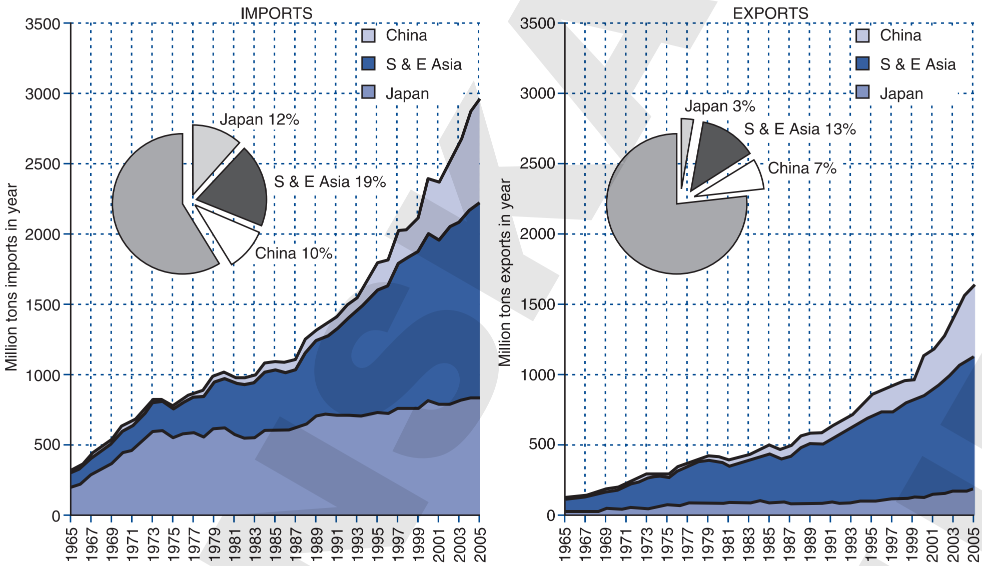


Figure 9.14
Asia's seaborne trade, 1965–2005
Source: United Nations and UNCTAD

industrial base. In 2006 Japan produced 115 mt of steel compared with 170 mt in western Europe and 100 mt in the United States. All the iron ore and coal for steel-making is imported, along with many other raw materials, including steam coal, oil, forest products, grain, non-ferrous metal ores and manufactures. Over the last 30 years Japan has been through a trade development cycle during which imports grew very rapidly during the 1950s and 1960s, reaching a peak of 588 mt in 1973. This was followed by a slump to 550 mt in 1983 after which growth resumed, though by 2005 imports had only edged up to 832 mt, an average growth rate of only 1% per annum. Of this total about two-thirds was iron ore, coal and crude oil. Export growth was more rapid, averaging 6% per annum between 1990 and 2005. Most of the export trade is manufactures and heavily concentrated in liner and specialist bulk cargoes, featuring motor cars, steel products, capital goods and the consumer goods for which the Japanese economy is famous.

All of the major Japanese ports are located in the industrial belt of Tokyo and Osaka-Kobe. In terms of cargo handled the biggest ports, shown in Figure 9.13, are Yokohama, Kobe, Nagoya, Osaka and Tokyo. These ports have many private terminals owned by the manufacturing companies. Yokahama is typical and its cargo gives a fair idea of the types of goods going through Japanese ports. In 2007 it handled about 90 mt of foreign cargo, with 43 mt of exports and 47 mt of imports. The imports include 6 mt of grain, 7 mt of crude oil, 6.5 mt of LNG and about 1.5 mt each of oil products, paper and pulp, processed foodstuffs, clothing, furniture, electrical machinery, non-ferrous metals, fruit and vegetables and animal feed. The exports included 14 mt of cars, 5 mt of auto parts, 5 mt of industrial machinery, 2 mt of chemicals, 1 mt of scrap and 1 mt of rubber products.

China

In the 1990s, after five decades of virtual isolation, China emerged as the dominant maritime force in Asian trade. With a population of 1.3 billion and GNP in 2005 of $2.2 trillion growing at 9% per annum, it had an enormous impact on the maritime industry both locally and internationally. In 1990 China imported 80 mt of cargo by sea, but by 2006 imports had increased tenfold to 801 mt, and China's share of world seaborne trade increased from 1% to 10%.

Industrial activity is mainly in the coastal strip, particularly around Shanghai and Canton. Imports are resource-intensive, and 40% was associated with the steel industry and 21% with the oil industry. In 2001 China's steel production was 151 million tons, about the same as that of the European Union, but by 2006 it had reached 414 million tons, accounting for one-third of global steel production, having added capacity equivalent to that of the EU and Japan in just five years. Such rapid growth was based on a business model which was very different from the one used by Japan and South Korea in previous decades. In the 1990s the Chinese government adopted a development strategy based on a blend of state industry and private enterprise. This proved a powerful combination. Overseas investors provided technology, management skills and direct inward investment in joint venture companies which took advantage of China's low labour costs. The result was a rapidly growing export trade, mainly containerized, and a substantial trade surplus. Meanwhile the government sponsored a major infrastructure development programme spread across the provinces, designed to give the country the accommodation, roads, railways and port infrastructure needed to support economic growth. On the raw materials front China has substantial coal reserves amounting to 13% of the world total and relies mainly on coal for energy. Production was 2.2 billion tons in 2006. The country is less well endowed with oil, producing 3 million barrels per day from mature oilfields in the North West.

China has more than 40 ports, of which the biggest are Dalian, Tianjin, Shenzhen and Shanghai. Shanghai, located at the mouth of the Yangtze River, has the highest cargo volume, handling 537 million tons in 2006 and 21.7 million container lifts, making it one of the world's largest container ports. Dalian is now the largest petroleum port in China, and also the third largest port overall, handling 140 million tons of cargo in 2006. It is a natural harbour located on the southern tip of the Liadong Peninsula. Its oil terminal is at the terminus of an oil pipeline from the Daqing oilfields, and Dalian is a major centre for oil refineries, diesel engineering and chemical production.

Situated in the south of the Pearl River Delta in China's Guangdong province, Shenzhen Port is adjacent to Hong Kong. In 2004, the cargo throughput was 135 million tons, with 88.5 million tons of foreign trade. In 2006 the container throughput was 18.66 million TEU. The other major container port is Qindao. Major iron ore ports include Tianjin and the nearby Xingang, Qindao, Beilun, Dalian and Guangzho. Oil is mainly shipped in through Qindao, Huangpu, Xiamen and Tianjin.

Southern and eastern Asia

In 2005 southern and eastern Asia[7] handled 934 mt of exports and 1384 mt of imports, making it a major maritime area. Between 1990 and 2005 exports grew by 5.3% per annum and imports by 6.1%, so the region is growing considerably faster than total sea trade. It is a region Adam Smith would have considered ideal for sea trade. The coastline stretches through 18 countries (see Figure 9.13) mainly strung out along the bottom of the Asian continent, stretching from Indonesia in the east to Pakistan in the west. South Korea, something of an out-rider, lies to the north; India and Pakistan to the west; and the islands of Indonesia and Malaysia to the south. Singapore lies roughly at the centre. It is hard to imagine an arrangement better suited to seaborne trade. The trading countries spread around the shores of the South China and East China Seas have large, often well-educated, populations, but limited natural resources. Sea transport provides the coastal cities with easy access to materials and markets, without the need for major investment in transport infrastructure. The positions which Singapore, located at the southern tip of the Malaysian Peninsula, and Hong Kong, situated off southern China, have built up as trading and distribution centres echo the success of the city-states of Antwerp and Amsterdam in the growing North Atlantic trade and Venice and Genoa in the Mediterranean. In 2006 they were the world's two largest container ports, lifting over 23 million TEU in the year.

At the north-easterly end of the trading area lies South Korea. With a land area of 10 million hectares and GDP of $788 billion in 2005 it is about one-third the size of Japan. South Korea developed its economy in the 1970s using a model which closely matched the growth of Japan twenty years earlier. Like Japan, South Korea focused on steel, shipbuilding, motor vehicles, electronics and consumer durables, relying on aggressive export marketing of these manufactures to pay for imported raw materials and energy. Also like Japan, development was controlled by a few very large corporations, with close government involvement. The major ports of South Korea are Pusan, situated on the south-east corner of the Korean Peninsula, and Ulsan, situated 60 miles north. Pusan is the principal port of South Korea, handling about 100 million tons of cargo each year. Pohang is the cargo-handling terminal of the Pohang Steelworks (POSCO).

The remaining countries in the region are less developed. Vietnam is only just moving into the development cycle, but Thailand has a small but rapidly growing economy. Strung along the south-western boundary are Indonesia, Malaysia, the Philippines and Taiwan. However, to the west India with its population of 1.1 billion people and GDP of $785 billion in 2005, about one-third the size of China, is an area of potential growth and development in the coming decades. There is a major crude oil export trade from Indonesia and dry cargo exports include substantial quantities of forest products from Indonesia and the Philippines, and various manufactures and semi-manufactures.

9.8 AFRICA'S SEABORNE TRADE

Africa (see Figure 9.15) is a large continent covering 1.8 billion hectares, but its trade is smaller than might be expected from such a large continent. It is a poor region of the world, and in 2005 GDP was $758 per capita. Forty countries are engaged in seaborne trade, and in 2005 they imported 258 mt of cargo and exported 602 mt, accounting for 6% of world trade, split between North Africa (346 mt), West Africa (248 mt), East Africa (36 mt) and South Africa (211 mt) as shown in Table 9.1. Primary commodities dominate exports and three-quarters of the export cargo is oil from Algeria, Libya, Nigeria and Cameroon. Dry cargo exports are composed principally of iron ore, phosphate rock, bauxite and various agricultural products. Between 1990 and 2005 the trade volume of both imports and exports grew slowly at about 1% per annum, as shown in Figure 9.16.

West Africa stretches from Morocco in the north to Namibia in the south. The area covers 825 million hectares, three times the size of Europe, with a population of 258 million (see Table 9.4). To put this into perspective, their combined GDP was

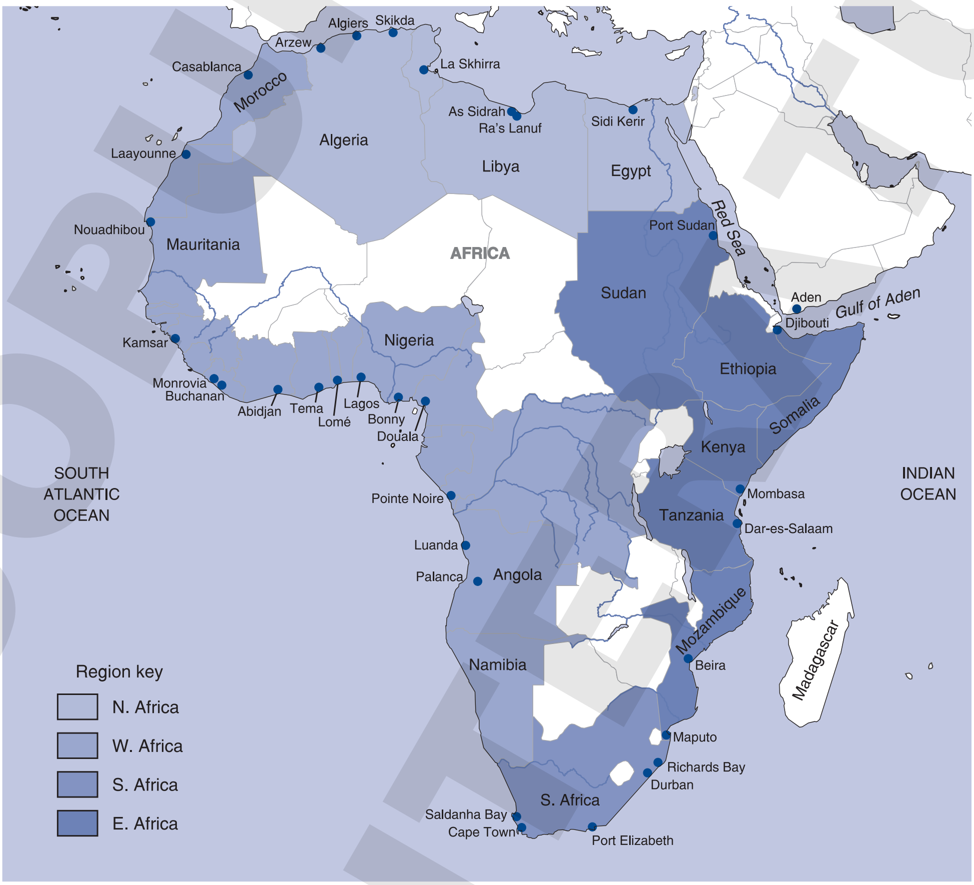


Figure 9.15
The main seas and ports of Africa
Source: United Nations and UNCTAD

$258 billion in 2005, the same as Denmark, and the average income was $778 per capita. As we would expect, the trade volume was also relatively low, accounting for 2% of the world total. In 2005 West Africa exported 218 mt of cargo and imported 50 mt. Two-thirds of the export cargo is oil from Nigeria. The remainder is dry cargo exports, mainly iron ore (Mauritania), phosphate rock (Morocco), bauxite (Guinea) and various agricultural products.

North Africa stretches from Egypt to Algeria, and the four countries have an area of 254 hectares and GDP of $220 billion. The average income in 2005 was over $2,000 per capita, much higher than West Africa, and Libya, a major oil exporter, had an income of $6500 per capita, making it one of the wealthiest countries in Africa. In terms of shipping North Africa exported 204 mt in 2005 and imported 142 million tons.

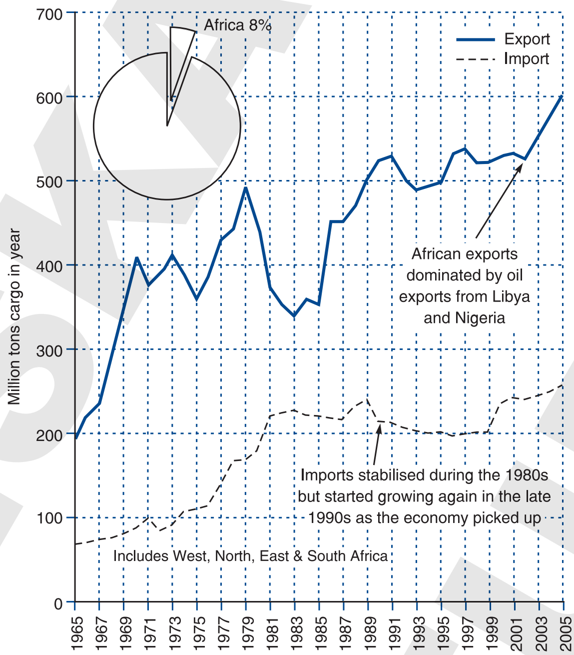


Figure 9.16
Africa's seaborne trade
Source: United Nations and UNCTAD

East Africa consists of six countries stretching from Sudan in the north to Mozambique in the south, plus two islands, Madagascar and Mauritius. It is a small economic region covering 514 million hectares, with GDP of only $73 billion in 2005 and a population of 112 million. Exports totalled 9 million tons and imports 26 million tons.

Finally, South Africa is by far the wealthiest country in Africa, with a population of 45 million and an average income of $25,000. This puts it in the same bracket as European countries in terms of size and wealth. It is an important dry bulk exporter of coal and iron ore, with deep-sea ports at Richards Bay and Saldanha Bay.

9.9 THE SEABORNE TRADE OF THE MIDDLE EAST, CENTRAL ASIA AND RUSSIA

The Middle East, central Asia and Russia form a convenient group because all three regional economies depend heavily on the export of oil. Between them they had 71.5% of the world's oil reserves in 2005, and in recent years they have been the marginal suppliers of this commodity to the world economy. The regional map shown in Figure 9.17 gives a rough idea of where the oil reserves are located. At the bottom of the map is the Middle East, with oilfields clustered around the Arabian Gulf in Saudi Arabia (35% of Middle East reserves), Iraq (15%), Kuwait (14%), and the United Arab Emirates (13%).

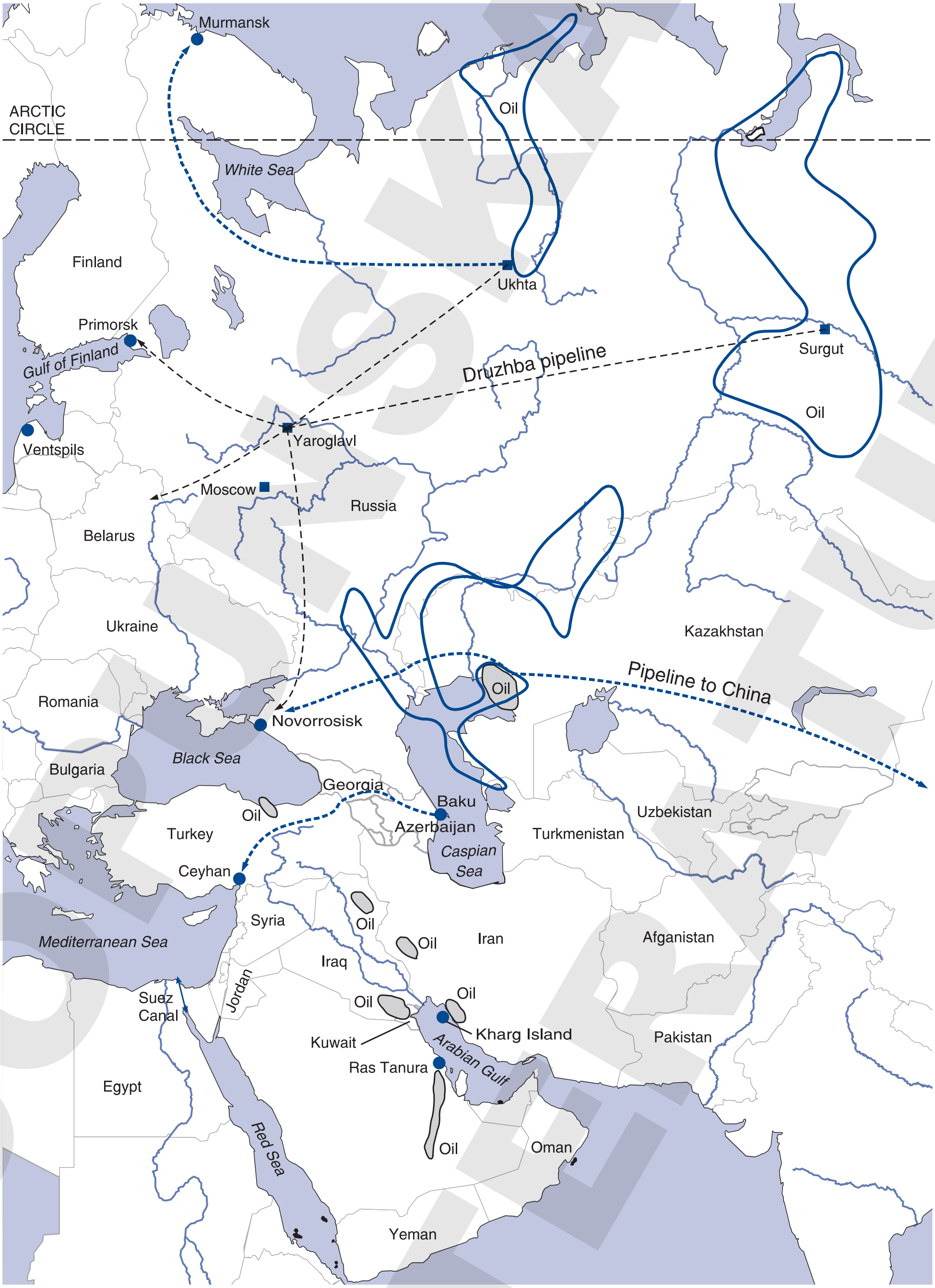


Figure 9.17
The countries and ports of the Middle East
Source: United Nations and UNCTAD

These oilfields are ideally located for sea transport, with relatively short pipelines moving the oil to deep-water terminals in the Arabian Gulf. Once on board ship, the journey times are relatively long, as we saw in Table 9.3(a), with voyage times of 19 days to Shanghai, 36 days to Rotterdam and 39 days to New Orleans.

Located north of the Arabian Gulf is the Caspian Sea, which has sizeable oilfields in Kazakhstan at its north-east corner. Although this was one of the original sources of crude oil in the nineteenth century, exports only started to become significant again in the 1990s, with shipments through three pipelines to Novorossiysk on the Black Sea, from Baku to Ceyhan in the East Mediterranean, and an eastward pipeline to north-west China.

At the top of the map Russia has major oilfields located to the north and north-west of the Caspian Sea, plus a third area of reserves located at Sakhalin Island on Russia's eastern coast and not shown on this map. These are located in or close to the Arctic Circle, and a long way inland from the ports of Primorsk, Ventspils, Murmansk and Novorossiysk on the Black Sea from which they are currently exported. The Druzhba pipeline provides a fifth outlet, carrying oil direct to north-west Europe. In all cases the oil must be transported long distances over land.

With the largest oil reserves and good sea access, in the last 20 years the Middle East has been an active area for the world shipping industry. The main trading countries are Bahrain, Oman, Qatar, Iran, Saudi Arabia, Iraq, UAE, Kuwait and Yemen. The Middle East has a population of 129 million, more than half of which is in Iran, and over 60% of the world's proven crude oil reserves. It is the largest oil exporting area, with total exports of 1121 mt in 2005 and imports totalling 160 mt, a 9% trade share (see Table 9.1), mainly due to oil exports. Figure 9.18 shows the development of imports and exports over the last 40 years. Exports of oil grew rapidly to reach 1 bt a year in 1973. Following the 'oil crisis' in that year imports halved to a trough of 440 mt in 1985 as coal was substituted for oil. However, the fall in oil prices in 1986 stimulated a recovery in export volume, and exports finally passed their previous peak in 2004. In contrast, the import trend has been upwards, stimulated by the sharp rise in oil revenues after the price increases in 1973 and 1979. During the three decades from 1975 to 2005 imports quadrupled from 58 mt to 160 mt. The commodity pattern of import

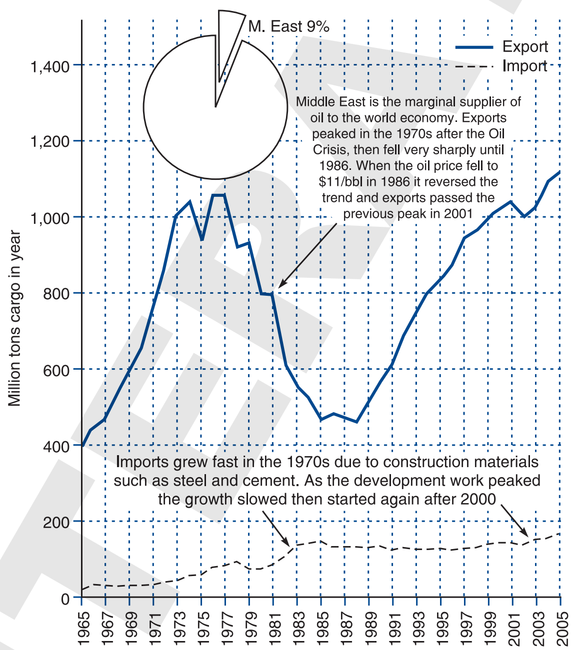


Figure 9.18
Middle East seaborne trade, 1965–2005
Source: United Nations and UNCTAD

trade of the Gulf states over the last decade closely reflects the pattern of economic development, with volume heavily concentrated in construction materials and foodstuffs. Construction materials account for a large proportion of imports, whilst the food and agricultural products comprise the second most important trade sector. These two commodity groups account for two-thirds of imports. The other two important categories are plant, machinery and vehicles, and chemicals and industrial materials.

Kazakhstan has an area of 270 million square hectares, similar in size to Saudi Arabia. In 2005 it had a population of 15 million and a GDP of $56 billion, about one-fifth the size of that of Saudi Arabia. Oil production increased from 100,000 barrels a day in the early 1990s to reach 1 million barrels a day in 2005, mainly shipped through pipelines to the Black Sea and the Mediterranean at Ceyhan.

Finally, Russia is an enormous country stretching from the Baltic Sea in the west to the Sea of Japan in the east. With a land area of 1.7 billion hectares, it is physically the world's largest country, almost twice the size of China. Its population was 143 million in 2005 and its GDP of $64 billion is approximately the same as that of Mexico. From a shipping point of view Russia's other distinctive feature is its northerly location and its widely dispersed access to the sea, with four separate routes to the sea: the first in the north through Murmansk and the White Sea; the second in the north-west through the Gulf of Finland; the third in the south through the Black Sea; and the fourth in the east through Vladivostok. The Gulf of Finland is ice-restricted for part of the year, but Murmansk is kept open by the Gulf Stream. Vladivostok in the East does not suffer from ice problems, but Sakhalin Island does.

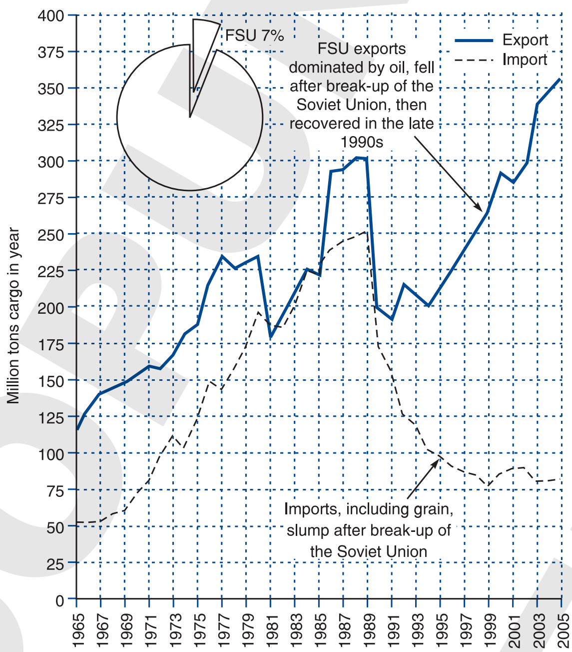


Figure 9.19
Russia and former Soviet Union sea trade, 1965–2005
Source: United Nations and UNCTAD

Russia's economic development strategy in the early twenty-first century focuses heavily on the export of primary commodities, particularly oil and gas, of which it has 13% of the world reserves. Figure 9.19 shows that following the break-up of the former Soviet Union, seaborne imports fell sharply from 250 mt a year to 75 mt a year in 2005, whilst exports initially fell from 300 mt to 200 mt, before recovering in the late 1990s and reaching a new peak of 360 mt in 2005. This mainly reflects the surge of oil exports through the Black Sea and the newly constructed export terminal at Primorsk in the Gulf of Finland.

9.10 THE TRADE OF AUSTRALIA AND OCEANIA

Australia has a population of 20 million and in 2005 its GDP was $701 billion, about the same as that of South Korea. However, it is physically almost the size of China, with a land area of 771 million hectares. It is well endowed with raw materials, and Australia is a leading exporter of primary commodities, principally iron ore, coal, bauxite and grain. It can be seen from Figure 9.20 that in the decade 1995–2005 exports doubled from 300 million tons to 600 million tons.

The location of the main primary resources which feed the exporting ports is shown in Figure 9.21. On the north-west coast of Western Australia there are major iron ore deposits, and in 2005 Australia had 38% of world iron ore export market, exporting 241 million tonnes of ore through Port Headland, Port Walcott and Dampier. Dampier handles about 80 million tonnes of iron ore a year and 11 million tonnes of LNG and LPG from the local gas fields. Coal deposits are mainly located in Queensland around the Gladstone area and in New South Wales inland from Sydney. The coal export ports are in this area – Gladstone, Abbott Point, Dalrymple Bay and Hay Point handle the Queensland exports, whilst Newcastle, Sydney and Port Kembla handle the New South Wales exports. This is a very big trade and in 2005 Australia exported 232 mt of coal, one-third of the world coal trade in that year. There are major bauxite deposits at Weipa in northern Queensland and at Bunbury near Perth – the Weipa bauxite is mainly shipped round to Gladstone for processing into alumina. Grain exports are smaller, totalling 22 million tons, shipped through various ports in the south-east and west.

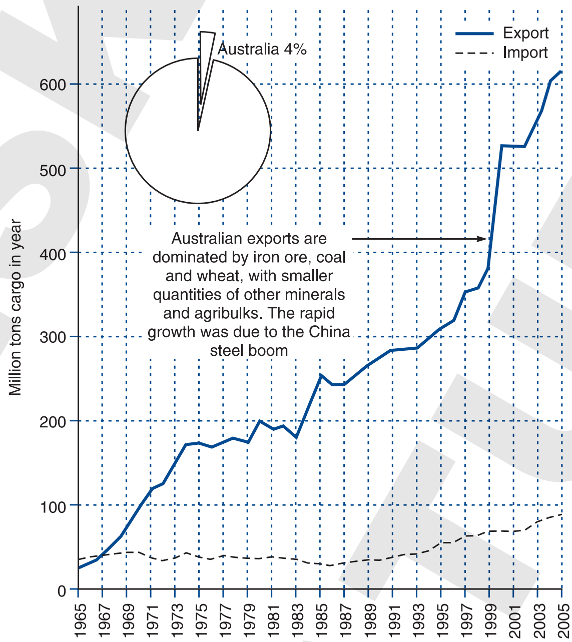


Figure 9.20
Oceania seaborne trade, 1965–2005
Source: United Nations and UNCTAD

9.11 SUMMARY

In this chapter we studied the geographical framework within which the maritime business operates. We started with the logistics model which is concerned with

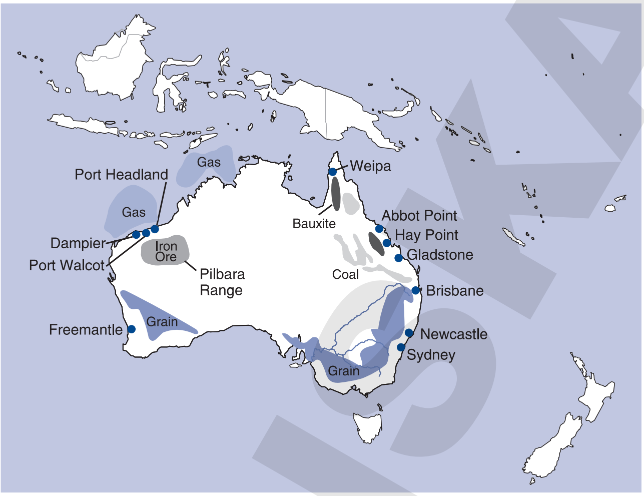


Figure 9.21
Oceania ports and resources
Source: United Nations and UNCTAD

the transport volume, frequency and cost per unit of transport. The four variables in the model are distance, speed, ship size and ship type, each of which has a part in determining the optimum transport solution for a particular trade. But we also saw that there are many other variables which determine the preferred solution, some of which involve judgements about the future, so shipping logistics, like market forecasting, is as much an art as a science and mathematical models are unlikely to provide decision-makers with a complete solution.

The focus of trade is created by the three economic ‘superpowers’ located in the temperate regions of North America, Europe and Asia. This means that the main trade routes are strung across the North Atlantic, the Pacific and the Indian Ocean, linked by the Panama and Suez canals.

The Atlantic, with imports of 3.7 bt and exports of 3.4 bt now has a 50% trade share. Much of the trade is generated by the mature economies ringing the North Atlantic which are exceptionally well served by rivers and ports. In 2005 the Pacific and the Indian oceans had the same total 50% share, but with imports of 3.3 bt and exports 3.7 bt. Distances in the Pacific are very large, but much of the trading activity is clustered in the area between Singapore and Japan. This region, which covers an area about the size of the Mediterranean, is now a major centre of maritime trade.

We reviewed the regions of the world, drawing attention to Europe which is still just the largest maritime trading area, but with a mature economy and relatively sluggish trade growth; North America which is also a mature economy with dynamic trade, due partly to the need to import raw materials such as oil and manufactured goods; South America which is a diverse low-income economy focusing on raw material exports; Asia which has become the powerhouse of growth in the twenty-first century; Africa which is a small economy largely focusing on the export of raw materials, especially oil; and finally, the Middle East, Central Asia and Russia which are the marginal suppliers of oil and gas.

This is the world within which the ships delivered today will earn their living over the next 25 years or so, and the political, geographical and economic environment that will determine the fortunes of shipowners.

10 The Principles of Maritime Trade

A kingdom, that has a large import and export, must abound more with industry, and that employed upon delicacies and luxuries, than a kingdom that rests contented with its native commodities. It is, therefore, more powerful as well as richer and happier.

(David Hume, *Essay of Commerce*, 1752)

10.1 THE BUILDING-BLOCKS OF SEA TRADE

Seaborne trade has a central place in our lives in the twenty-first century. Walk into any shop, and much of what you see will have come from overseas. Between 1950 and 2005 sea trade grew from 0.55 billion tons to 7.2 billion tons, an average of 4.8% per annum. This expansion was the result of the most fundamental redesign of the world's political and economic arrangements since the industrial revolution. The rapid economic growth and increasing consumer wealth which drove this change were, as we saw in Chapter 1, initiated at the Bretton Woods conference in 1944 which established the economic foundations for a period of economic stability which allowed companies and investors to operate freely across the globe. Three important developments helped:

- The world was progressively opened to free trade. The European empires were dismantled in the 1950s, removing a network of bilateral trade preferences, followed by the break-up of the Soviet Union in 1989 and the opening of the Chinese economy to free trade in the mid-1990s.
- Communications improved as telex, direct-dial telephony, fax, e-mail and the internet appeared in rapid succession. That process is taking another step forward with inter-regional broadband cabling.
- Cheaper transport. The falling cost of sea and air transport gave remote areas of the world access to world markets, making economic development possible. With the associated improvements in inland transport infrastructure, the catchment area for trade widened with each decade.

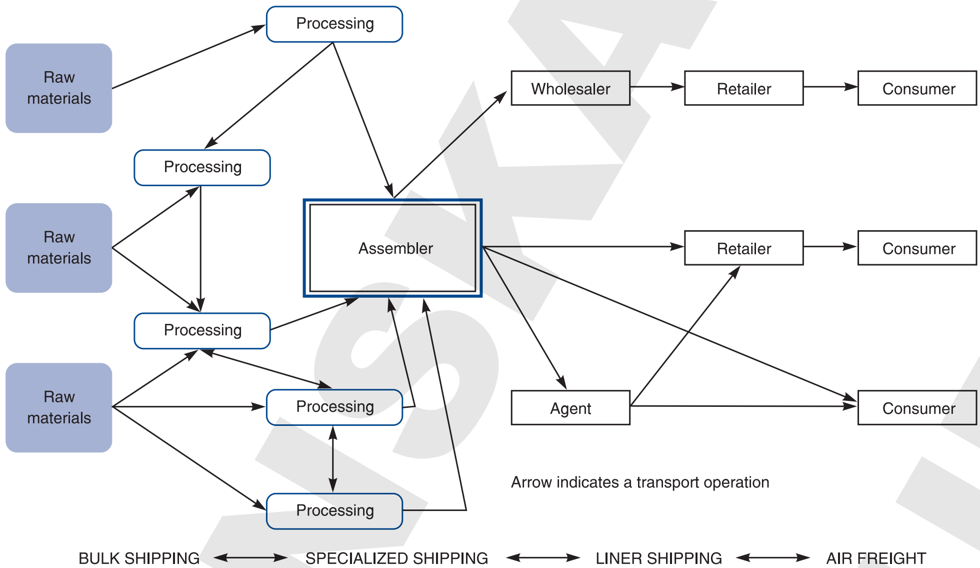


Figure 10.1
The shipping trade and transport system

In the quest to cut costs, corporations were able to shop around the world for components, raw materials and new markets. In doing so they brought new countries into the global system, generating new trade growth and giving rise to the trade system outlined in Figure 10.1. On the left are raw materials, which are shipped by sea to processing plants, often near the markets; in the centre are the assembly plants, and on the right the wholesalers and retailers. As sea transport costs fell, new opportunities for manufacturing were opened up, often involving multiple sea voyages. For example high-technology components are shipped to an assembler in a low-cost economy, processed, then exported as finished goods. This type of classic trade arbitraging is made possible by the transport network.

In this expanding global economy sea trade grew in pace with the world economy. For example, between 1986 and 2005 sea trade grew at an average of just over 3.6% per annum, very slightly faster than the growth of world GDP, which averaged just under 3.6% per annum. But when we dig deeper and look at the individual commodities shown in Table 10.1 we find that the rate of growth varied enormously. The phosphate rock trade declined, whilst coking coal grew at less than 2% per annum. Others grew very rapidly, for example the LNG trade grew at 6.8% per annum. A few new trades such as steam coal appeared and others such as asbestos disappeared. Containerized cargo grew at 9.8% per annum. Regional trade was also constantly on the move. Two of the biggest trading regions, western Europe and Japan, went through a cycle of growth until the early 1970s and stagnation for the next decade. New high growth economies emerged in other areas, notably in Asia and North America. Finally, although on average trade grew rapidly, its path was sometimes irregular, with deep recessions in the 1970s and 1980s.

The theory of maritime trade

Changing trade flows set the framework for the sea transport business, and in this chapter our aim is to understand what drives change. This is not just a theoretical exercise. Liner companies planning new services, shipowners specializing in industrial shipping, shipbuilders planning capacity, and bankers financing fleet expansion all have an interest in understanding what drives trade. Because shipping is demand-derived, we must delve into the world economy for the explanation.

Over the last 200 years economists have developed an extensive body of international trade theory, and this is the starting point for our discussion. However, there are three significant differences between the approach of international economists and our focus as maritime economists. Firstly, maritime economists are primarily concerned with the physical quantity of cargo, whilst trade economists generally focus on the value of trade, which allows them to link their analysis to the economics of the trading economies. Since high-value commodities often have a low volume and vice versa, this inverts the importance of individual commodity trade flows. For example, iron ore exports from Brazil at $45 per ton represent a lot of cargo, but little value compared with manufactures at $20,000 per tonne. Secondly, maritime economists are interested in the way the detailed commodity composition of trade changes with economic circumstances while international economists are more interested in broad categories of trade, for example primary commodities, and manufactures. Thirdly, maritime trade analysis is more focused on geographical regions than political nation states – for example, whether trade is from the US East Coast or West Coast. None of this invalidates the body of trade theory, it simply changes the emphasis which we will place on these different economic tools in the course of this chapter.

Table 10.1 World seaborne trade by commodity

Million tonnes	1986	2005	% pa
Iron ore	311	631	3.8%
Coking coal	141	191	1.6%
Steam coal	134	491	7.1%
Grain	187	273	2.0%
Bauxite & alumina	42	69	2.7%
Phosphate rock	45	30	–2.1%
Minor ores	555	781	1.8%
Crude oil	1030	1848	3.1%
Oil products	401	672	2.7%
LPG trade	22	37	2.7%
LNG trade	38	132	6.8%
Containerized cargo*	173	1015	9.8%
Other cargo	555	995	3.1%
World sea trade	3634	7163	3.6%
World GDP (1960=100)	279	543	3.6%

*estimate

Source: Clarkson Research Services Ltd

Our basic aim is to answer the question ‘What causes trade?’, but before we do this we should consider the fact that, however powerful the economic arguments may be, if a country does not believe that trade is in its interest, it can close its borders. China, the former Soviet Union and Japan have all followed this policy, and at one time or another most Western countries have restricted trade in some way. A policy of not trading, or limiting trade by tariffs or quotas, is known as *protectionism*, or in its extreme form *isolationism*. It seeks to exclude the goods produced by foreigners from local markets in order to protect the livelihood of local producers or for political reasons. Over the last century isolationism in major regions such as the Soviet Union and China shaped the trading world and the opening up of these areas had a major impact on growth and development.

Protectionism is generally driven by the political influence of interest groups whose livelihood is threatened by trade. For example, protectionists may try to prevent the export of local resources which they argue are being exported by unprincipled traders, leaving nothing for the local inhabitants. When the reserves are all gone, the country will be left in poverty.[1] Or the aim may be to protect local jobs and skills which are threatened by cheap imports. If the local shipyard or car plant is about to close because it cannot compete with foreign facilities, offering subsidies or passing laws preventing imports is a natural response. After all, this could be just the beginning. Soon other industries will be under attack and then how will the country earn its living? Currency reserves will drain away and the country will be left in poverty, so trade must be prevented at all costs. Or must it?

The arguments for free trade

Three hundred years ago this 'mercantilist' argument against free trade attracted much attention, and David Hume addressed it in his *Discourse on the Balance of Trade* (1752). Hume did not think much of the mercantilist approach, commenting:

> It is very usual in nations ignorant of the nature of commerce, to prohibit the exportation of commodities, and to preserve among themselves whatever they think valuable and useful ... There still prevails, even in nations well acquainted with commerce, a strong jealousy with regard to the balance of trade, and a fear, that gold and silver may be leaving them.[2]

In nineteenth-century Britain, as in many developing economies, free trade became a major political issue, centring on the question of whether the import of cheap grain should be permitted. Manufacturers in the towns were in favour because they wanted cheap food for their workers, but the domestic landowners, who stood to lose their protected market, were opposed. The issue split the country. Eventually free trade prevailed and in 1847 the Corn Laws, which prohibited imports, were repealed, helping Britain to develop as an industrial economy. Today the principles of free trade are broadly accepted through the World Trade Organization (WTO), but protectionism remains a live issue. In the West there are still concerns that developing economies in Asia will put the older industrial countries out of business, as demonstrated by the difficulties faced by the GATT negotiations over ten years. Apart from any personal considerations for the inhabitants of the developed countries, this would be very bad for shipping. Even where trade is relatively open, many countries protect inefficient industries whose output in a free market would be replaced by trade.

10.2 THE COUNTRIES THAT TRADE BY SEA

The differences in maritime trade by country

There are currently about 100 countries which trade by sea. If every country is included, down to the smallest Pacific island, there are many more, possibly as many as 170. To explain their trade the starting point is to take a close look at the economic differences between the trading countries. Table 10.2 lists the imports and exports of 40 major trading countries, or in some cases groups of countries.[3] Together they account for 89% of world seaborne trade, so it provides a reasonable overview of the countries which trade by sea. Column 1 shows the country's rank; the second its name; columns 3 and 4 its seaborne imports and exports; and column 5 shows the total trade used in the ranking exercise. Columns 6–12 provide details of the geographical and economic size of each country in relation to its sea trade.

At the top of the list is north-western Europe with 1.91 billion tons of imports and exports, followed by the United States with 1.31 billion tons, the Middle East with 1.23 billion tons and China with 0.998 billion. Moving to the bottom of the list, we find some countries with very little trade, for example Cyprus with 6.7 mt and Brunei with 1.9 mt. To explain these trade volumes in a general way is difficult enough, but to do it well enough to forecast their future trade flows is a daunting task. Clearly a short cut is needed. We must look for a theory which will allow us to generalize about the factors which determine a country's trade. Armed with this theory, we can reduce the task to more manageable proportions. The starting point is to see how trade relates to the country's general economic structure, and for this purpose three economic indicators are shown in the table, land area (measured in thousands of hectares), population (measured in millions) and GDP (measured in billions of dollars). The final columns show three important ratios: population density, sea trade volume per capita and the trade per million dollars of GDP. In the following paragraphs we will examine each of these variables – the balance of trade, the size of the region, its level of economic activity, and of course its trade intensity – to draw some general conclusions about what determines the volume of sea trade.

The balance of imports and exports

The first step is to examine the balance of trade. Figure 10.2 plots the imports and exports of the 40 trading countries accounting for 89% of world seaborne trade (see Table 10.2), with each dot representing a country or region. Imports are shown on the vertical axis and exports on the horizontal axis, so a country with balanced trade would fall on the dotted line which bisects the chart on the diagonal. In fact few do, especially amongst the bigger trading countries. The graph shows that trade volumes are very diverse, with one group of countries, including north-western Europe, USA, Japan, China and South Korea, strung out to the left of the dotted line and another group, including the Middle East, Australia and East Coast South America, strung out along the horizontal axis. This focuses on one of the main drivers of trade, the imbalance of supply and demand for resources between regions of the world. To the left of the dotted

Table 10.2 Seaborne trade of 40 countries and regions ranked by trade volume

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)	(10)	(11)	(12)
1	2	Sea trade 2004			Country size, 2004				Trade intensity	
	Country	*Exports mt*	*Imports mt*	*Total*	*Area m HA*	*Pop. m*	*GDP US$ bill*	*Pop. Per HA*	*Trade intensity (tons) per capita*	*per $mn GDP*
	Germany	100	164	264	36	83	2,714	2.3	3.2	97
	Belgium	446	452	898	4	10	350	2.8	89.8	2,566
	Netherlands	102	329	431	3	16	577	5.2	26.9	747
	France	97	224	321	55	60	2,003	1.1	5.3	160
1	*Total NW Europe*[a]	745	1,168	1,913	97	169	5,644	1.7	11.3	339
2	*USA*	350	956	1,306	937	294	11,668	0.3	4.4	112
3	*Middle East*	1,084	148	1,231	730	294	600	0.4	4.2	4,188
4	*Japan*	178	829	1,008	38	128	4,623	3.4	7.9	218
5	*China*	352	646	998	960	1297	1,649	1.4	0.8	605
6	*S. Korea*	184	486	669	10	48	680	4.8	13.9	985
7	*Australia*	587	67	653	771	20	631	0.0	32.7	1,035
8	*E. Coast S. America*[b]	463	128	591	1,390	45	97	0.0	13.1	6,063
9	*Singapore*	197	197	393	0	4	107	58.8	98.3	3,680
10	*Spain*	108	258	366	50	41	991	0.8	8.9	369
11	*Indonesia*	246	82	328	190	218	258	1.1	1.5	1,275
12	*Central Asia*[c]	190	50	240	1,708	143	582	0.1	1.7	412
13	*W. Coast S. America*[d]	136	85	221	364	102	290	0.3	2.2	762
14	*Hong Kong*	86	135	221	0	7	163	62.5	32.1	1,355
15	*South Africa*	163	40	203	122	46	213	0.4	4.4	954
16	*Panama*	114	80	194	8	3	14	0.4	64.6	14,039
17	*Norway*	157	25	182	32	5	250	0.2	36.4	727
18	*Malaysia*	70	98	168	33	25	118	0.8	6.7	1,425
19	*Sri Lanka*	66	79	144	7	19	20	2.9	7.6	7,175
20	*Sweden*	65	71	137	45	9	346	0.2	15.2	395
21	*Finland*	43	53	96	34	5	187	0.1	19.2	514
22	*Iran*	33	58	91	165	67	163	0.4	1.4	561
23	*Turkey*	65	11	77	78	72	302	0.9	1.1	254
24	*Ukraine*	62	11	74	60	47	61	0.8	1.6	1,207
25	*Morocco*	28	37	65	45	31	50	0.7	2.1	1,305
26	*Latvia*	54	3	57	7	2	14	0.4	24.8	4,211
27	*Poland*	39	17	56	30	38	242	1.2	1.5	232
28	*Israel*	16	33	49	2	7	118	3.4	7.1	420
29	*Portugal*	10	39	49	9	10	168	1.1	4.9	290
30	*Estonia*	42	4	46	4	1	11	0.2	46.4	4,293
31	*Egypt*	13	29	41	100	69	75	0.7	0.6	549
32	*N. Zealand*	22	18	41	27	4	100	0.1	10.2	410
33	*Pakistan*	8	31	39	80	152	96	1.9	0.3	408
34	*Lithuania*	22	5	27	7	3	22	0.5	9.2	1,232
35	*Tunisia*	7	14	21	16	10	28	0.6	2.1	749
36	*Croatia*	7	13	20	6	4	31	0.8	4.5	646
37	*Bangladesh*	1	16	17	14	140	57	9.7	0.1	299
38	*Slovenia*	3	9	12	2	2	32	1.0	6.0	375
39	*Cyprus*	2	5	7	1	1	15	1.1	6.7	438
40	*Brunei*	0	2	2	1	0	5	0.4	5.4	386
	Total 1–40	6,018	6,037	12,054	8,180	3,583	30,722		3.4	392
	Other countries	741	750	1,491						
	World	6,758	6,787	13,545						

Source: World Bank (GDP), *UNCTAD Monthly Bulletin of Statistics,* UNCTAD (2005)
Notes:
[a]Total NW Europe includes only Germany, Belgium, the Netherlands and France
[b]East Coast S. America includes Guyana, Venezuela, Suriname, Argentina, Bolivia, Brazil, Uruguay
[c]Includes Russia, Kazakhstan, and various other central Asian countries
[d]West Coast S. America includes Chile, Columbia, Ecuador, Peru

line are the highly populated and wealthy regions of the world which are relatively resource-poor, whilst to the right are the resource-rich areas where demand is lower due to lower population (in the case of Australia) or income (in the case of East Coast South America).

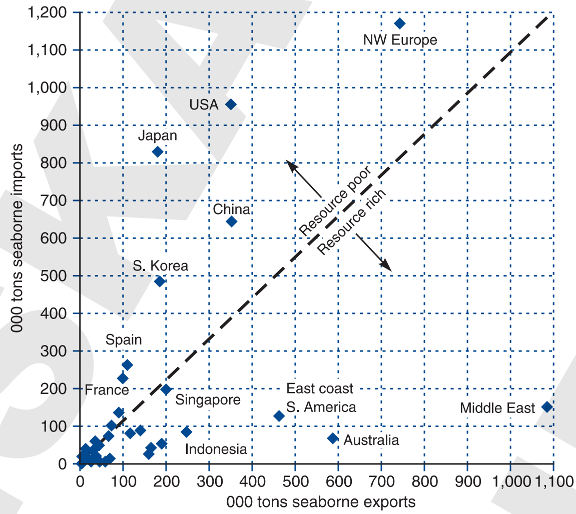


Figure 10.2
Seaborne imports and exports, 2004
Source: UN *Monthly Bulletin of Statistics*

Wealth and seaborne trade

The obvious explanation of a country's seaborne trade is the size of its economy. Common sense tells us that bigger economies are likely to generate more trade. If we examine the relationship between seaborne imports and GDP, we find there is indeed a close relationship, as is demonstrated by Figure 10.3. This plots the seaborne imports of the 40 countries in 2004 against their GDP. As the level of GDP increases, so do imports. For example, the USA has a GDP of $11.66 trillion and imports of 956.2 mt, whereas the GDP of Cyprus was only $15 billion and its sea imports are 5.1 mt.

Taking the analysis a stage further and fitting a linear regression model of seaborne imports on GNP (see graph inset) we find that 71% of the variation in seaborne imports is explained by variations in GNP (this is R^2). The model implies that in 2004 seaborne imports start when GNP reaches $60 billion and increase by 110,500 tons for each $1 billion increase in GNP. The relationship is very approximate, but it is clearly significant and follows the sort of pattern we would expect. There are three reasons why rich countries with a high GNP might be expected to have a higher level of imports than a poor country with low GNP. First, a larger economy has greater needs in terms of the raw materials and manufactured goods which are shipped by sea. Some of these will not be available locally. Second, mature

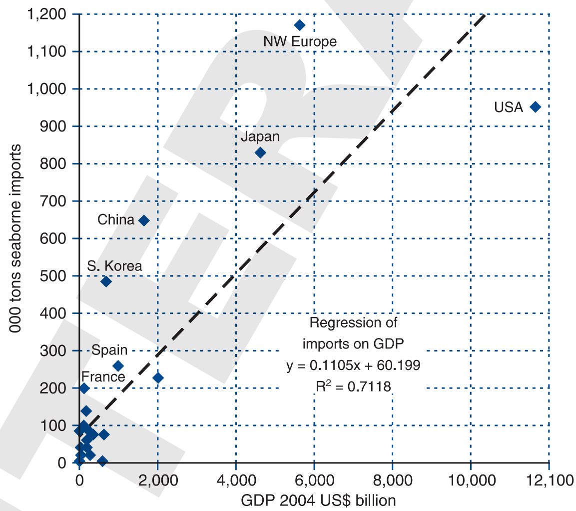


Figure 10.3
Seaborne imports and GDP, 2004
Source: UN *Monthly Bulletin*, World Bnak

economies which started out with plentiful local resources will eventually use them up, leading to the need for imports. For example, the USA started out with abundant oil reserves but now imports more than half its requirements. Third, a country with high GNP can afford to purchase imports and has more to export in return.

Land area and sea trade

When considering the trade of a country, the next factor to consider is its physical size. We might expect the size of a country in terms of its land area to influence trade because it determines the amount of physical resources available locally. After all, reserves of energy, minerals and the production of agriculture and forestry are all likely to be greater in a large land mass than a smaller one. When we examine the correlation between sea trade and land area, (Table 10.2), we find that there are many countries that very obviously do not fit the model. For example, Singapore, a country with only 62,000 hectares, has roughly the same trade volume as Spain, which has an area of 50 million hectares.

But when we distinguish importers from exporters things start to make more sense. Figure 10.4 shows the relationship between seaborne imports and land area. Strung along the vertical axis of the graph are some quite small countries with big imports – north-western Europe, Japan, South Korea and Spain. Conversely, strung out along the horizontal axis are the countries with a big area and low imports, including the Middle East, Australia and Indonesia. In other words, imports are inversely related to country size, though the precise amount of trade arising from natural resources is also a matter of supply–demand economics. Where demand is high and no local reserves are available, as in the case of iron ore used by the Japanese steel industry or oil used by France and Germany, trade is directly related to demand. But often there is an economic choice between domestic and imported resources. For example, Europe has extensive coal deposits, but finds it more economic to import cheaper foreign coal. So we see the very high imports shown for north-western Europe, Japan and South Korea in Figure 10.4. Resource depletion is also an issue, and we have very large countries such as China and USA with abundant resources, but where imports are high because the resources are insufficient to meet domestic demand. In the case of China this is due to the high population and for USA the high GNP. In these large economies the domestic resources are diverted to the domestic market, whereas

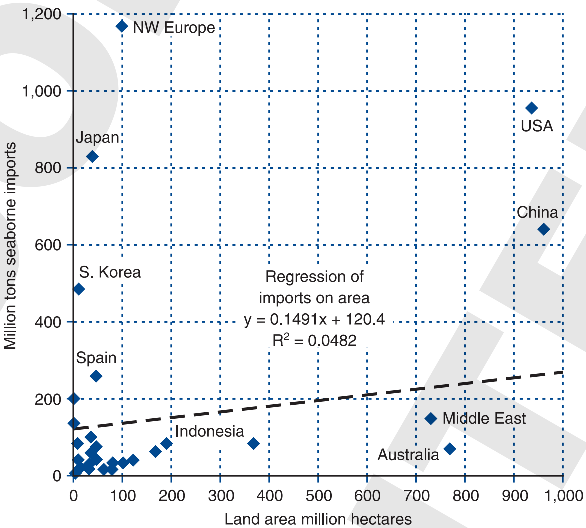


Figure 10.4
Seaborne imports and land area, 2004

for large landmasses with smaller population or GDP such as the Middle East, Australia and Indonesia, which appear at the bottom of the graph, local resources are the sufficient so there is little demand for imports. As we shall see when we study trade theory, factor endowments play a vital part in explaining trade, but this does not allow us to generalize about the relationship between resources and trade. The results of the regression analysis are a reminder of this fact.

So although common sense suggests that the area of a country should be important, it is not a simple relationship. Statistically there is almost no statistical correlation between a country's area and its volume of trade. But on reflection this is not really a surprising result. It reinforces the point that trade is about economic growth, not physical size. A country may be very large, but if it is mainly empty, there will not be very much import trade.

Population and sea trade

Finally there is population. The idea that population and trade go hand in hand stretches back to the nineteenth-century trader's dream of 'oil for the lamps of China'. If there are enough people, it was argued, there is great trading potential. Much the same hopes were extended to South American countries such as Brazil. In both cases the expectations were disappointed and trade was slow to develop, despite the size of the population. For example, China has a population of 1.3 billion, ten times Japan's 128 million, but in 2004 it imported 25% less cargo (see Figure 10.5). A statistical analysis of the relationship between population and trade shows virtually no correlation. The correlation coefficient is 0.2. If nothing else, this demonstrates that sea trade is primarily an economic phenomenon.

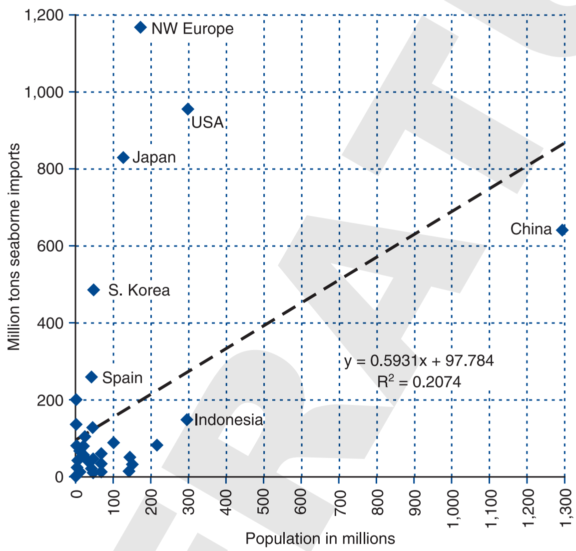


Figure 10.5
Seaborne trade and population, 2004
Source: *UN Monthly Bulletin*, World Bank

10.3 WHY COUNTRIES TRADE

Trade theory and the drivers of trade

The conclusion from the brief overview of sea trade is that economic activity creates the demand for imports and the supply of exports, not numbers of people, or land area, though both have some influence. The countries that trade more than others generally have bigger economies (GDP), but trade volumes are also a matter of supply and demand. The USA, a major oil producer, imports oil because demand has outstripped supply. Similarly, China suddenly imported 60 mt of steel products in 2003 because local demand surged ahead of local steel production. That is fine for raw materials, and the bulk shipping industry, but what about manufactures? Why is the Japanese export trade in manufactures so high? Why does Europe import so many Japanese motor cars when it has a car industry of its own? These issues become more important when we study the container trade.

The three fundamental reasons for trade

The starting point is that trade takes place because someone makes a profit from it. There are a few minor exceptions to this rule, such as food aid, but it applies to most trade and our quest to explain trade in theoretical terms starts here. That leads on to the question of what makes trade profitable, and the answer is generally a difference in costs. If it is possible to sell a foreign product for less than the price of locally produced goods, after deducting freight and duties, and make a profit, someone is going to do it. It does not need a model to figure that out, but it is useful to state the model anyway:

$$TR_{ij} = f(p_i, p_j, T_{i,} \mathrm{F}_{ij}) \tag{10.1}$$

This model stipulates that the trade (TR) between regions i and j depends on the price in country i (p_i), the price in country j (p_j), any tariffs between the two areas (T_{ij}) and the cost of freight (F_{ij}). So all we have to do is explain why products produced overseas cost less than their local counterparts. Of course, there are an infinite number of specific circumstances, but as far as explaining global sea trade of the type we reviewed in Tables 10.1 and 10.2 is concerned, three stand out: differences in manufacturing costs, differences in local natural resources, and temporary shortages or surpluses which disrupt the normal pricing process. We will consider each of these in the following sections, but a brief preview puts them into perspective:

1. Differences in manufacturing costs. If one country can manufacture a product cheaper than another, for whatever reason, and the price difference is more than the transport costs and tariffs, trade is profitable. So we need to explain why certain goods cost more to manufacture in one area than another, an issue which has preoccupied trade economists more than any other.
2. Differences in natural resources. Natural resources are not spread evenly around the world, so another set of trade flows developed moving them from where they are located to where they are needed. Unlike manufacturing plants which can be relocated, commodity trades are dictated by the distribution of resources. But the cost of recovering natural resources is important, too. If a country has no oil and there is a demand for motor cars, it has to import. But where there are local supplies, trade is determined by relative delivered costs of domestic and imported oil.

3. Temporary imbalances. A third category of trade is a subset of item 2 which is important for shipping. Temporary local imbalances create a price differential between local and overseas products. This type of trade often happens during business cycles when, for example, shortages of chemicals, petroleum products or steel products result in imports of commodities, even if they can normally be manufactured competitively at home. However, cyclical patterns of trade also occur over much longer periods as economies develop, which we will refer to as the 'trade development cycle'.

These three types of trade are closely related, but each involves a slightly different theoretical model to explain how much trade, where and when. However, it is helpful to see them in the context of the transport system we reviewed at the beginning of the chapter (Figure 10.1). This highlighted the differences between the primary commodity trades which can generally be explained by a relatively simple model focusing on differences in primary commodities availability and the manufactures trades which involve a more complex trade model. The primary commodities are shipped from areas of low-price abundance to manufacturers who process them into semi-manufactures such as steel products, oil products, and chemicals. These are the backbone of the bulk trades discussed in Chapter 11. In contrast, the manufactured goods may be shuffled around the world between components manufacturers, assemblers and retailers, and we are interested in what determines who does what. From a shipping viewpoint the manufactures trade offers endless opportunities for sea transport, and before they reach the consumer, some components may have made several voyages and most are shipped in general cargo, which is discussed in Chapter 13. The specialized cargoes discussed in Chapter 12 fall somewhere between the two.

10.4 DIFFERENCES IN PRODUCTION COSTS

Interest in the 'who does what' aspect of trade was initially sparked during the industrial revolution in Britain because various parties stood to gain or lose a great deal of money from opening global free trade (there is nothing like hard cash to create economic controversy!). In the seventeenth and eighteenth centuries the dominant economic argument was that a country should encourage exports and discourage imports so that it could accumulate gold reserves and grow rich. Adam Smith coined the term 'mercantile system' to describe this trade theory.[4] The mercantilist theory suited the interests of the British landowners who were keen to prevent imports of cheap American corn, and they had the upper hand politically, so the country's policy was to restrict trade. But as the industrial revolution gathered force the merchants and producers became more powerful, and they wanted cheap grain to feed their workforce and a free world market to sell their goods. Naturally they became keen supporters of any trade theorists who argued that free trade was a beneficial strategy. Rarely have economic theorists been so close to frontline policy-making.

The theory of absolute advantage

The best known of the early theories of the benefits of trade was developed by Adam Smith in *Wealth of Nations* and it is often referred to as the 'theory of absolute advantage'. At this time England was a rapidly growing industrial economy with a thriving export trade, and Smith treated the topic as a matter of common sense. He argued that countries are better off if they specialize, trading their surplus production for the other goods they need, because specialization makes them more productive. Although it might be possible to grow grapes in Scotland and make wine, the cost would be prohibitive and the quality poor. Importing wine and specializing in something the Scots are better able to produce means everyone benefits because the world's limited economic resources (factors of production) are used more efficiently. To illustrate the point he drew the analogy with tradesmen, who are better off if they specialize:

> It is the maxim of every prudent master of a family, never to attempt to make at home what it will cost him more to make than to buy. The tailor does not attempt to make his own shoes, but buys them from the shoemaker. The shoemaker does not attempt to make his own clothes, but employs a tailor. What is prudence in the conduct of every private family, can scarce be folly in that of a great kingdom. If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy of them with some part of the produce of our own industry, employed in a way in which we have some advantage.[5]

Goods are cheaper because trade permits greater division of labour, allowing more to be produced with the same resources. So long as transport costs do not exceed the cost saving in production, trade is bound to be beneficial.

The point is easily demonstrated by the numerical example in Table 10.3. Two countries, Big and Bouncy, produce two goods, food and cloth. Both have 60 labourers. Bouncy, which is better at growing food, needs only 3 labourers per ton, whilst Big needs 4. But Big is better at cloth, using only 2 labourers per bale, whilst Bouncy needs 6. Assume that there are constant costs (i.e. they use the same labour per unit of output, regardless of volume). Big's production possibilities are 15 tons of food or 30 bales of cloth (or any combination). Write this as (15, 30). Bouncy's production possibilities are 20 tons of food or 10 bales of cloth (20, 10). They both need 12 tons of food to live on. Big uses 48 units of labour to produce its food and uses the remaining 12 units to produce 6 bales of cloth, so its output is (12, 6). But Bouncy only needs 36 units of labour to produce its food and uses the remaining 24 units to make 6 units of cloth (12, 6). So both states end up with exactly the same amount of food and cloth (12, 6).

Now we introduce trade and allow the two countries to specialize in their best products. Bouncy switches all its labour into food, producing 20 tons, consuming 12 and exporting 8 to Big. Thanks to the imports Big only produces 4 tons of food, using its remaining 44 units of labour to make 22 bales of cloth. It consumes 11 bales and exports 11 to Bouncy in return for the food. Thanks to trade Big and Bouncy now have 12 tons of food and 11 bales of cloth (12,11), almost twice as much cloth as previously. It's magic!

The theory of comparative advantage

This theory leaves a crucial question unanswered. If Bouncy is better at producing food and Big at producing cloth there is no problem, but suppose one country is better at producing both goods? The mercantilists could still argue that under free trade the less efficient country would be driven out of both food and textile production, and would sink into poverty, so inefficient countries must avoid trade at all costs. In 1817, in his *Principles of Political Economy and Taxation*, David Ricardo came up with an elegant demonstration of why that was not the case. Trade is beneficial, he argued, even if one country is more efficient than its trading partners at producing all goods. If we rerun the example, but make the Bouncy better at producing both food and cloth, the countries are still richer with trade than without.

Bouncy now requires less labour than Big to produce both food and cloth. If there is no trade it can produce the 12 tons of food it needs and 24 bales of cloth (12, 24). Big would produce 12 tons of food, but only 6 bales of cloth (12, 6). However, if the countries specialize in the product in which they are *comparatively* more efficient, their production increases. Big is now relatively more efficient at food production, because it uses only twice as much labour as cloth, whereas Bouncy uses three times as much labour to produce food. So Big specializes in food, producing 15 tons, consuming 12 and exporting 3. With imports of 3 tons of food, Bouncy now cuts food production to 9 tons, requiring 27 units of labour. With the remaining 33 units of labour it produces 33 bales of cloth, nine more than previously. It exports 6 bales to Big in return for the 3 tons of food and is left with 3 more bales of cloth than it had

Table 10.3 Absolute and comparative advantage

	Big	Bouncy
1. Absolute advantage example		
	Big	Bouncy
Available labourers	60	60
Labour required per unit of output		
Food (tons)	4	3
Cloth (bales)	2	6
Production possibilities		
Food production (tons)	15	20
Cloth production (bales)	30	10
Production without trade (full output)		
Food production (tons)	12	12
Cloth production (bales)	6	6
Total (units)	18	18
Production with trade		
Food production (tons)	4	20
Cloth production (bales)	22	0
Total (units)	26	20
Memo: exports	11	8
2. Comparative advantage example		
	Big	Bouncy
Labour required per unit of output		
Food	4	3
Cloth	2	1
Production without trade (full output)		
Food production (tons)	12	12
Cloth production (bales)	6	24
Total (units)	18	36
Production with trade		
Food production (tons)	15	9
Cloth production (bales)	0	33
Total (units)	15	42
Memo: extra output	3 bales of cloth	

without trade, so trade has increased output by 3 bales of cloth. The question is how much of this does Big get?

The heart of the theory is that free trade allows each country to specialize in its most competitive products. More wealth is created by trade because limited ‘factors of production’ are used more efficiently and all participants are better off than they would be without trade.[6] This has important implications for trade. The appearance of new competitors in the international market does not put existing traders out of business. Provided there are relative differences in efficiency it leads to more trade and greater wealth, though it does raise difficult questions about the redistribution of economic resources and how the gains from trade are distributed between the participating countries.

In reality free trade is often not all good news for individual interest groups. As the balance of comparative advantage adjusts, there are winners and losers. For example, the English landowners who resisted the repeal of the Corn Laws in the nineteenth century were right in thinking that they would suffer from free trade. After the Corn Laws were repealed in 1847, cheap foreign corn flooded into the country, depressing prices and impoverishing the countryside. Workers were forced to migrate to the towns, helping Britain to become even more successful as an exporter of manufactures. In the end Britain as a whole was better off for free trade, but the process of change left some individuals, particularly landowners, seriously worse off. There are parallels with the competition between European heavy industry and Far East in the 1970s and 1980s. European manufacturers were driven out of business by Far East competition. It is not much compensation to a redundant shipyard worker that he has lost his job because the country now has a comparative advantage in financial services, a business that has no call for welders. This is important because these side effects can lead to protectionism.

Modern theories of manufacturing advantage

Comparative advantage is one of the most influential economic theories ever developed, providing the intellectual foundation for the free trade philosophy which has dominated political thinking over the last half century through the WTO. Much work has been done to extend the model to deal with multiple commodities and countries and to examine the effects of tariffs and imperfect competition. From a maritime perspective the important issue is the light it casts on why trade has grown so rapidly in the last fifty years. During this period of free trade improved transport and communications have stimulated growth by allowing global sourcing and marketing of products. The new technology also improved the services that support trade. Legally secure documentation, especially in such areas as establishing the ownership of goods, cheap direct-dialled phone calls, improved international banking, and more recently e-commerce have made global trading easier, especially for smaller companies.

Armed with these new services, industry can migrate to the remote corners of the globe where costs are low and many more towns and cities in these areas are continuously being drawn into the global trading system. Today trade growth in manufactures is driven by exploiting differences in labour costs between regions, but it does not rely exclusively on inter-country differences. Michael Porter's model of world trade attributes comparative advantage not only to local resources such as cheap labour, but also to expertise. He argues that clusters of companies specializing in a particular item, say ski boot clamps, develop a 'comparative advantage' in that product. With the right communications and transport, these clusters can exploit their advantage globally, leading to a broader trade matrix and improved global efficiency and trade growth even if wage cost differences are eliminated.[7] This process is dynamic. Once a particular company, country or cluster has become an established product area, it is difficult for others to build up sufficient volume of sales to break into that market. In the nineteenth century Britain developed mechanized textile manufacturing, and for some years gained a comparative advantage from this. Eventually other countries caught up. Today technical advance is continuous. The manufacture of medical equipment, the production of a particular type of rubber belt drive, and the manufacture of complex products such as cruise ships and aircraft are all examples where one country has developed a competitive advantage based on technical innovation and is protected by barriers such as the high cost of entry. In the case of particular inventions the manufacturing rights may even be covered by a patent.

A variant on this is driven not by production technology, but by *product differentiation* in the market. Motor cars are a good example, but petroleum products, electronic equipment and a whole range of consumer goods also qualify. In these cases the cause of trade is differences in tastes between countries. For example, motor car manufacturers face economies of scale, so low-volume production is expensive. If most Americans like to drive very big motor cars, while most Europeans prefer to drive small motor cars, then the minority in Europe who wish to purchase large motor cars can benefit from importing American cars and vice versa, especially if transport costs are low. This has had a tremendous impact on trade. In most countries consumers can now choose from twenty or thirty different brands of motor car, each sold at a highly competitive price. The production economics of car manufacture is such that if the market were fully supplied by UK manufacturers, there could only be a small number of different designs, and costs would almost certainly be higher. Similarly, if oil refineries are technically restricted to producing a mix of petroleum products which does not exactly match local demand, they will seek to export the products not needed locally.

10.5 TRADE DUE TO DIFFERENCES IN NATURAL RESOURCES

The classical economists were mainly interested in trade theory from a *normative* viewpoint and the theory of comparative advantage was a response to the political debate over free trade. Ricardo and other classical economists did not pay much attention to explaining what determines the comparative advantage a country may have. However, by the early twentieth century when the free trade battle had been won, economists became more interested in explaining trade patterns. The key issue turned out to be the assumption of constant costs, which is one of the basic building-blocks of Ricardo's model.

Resource-based trade and the Heckscher-Ohlin theory

The theory of comparative advantage makes the important assumption that resources can be freely switched between the manufacture of different products without any loss of productivity. Even in the abstract world of economic theory this is clearly not realistic. In the 1920s two Swedish economists, Eli Heckscher and Bertil Ohlin, concluded that because countries have different endowments of factors of production, attempts to substitute one factor for another usually result in falling productivity or may not be possible at all. For example, America with its great prairies can expand grain production, but if the UK tries to switch more labour into agriculture, as we assumed in the example earlier in the chapter, yields would fall as the land was farmed more intensively. Conversely, although the UK with its abundant skilled labour can easily expand cloth production, the USA runs into diminishing returns due to the lack of suitable labour. Heckscher and Ohlin argued that these differences in the available factors of production (land, labour, etc.) can lead to differences in production costs between countries. All we need for trade to be beneficial is that economic resources are unevenly distributed between countries. Winters [8] summarizes these minimum conditions as follows:

1. The production functions for the two products give constant returns to scale if both factors are applied proportionally, but diminishing returns to any individual factor (i.e. if a country runs out of land, but keeps applying more labour, fertilizers, machinery, etc., marginal returns fall).
2. Goods differ in their requirements of different factor inputs (e.g. food production needs more land than textile manufacture).
3. The countries have different relative factor endowments.

As an illustration, imagine the ‘no trade’ situation on two islands. Each island relies on its own domestic resources. Island A struggles to feed a large population by intensive agriculture on the limited land available. It mines coal from a few deep mines and manufactures a whole range of products, mainly on a small scale. In agriculture and labour the islanders face sharply increasing costs as they try to maintain growth by pouring more labour into fixed physical resources.

Island B has the same population but open-cast coalmines and better land. If trade is opened up the islands specialize. Because island A has few natural resources, its comparative advantage is in manufacturing. It imports coal and food from island B and switches the labour into manufacturing industry which for it (but not island B) is relatively more productive. In other words, it exports those goods whose production is relatively intensive in the factors with which it is well endowed. Island B opens more coalmines and switches labour into them, exporting coal. It all depends on their relative factor endowment. The precise definition of ‘natural resources’ raises all sorts of questions. In Chapter 1 we showed that the trading world is constantly on the move, so we should not rely too heavily on static models. However, the Heckscher-Ohlin theory suggests that in a free world market, countries must make the best of whatever resources they have, and this theory goes a long way towards explaining the diversity of trade in Figure 10.2. The countries on the left of the dotted line are like island A and the countries on the right of it are like island B.

The commodity trade supply–demand model

This is a good point at which to discuss the commodity trade model. Raw materials account for a large part of seaborne cargo, and one of the main tasks of the bulk shipping industry is to anticipate future trade, so that efficient transport can be planned. For this reason alone shipping analysts often have to analyse trends in the commodity trades. The supply–demand model is the most commonly used technique for carrying out this analysis. For example, Japan has no local supplies of iron ore, so it must import what it needs from mines in Australia or Brazil. Iron ore is traded in an international market and supply and demand for the commodity are controlled by price movements. Thus the model consists of a demand function for the commodity, showing the relationship between demand and price, and a supply function, showing how supply responds to price changes.

The demand function describes the relationship between per capita income, commodity prices, and the consumption of the product and is generally referred to as the consumer demand function. It is expressed as

$$q_{it} = (\, p_{1it}, p_{2it}, y_{it}) \qquad (10.2)$$

where q is per capita consumption of the commodity, p_1 is its price in domestic currency, p_2 is the price of other commodities and y is per capita income for the ith country in year t.[9] This function suggests that the demand for a commodity responds to changes in relative prices and income. To explain how demand responds to a change in price we need to introduce two economic concepts, the income elasticity and the price elasticity.

The income elasticity shows how consumers of the commodity adjust their consumption in response to a change in income. It is defined as the proportionate change in the purchase of the commodity such as energy for a change in income, with prices constant:

$$e_i = \frac{(\log q)}{\mathrm{d}(\log y)} \qquad (10.3)$$

In other words, the income elasticity is the percentage change in demand divided by the percentage change in income. The nature of this relationship varies from one commodity to another, with important consequences for trade. We can use the income elasticity to classify commodities into three different groups. *Inferior goods* have a negative income elasticity (i.e. less than 0), so when income rises, demand falls. For example, at higher incomes people typically consume less of basic foods such as bread and potatoes, switching their demand to other foodstuffs such as meat. *Necessities* are goods whose demand increases as income rises, but more slowly than income (i.e. the income elasticity is in the range 0–1). Finally, *luxuries* are goods for which demand grows faster as income rises (i.e. the income elasticity is greater than 1). These differences are important because they warn us to expect demand relationships to change when income changes. For example, the income elasticity of motor cars could be very high at low income levels because buying a motor car is a priority. When most people have a car the demand continues to rise with income as a few buy second cars, but the rate of increase slows and car demand eventually stagnates, or switches to higher value-added vehicles. The same is true of housing. For anyone modelling the demand for steel, much of which is used in construction and motor vehicle production, it is vital to model these relationships in a way which allows for these changing relationships.

The price elasticity shows how demand responds to a change in prices. It is derived from the demand function and represents the percentage change of consumption for a 1% change in prices. In mathematical terms the price elasticity can be expressed as follows:

$$e_p = \frac{\mathrm{d}(\log p)}{\mathrm{d}(\log q)} = \frac{p.\mathrm{d}q}{q.\mathrm{d}p} \tag{10.4}$$

where e_p is the price elasticity, p is the price of the commodity and q the quantity consumed. It is possible to sub-divide the price elasticity into two components, the substitution effect and the income effect.

$$\frac{\mathrm{d}q}{\mathrm{d}p} = \left.\frac{\mathrm{d}p}{\mathrm{d}q}\right|_{\bar{u}} - \frac{\mathrm{d}p}{\mathrm{d}m}q \tag{10.5}$$

where m is income. Equation (10.5) is known as the Slutsky equation. The first term on the right-hand side represents the *substitution effect* and the second the *income effect*. The substitution effect measures the extent to which a change in the price of a commodity results in the substitution (negative or positive) of other commodities in the total budget. The income effect measures the change in the level of consumption due to the change in real disposable income as a result of the price change.

This relationship is helpful to analysts in explaining and modelling sudden commodity price changes because it shows the different factors involved. For example, it was useful in explaining the crude oil trade during the two oil crises in 1973 and 1979 (see Figure 11.8, which shows the relationship between oil prices and seaborne crude oil shipments). When the price of oil increased sharply in 1973, the income effect was dominant because oil was a necessity and there was not very much substitution. Consumers spent more of their income on oil and had less to spend on other goods, triggering a recession in the world economy. But by the time the oil price went up again in 1979, the substitution effect was the dominant response because by that time it was technically possible to substitute coal and gas for oil. As a result consumers, particularly power stations, switched from high-priced oil to cheaper coal and gas and the crude oil trade fell sharply (see Figure 4.5 which shows how the oil trade declined), providing another different example of the two components of the Slutsky equation at work.

Derived demand for a commodity

The next step in the commodity trade model is to reproduce the relationship between the demand for raw materials in an industry, and demand for the products of that industry which are sold to the final consumer. Industrial users often have a choice in sourcing their raw materials, raising the possibility that manufacturers will substitute one raw material for another. Heavy industries such as steel production and motor manufacturing are major users of raw materials, as is the transport industry (e.g. ships' bunkers). These industries will be concerned with minimizing their costs, and their demand for raw materials is derived from the underlying demand for the commodities the industry produces. The starting point is the cost function. For a given output level the cost function is

$$C = P_1 X_1 + P_2 X_2 + b \tag{10.6}$$

where C is the cost of production, P is the price of each commodity, X represents the quantities of factor inputs required at that price level and b is capital cost, which is assumed to be fixed. Faced with a change in the price of raw material (P_1) and a fixed capital stock, the key issue for the industrialist will be whether it is cheaper to use less of one input (X_1) and more of some other input (X_2). The answer to this question is provided by the rate of technical substitution (*RTS*) which represents the extent to which commodity inputs can be substituted for each other with the available industry technology. It can be defined as

$$RTS = \frac{\mathrm{d}X_2}{\mathrm{d}X_1} \tag{10.7}$$

We have already mentioned the example of power stations which can use oil, coal or gas. In 1973 when the oil price increased sharply, most power stations used oil and were not equipped to burn other fuels, so the substitution effect (*RTS*) was small. By 1979, when the price of oil rose to over \$30 per barrel, most power stations had invested to allow other fuels such as coal or gas to be burned. As a result the substitution effect was very large and oil consumption fell sharply. But that substitution is a one-off change which could not be repeated when the oil price started to rise again twenty years later. Thus *RTS* shows how the manufacturers respond to a change in the relative price of their raw materials. The relationship expressed in equation (10.7) is subject to the influence of technical development and change, which may significantly influence the amount of primary energy required to achieve a given effect – for example as a result of an improvement in the fuel conversion rate in marine diesel engines.

Picking up the example of forecasting Japanese iron ore imports, there is the impact of stock building during periods of economic change to consider. For example, as the Japanese economy matured in the 1980s, the growth rate of steel demand slowed. This caught out forecasters who, in the early 1970s, had assumed that steel demand in Europe and Japan would continue to grow at the same rate in the 1970s as it had in the 1960s. To meet this demand steel-makers planned to expand output from 110 mt to 180 mt.

But as the economy matured steel demand stopped growing and Japanese steel production never exceeded 120 mt. The same issue arose with the Chinese steel industry when it started to grow very rapidly in 2003–8. Analysts had to estimate how long the very rapid growth of steel production would continue. The problem was that the underlying demand was growing rapidly because the economy was building infrastructure, housing and durable goods stocks such as motor cars, and once the stocks were built up demand growth would slow. In both cases a carefully structured forecasting model would show how much of the demand growth was driven by stock building of steel-intensive products such as buildings and motor vehicles and how that trend might change as the economy matured. What it cannot usually do is predict how rationally people will approach the process of building the economy – whether it will be a sequence of boom and bust cycles or a carefully planned evolution. That is a matter of judgement.

Another potential trap for unwary forecasters is factor substitution. In addition to iron ore, there are other materials such as steel scrap which will do the same job. If the supply of steel scrap increases, this can be used instead of ore, making the iron ore demand forecast more complex. Or consider the thermal coal trade. There may be no local coal, but many power stations can use oil or gas in place of coal. Another complexity is the competition between domestic and foreign supplies. During the 2003–8 Chinese steel boom, international iron ore prices rose sharply and in 2005 there was a large increase in Chinese domestic iron ore production, which had previously been static, but which suddenly became very profitable. Sometimes technology changes alter the domestic or foreign production functions, with major consequences for trade. For example, the rise of 'mini-mills' using cheap scrap in Asia provides direct competition for blast furnace steel, changing the pattern of the iron ore trade. Similarly, new technology which reduced the cost of offshore production enabled Europe to increase its domestic oil production in the 1990s. Whilst these relationships are not easy to quantify, they illustrate the importance of gaining a thorough understanding of the demand relationships underlying the demand function for a commodity.

10.6 COMMODITY TRADE CYCLES

Another aspect we need to get to grips with in analysing trade is the trade cycle. When we discussed shipping cycles in Chapters 3 and 4, we saw that part of the cyclical effect filters through from the demand side of the shipping model. Trade is subject to cycles at three levels: seasonal cycles which occur regularly at particular times of the year; short-term cycles which accompany the international business cycle; and long-term waves arising from structural developments in the international economies.

Seasonal and short-term cyclical trade

Seasonal cycles are well known in shipping and may arise from seasonal effects on the supply or demand side of the commodity market. An example of a supply-driven seasonal cycle is the summer lull in the bulk carrier market caused by the slow down of grain exports from the USA in July and August. This is when the US grain harvest takes place and by this time shipments from the previous season have usually run down but the new season shipments have not yet started. An example of seasonality in commodity demand is the cycle in world oil demand which results in lower trade in the second quarter of the year and higher trade as stocks are built up for the Northern Hemisphere winter in the fourth quarter. This is shown in Figure 10.6, which plots quarterly oil demand. These seasonal fluctuations are generally more noticeable when the oil market is just in balance and less apparent when it is very tight or in surplus.

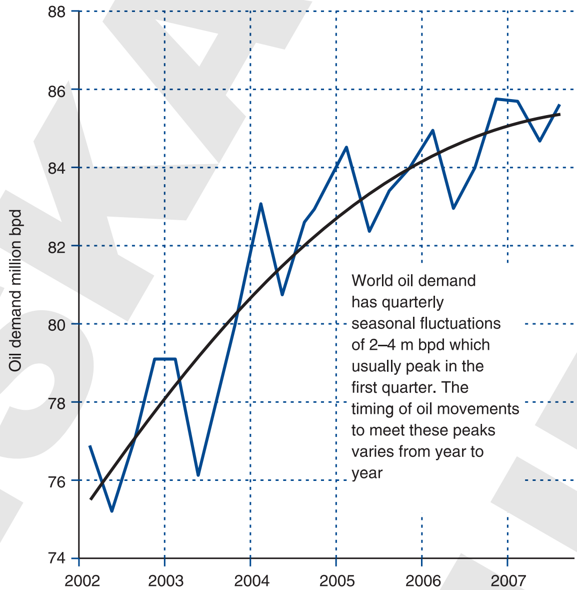


Figure 10.6
Quarterly cycles in world oil demand
Source: IEA Monthly Oil Market Report

Short-term volatility in commodity trades can also result from temporary local shortages of a product or commodity which could normally be obtained locally at a competitive price, but which temporarily is not available in sufficient quantities. Temporary shortages may arise from business cycles in demand, mechanical failure, disasters (e.g. the Kobe earthquake in 1994), poor planning or a sudden burst of commodity inflation which encourages manufacturers to build stocks of raw materials. In these circumstances the pattern of trade suddenly changes. For example, chemical manufacturers produce many different compounds and much of the seaborne chemicals trade is to supply temporary shortages for a particular compound or feedstock.

Long-term influences on trade

There are also long-term cycles in trade. Our analysis of the ‘causes’ of sea trade at the start of this chapter identified economic activity (GDP) as by far the most important and that on average trade increases with GDP at an average rate of 104,300 tons for each extra $1 billion of GDP. One of the important lessons to be learned is that the relationship between trade and GDP is not static. As countries grow, their economies change and so does their trade. One of the most fundamental principles of trade forecasting is to recognize these changes and build it into the forecast. To do this we must understand the relationship between trade and GNP.

The key is to recognize the patterns in the way different parts of the economy develop over time. If we look more closely at the structure of world economic activity we can

BOX 10.1 ISIC SECTORS

ISIC	*Sector*	*% Total GNP*	*Maritime intensity*
1	Agriculture	8	High
2–3	Mining and utilities	4	High
4	Manufacturing	28	High
5	Construction	6	High
6	Wholesale and retail	16	None
7	Transport and comm	7	None
8–9	Other (services)	31	Very low
	TOTAL	100	

immediately see why trade is likely to change as a country grows. Gross national product, a measure of the total economic output of a country, can be divided into the nine sectors shown in Box 10.1, which follow the International Standard Industrial Classification (ISIC). Each sector has a different propensity for maritime transport. Agriculture, mining and manufacturing are directly involved with trade because they produce and consume physical products which can be imported or exported. In contrast, businesses in the wholesale, retail, transport and service sectors produce services rather than physical goods. For example, the service sector consists of activities such as banking and insurance, public administration, social services, education, medicine, recreation facilities, and household services (repair, laundry) which have little if any impact on maritime transport. Of course, it is not quite that simple because a thriving service sector generates income which may be spent on physical goods, but often as income rises demand switches to services such as health care, education and eating out.

When we examine the growth of modern economies we find that economic activity shifts away from the trade-intensive activities towards the service sector. It follows that we must expect the pattern of trade growth to change as the country grows and develops. To illustrate the nature of this change, Figure 10.7 shows how the GDP of South Korea changed between 1970 and 2006 when the country was going through its development cycle. In 1970 the South Korean economy was in the early

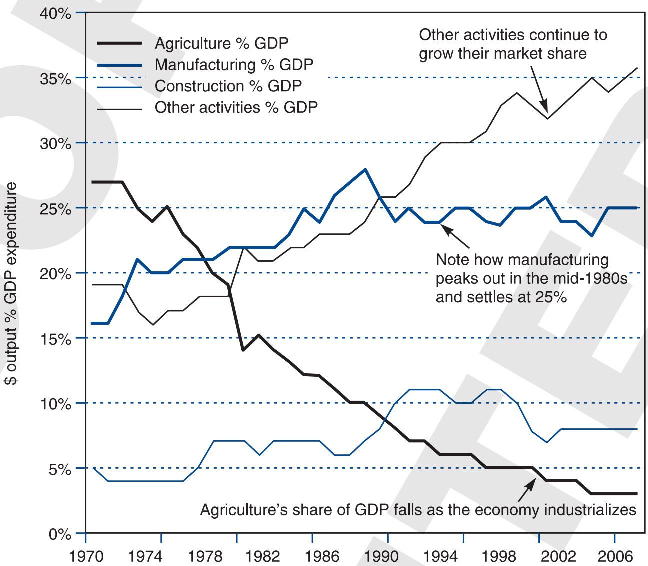


Figure 10.7
Structural GDP changes, South Korea, 1970–2006
Source: United Nations statistical database

stages of industrialization and the economy was dominated by agriculture, which accounted for 28% of GDP, while manufacturing was only 16% of GDP. But in the following decades agriculture declined to 3%, whilst manufacturing, construction and other service activities increased their share of GDP, changing South Korea from a rural society to a modern industrial economy. As a result, seaborne imports grew very rapidly at 11% per annum. But in the mid-1980s manufacturing's share stabilized at 25% and construction did much the same. But the other activities, which include many services such as education and healthcare, continued to grow, reaching 37% in 2006. Much the same development pattern was followed by Japan during its development cycle in the 1960s. Agriculture, mining, utilities, construction and manufacturing all peaked out, but services increased their share of GDP. In the USA, a very mature economy, services now have a dominant position, accounting for 56% of GDP in 2006, whilst agriculture, still a major US business, fell to 0.9% and manufacturing was only 13%. The development pattern is clear from these examples – agricultures give way to manufacturing and construction, which in turn give way to services.

However, this is not the whole story. As manufacturing industry loses market share, there is also a change in the type of goods manufactured. An analysis carried out by Maizels to establish a typical pattern of expansion of manufacturing industry, shown in Table 10.4, illustrates the point. At low income levels food manufacturing and textile industries are the most important when, in accordance with Engel's law, these products make up a large part of demand. Their share then declines rapidly, to be taken over by metals, metal products and chemical. At a certain income level the share of metals stabilizes, while the share of metal products continues to grow as more value is added to the basic materials. This implies that output becomes less resource-intensive at high income levels, being directed towards value-added products. For example, motor car production progresses from economy models to executive limousines. Again we see evidence that we must expect the structure of economic activity to change with growth, bringing consequences for trade.

Table 10.4 Pattern of manufacturing production per head, 1955 prices and percentages

	$100	$250	$500	$750	$1,000
Food and beverages	40	33	26	21	18
Metals	4	5	7	7	8
Metal products	4	10	18	24	29
Chemicals	0	2	4	7	9
Textiles	26	18	13	10	8
Other manufactures	27	32	32	31	29
Total	100	100	100	100	100

Source: Maizels (1971).

The stages of economic development

Academics have spent much time discussing these changes to see if there is a consistent pattern of development. The 'stages of growth' theory developed by Rostow provides a useful starting point.[10] He argued that as economies grow they go through a series of different phases which he put into five categories according to the stage of economic development they had reached. The five stages are shown in Box 10.2.

There has been a good deal of discussion of Rostow's work. Like so many economic theories, Rostow's theory is based in a simple common-sense idea. As economies grow they start by producing necessities such as infrastructure which are resource-intensive, then progressively turn to the finer things of life (value-added products) as they become wealthier.

BOX 10.2 ROSTOW'S FIVE STAGES OF ECONOMIC DEVELOPMENT

Stage 1 *The traditional society*. This is a predominantly agricultural economy. Unchanging technology places a ceiling on the level of attainable output per head. This ceiling results from the fact that 'the potentialities which flow from modern science and technology are either not available or not regularly and systematically applied'. These societies devote a very high proportion of their resources to agriculture. They hardly trade by sea, except for food aid and the export of a few cash crops.

Stage 2 *The pre-conditions of take-off established*. The second stage requires a surplus above subsistence, the development of education and a degree of capital accumulation to provide the foundation for economic growth. For example, in seventeenth-century England these conditions were established by a change in attitudes to investment, the emergence of banks and other institutions for mobilizing capital, etc. Sea trade is small but very active and growing fast.

Stage 3 *The take-off*. In Rostow's analysis this stage is followed by a long interval of sustained but fluctuating progress as technology is extended over the whole front of economic activities. Increased investment permits output regularly to outstrip the increase in national population. New industries appear, older ones level off and decline. Changes take place in the external trade of the country, goods formerly imported are produced at home, new import requirements develop and new commodities are made for export.

Stage 4 *Maturity*. After a period, which Rostow placed at 60 years after the beginning of take-off, maturity sets in. By this stage the economy has extended its range into more refined and complex processes, with a shift in focus from coal, steel and heavy engineering industries to machine tools, chemicals and electrical equipment. He thought Germany, Britain, France and the United States passed through this phase by the end of the nineteenth century or shortly afterwards. Depletion of raw materials may boost the import trade, while manufacture will dominate exports.

Stage 5 *Mass consumption*. The fifth stage sees a movement of the leading sectors of industry towards durable consumer goods and services. A large proportion of the population can afford to consume much more than basic food, shelter and clothing, and this brings about changes in the structure of the working population, including a progressive movement into office and service work.

Maizels, who made a very long-term study of this hypothesis, explained it in the following terms:

> as a country becomes progressively more industrialised the proportion of the occupied population engaged in manufacturing does not rise indefinitely – there is an effective limit which may have been reached in a number of countries. This limit comes into operation for two reasons. Firstly as the economy grows and income rises the demand for workers in service operations such as doctors, typists, government officials increases as fast [as] or faster than the demand for manufactured goods. Secondly as productivity increases in manufacturing tend to outstrip the productivity increase in the distribution of goods from factory to the consumer, these workers tend to be absorbed in distribution to match the increased flow of industrial products.[11]

This reasoning suggests that the progress of economic growth will be associated with an increasing share for services and a corresponding decline in the growth rate of manufacturing industry and seaborne trade. Each development cycle is different, so it is not possible to set precise limits on the duration of a stage, or even to be sure when a new stage is about to begin, and the concept of a progression is helpful.

The trade development cycle

If we apply the `stages of growth' concept to seaborne trade it is clear that, over a period of years, we must expect the trade of a country to change. How it changes depends on what stage the economy has reached in the economic growth cycle. The early stages of growth involve the import of all but the simplest items such as food and textiles, paid for by the export of whatever 'cash crops' are available – sugar, tropical fruit, oil, copper, jute and hardwood logs are typical examples. The availability of foreign exchange is the main constraint on trade and generally keeps trade at a low level. Countries such as Guinea, Togo and Cameroon in West Africa currently fall into this category.

As the economy develops through stages 2 and 3, the demand for raw materials such as iron ore, coal, non-ferrous metal ores and forest products increases as the industrial infrastructure is built up. If raw materials are not available locally they must be imported, as must the more sophisticated machinery, and paid for by exports of semi-manufactures and any primary exports which are available. The reconciliation of domestic and foreign markets thus forms a basic requirement of growth at this stage. Industries such as shipbuilding and automobiles are frequently developed as lead export earners, a pattern set by Japan in the 1950s and subsequently followed by South Korea, Poland and China.

When the economy matures, the character of seaborne trade changes again. In the course of time, whether 20 years or 50, the building-blocks of a capitalist economy are in place. Industrial infrastructure, housing, roads, railways and stocks of consumer durables such as motor vehicles and washing machines have reached a mature level.

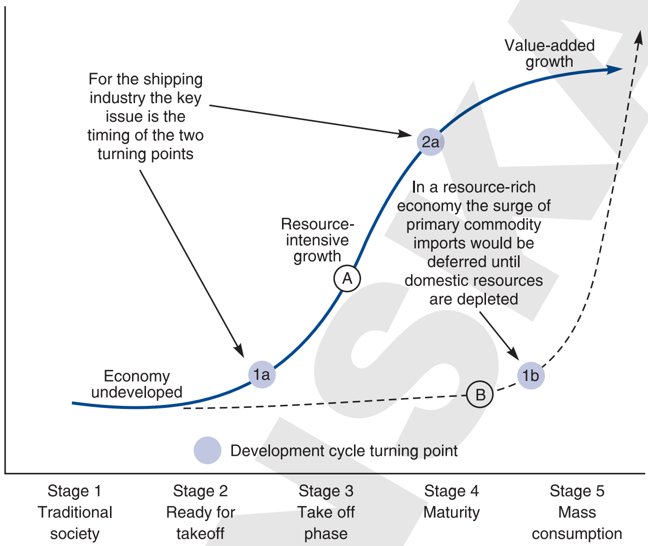


Figure 10.8
Seaborne trade development cycle
Source: Martin Stopford

Industries such as steel, construction and vehicle manufacture, which underpinned the growth during stage 2, stop growing and economic activity gravitates towards less material-intensive activities. Manufacturing gravitates towards the higher value-added end of the product range. How this affects trade depends on domestic resources. If the economy has always relied on imported raw materials, the growth rate of bulk imports slows, though the trade in manufacture shipped by liner and air freight will continue to grow. Typically this produces a trade development cycle of the type shown by curve A in Figure 10.8. However, the sea trade of countries which start out with extensive natural resources is likely to follow a different path. As industrialization consumes resources and domestic supplies become depleted, or better-quality materials become available abroad, bulk imports may start to increase. This happened in the USA when oil demand drew ahead of domestic production and imports started to grow rapidly after 1970. In such cases the trade development cycle may follow a path more like curve B in Figure 10.8.

Ultimately the seaborne trade development cycle is just a convenient way of summarizing certain common patterns which appear to occur in the world economy – it is not a law, nor does it apply in every case. Since economic development draws heavily on natural resources which are unevenly distributed between countries, we must expect each country to have a unique trade development cycle, determined by its factor endowments or other unique political and cultural characteristics. Thus the trade development cycle of a resource-rich economy which can draw on local raw materials in the early stages of growth, possibly with an exportable surplus, will be completely different from that of a country without raw materials. The shape of these 'trade development curves' can be seen in Figure 4.3 which shows the imports of western Europe, Japan, South East Asia and China between 1950 and 2005. The pattern is surprisingly similar considering the diversity of the countries and regions. Europe took a long pause in its development path between the mid-1970s and the mid-1980s and Japan's import path changed more dramatically than Europe's has done yet, probably because Europe is a much bigger economic unit with more domestic resources. Clearly there is much to consider in explaining the precise shape of these curves, but what we can be sure of is that economies are constantly changing and these changes have a major impact on the international transport industry.

10.7 THE ROLE OF SEA TRANSPORT IN TRADE

Long-term price elasticity of sea transport demand

Finally, we should be aware of the part played by sea transport in facilitating trade. In the short term demand for sea transport is generally price inelastic, since once the cargo reaches the quayside shippers generally have few options other than shipping it. But in the longer term, trade volumes are price elastic and the price of freight plays a vital part in determining the growth and pattern of trade. The world trade model we discussed in Sections 10.4 and 10.5 suggests that the location of manufacturing processes will respond to the relative costs of factors of production between regions, and for many commodities the cost and availability of sea transport plays a part in that process. So the sea transport model should take account of this long-term relationship between transport costs and the volume of trade.

Because freight is part of the delivered cost of goods, a change in relative transport costs can affect the volume of cargo shipped. For example, in today's highly competitive world a television set assembled in Malaysia and exported to London could be competing in London shops with a similar set assembled in Wales. In one case the television set makes a 10,000 mile sea voyage, whilst the other only travels 200 miles from Wales to London. So we have two sets of relative costs to consider: the relative cost of manufacturing in Malaysia and Wales, and the relative cost of transport. If the c.i.f. price of the Malaysian product is lower than that of the Welsh product, the retailer will buy the Malaysian product in place of the Welsh one and sea trade will grow.

Viewed in this way, the liner trade is likely to be price elastic because lowering prices encourages the substitution of cheap foreign substitutes for local products. As manufacturers adjust their sourcing strategy to changes in relative c.i.f. costs and the transport element in this calculation falls, overseas suppliers will increase their market share, boosting trade. This resulted in the trade system we discussed at the beginning of the chapter (see Figure 10.1) with shipping providing the vital economic link between raw materials exporters, primary processing plants, assembly plants, wholesalers and retailers. As sea transport costs fell in real terms over the last fifty years, it opened up new opportunities for low-cost manufacturing, often involving multiple sea voyages. For example, in the present case, many high-tech components are shipped to China where they are processed and exported as finished goods. An extreme example is rough castings from Detroit, which are shipped to China for machining and then back to Detroit for finishing. This is just a simple arbitraging based on the reliability and cost of the transport network. So the liner operator who drives freight costs down by ordering bigger ships helps to generate new cargoes.[12]

Unit costs and transport logistics

By far the most important way of reducing the price of sea transport is economies of scale, but when viewed in the context of the whole seaborne logistics operation, the relationship between ship size and unit cost is not simple. We touched on economies of scale in earlier chapters (Sections 2.6, 2.8, 6.2), but now it is time to analyse its impact on the operating economics of the bulk, specialized and liner trades we discuss in the next three chapters, using a modified version of the unit cost model discussed in Chapter 6.

The cost per tonne of cargo transported depends upon the annual cost of the ship itself plus the bunkers consumed in the year, divided by the tonnes of cargo transported:

$$\text{Cost per tonne} = \frac{\text{Ship cost p.a.} + \text{Bunker cost p.a.}}{\text{Tonnes transported p.a.}} \tag{10.8}$$

As we saw in Chapter 6, the cargo transported depends on the number of trips made in a year, multiplied by its cargo capacity, which in this case is measured in deadweight:

$$\text{Tonnes transported p.a.} = \frac{\text{Days on hire}}{\text{Days per trip}} \times \text{Ship size (dwt)} \tag{10.9}$$

Finally, the days per trip depends on the distance, the speed and the port days:

$$\text{Days per trip} = \frac{\text{Distance per trip}}{\text{Speed} \times 24} \times \text{Port days per trip} \tag{10.10}$$

The analysis in Table 10.5 illustrates the relationship between ship size, unit transport costs, and transport volumes which is an equally important part of the logistics problem facing the sea transport business. The analysis uses vessels ranging from 30,000 to 170,000 dwt and the general assumptions are shown in column 1 of Table 10.5(a). All ship sizes spend 6 days per trip in port, 350 days on hire per annum, and operate at 14 knots using bunkers costing $200 per tonne. Backhaul voyages are in ballast. The ship costs are shown in columns 2–5 of Table 10.5(a). Time-charter rates are taken from Table 6.1 and represent the break-even cost in 2005. Bunker costs shown in columns 5 and 6 are based on typical consumption rates for each size of ship. Finally, in column 7 we calculate the annual cost per deadweight for each ship size, which falls from $185 per deadweight per annum for a 30,000 dwt vessel to $66 per deadweight per annum for a 170,000 dwt bulk carrier. So transporting cargo in the Capesize bulk carrier saves about 65% compared with a 30,000 dwt bulk carrier because the unit costs of both the ship and bunkers are lower for the big ship.

Table 10.5(b) examines the impact of distance on transport costs and transport volumes. Voyages range from 4,000 miles per round trip to 11,000 miles. Part A shows that the number of trips per annum reduces from 30 for a 4,000 mile trip to 11 for an 11,000 mile trip. This covers the range of voyages normally undertaken by deep-sea bulk carriers.

Table 10.5 Economies of scale model for different bulk carrier sizes and distances

(a) Basic assumptions

	1	2	3	4	5	6	7
		Ship costs					
	General assumptions	*Ship size dwt*	*Timecharter hire (1) $/day (1)*	*Timecharter hire (1) $ mill pa*	*Bunker costs (2) Tons/day*	*Bunker costs (2) $ mill pa*	*Total $/dwt/pa*
Port days per trip	6						
Days on hire pa	350	170,000	24,374	8.53	39	2.73	66
Speed (knots)	14	72,000	16,360	5.73	30.5	2.135	109
Bunker price $/ton (1)	200	46,000	13,657	4.78	24.3	1.701	141
Backhaul %	0	30,000	11,494	4.02	22	1.54	185

(b) Transport performance calculation

	Round trip distance							
Ship size (dwt)	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000
A Trips per year (number)								
All sizes	30	24	20	17	15	13	12	11
B Days at Sea per year (no Backhaul)								
All sizes	170	206	230	247	260	270	278	285
C Tons of cargo transported per year (million tonnes)								
170,000	5.09	4.07	3.39	2.91	2.54	2.26	2.03	1.85
72,000	2.15	1.72	1.44	1.23	1.08	0.96	0.86	0.78
46,000	1.38	1.10	0.92	0.79	0.69	0.61	0.55	0.50
30,000	0.90	0.72	0.60	0.51	0.45	0.40	0.36	0.33
D Total cost per tonne of cargo transported ($ per tonne)								
170,000	2.21	2.77	3.32	3.87	4.43	4.98	5.53	6.09
72,000	3.65	4.56	5.47	6.38	7.30	8.21	9.12	10.03
46,000	4.71	5.89	7.06	8.24	9.42	10.59	11.77	12.95
30,000	6.20	7.75	9.29	10.84	12.39	13.94	15.49	17.04
E Cost per tonne ratios								
170,000	35.7%	35.7%	35.7%	35.7%	35.7%	35.7%	35.7%	35.7%
72,000	58.9%	58.9%	58.9%	58.9%	58.9%	58.9%	58.9%	58.9%
46,000	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%
30,000	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes

1. Time-charter rates from the final column of Table 6.1 based on 2005 capital costs and OPEX
2. From 1990 to 2006 380cSt bunker oil in Rotterdam varied from $90/tonne to $340/tonne

Part (b) focuses on the time spent at sea, and this obviously depends on the time in port. On a 4,000 mile voyage the ship only spends 170 days at sea, compared with 285 days on an 11,000 mile voyage, so cargo handling is very significant on the shorter routes. This is one reason why ships used on long-distance trades generally do not have their own gear, whereas vessels likely to be used in short trades are generally geared. It also explains why vessels for short-haul routes are often designed with smaller engines and slower speeds and are less sensitive to fuel costs, and more sensitive to port turnaround times.

In Part C we look at the tonnes of cargo carried in a year, and the result is dramatic. The Capesize bulk carrier operating on a 4,000 mile trip transports 5 million tonnes of cargo, whilst the 30,000 deadweight vessel operating on a 11,000 mile trip transports only 300,000 tonnes. This reveals an important logistics characteristic of the economies of scale model. Big ships are cheaper in any trade, but the volumes of cargo they transport may be too large to provide a regular delivery service. In this example to permit a monthly delivery of cargo, the trade would need to be 60 million tonnes a year. This is an important constraint on ship size in both the liner and bulk markets. By the time you get down to the small and medium-size trades there just is not the cargo volume to support a bigger vessel. However, it does mean that small ship trades are always ‘upsizing’.

Finally, the total cost per tonne of cargoes transported is shown in Part D. The cheapest transport is provided by the Capesize bulk carrier on the 4,000 mile round trip. It costs just $2.21 per tonne. At the other extreme, on the 11,000 mile round trip, the 30,000 dwt bulk carrier costs $17.04 per tonne. So economies of scale obviously do matter. A general point confirmed by the analysis is that economies of scale diminish as the size of ship increases. For example on the 11,000 mile voyage, by moving up from a 30,000 dwt bulk carrier to a 46,000 dwt bulk carrier the saving is $4.09/dwt, but increasing the ship’s size by another 16,000 dwt to 72,000 deadweight only saves $2.90/dwt. Finally, the jump in size from Panamax to Capesize, an increase of 100,000 dwt, only saves another $3.94/dwt, roughly the same as increasing from Handy to Handymax. So the pressure to increase parcel size is at its most intense in the smaller sizes. There are many more of these vessels, which explains why size increases in the various bulk fleets occur in all size categories of vessels, not just the biggest.

From this analysis we can derive four conclusions on the role of economies of scale in sea transport:

1. Big ships are always cheaper than small ships creating a financial incentive to use a bigger ship in a particular trade, other things being equal.
2. In absolute terms, the economies of scale on short-haul routes are much smaller than on long-haul routes, so there is less financial incentive to invest in the necessary infrastructure to handle bigger ships.
3. Short-haul trades spend less of their time at sea, therefore design should be focused on cargo handling.
4. Delivery volumes increase rapidly as the voyage length reduces, so the ship size also depends on there being sufficient cargo to fully occupy bigger ships.

One way or another, these conclusions help to explain why the fleets of bulk ships which we will examine in the next two chapters include vessels of many different sizes. In every market we find size segments ranging from very small ships to very large ships, with new investment in every category. We also find that in most trades there is a steady upward drift as bigger ships slowly become substituted for smaller ships.

10.8 SUMMARY

In this chapter we have looked at sea trade from the viewpoint of the countries which trade. There are 100 countries and regions that trade by sea, but some are much bigger than others. In 2004 north-west Europe headed the list with 1.9 billion tonnes of imports and exports, while Brunei, the smallest, reported trade for only 2 million tonnes. When we looked for an explanation for the volume of trade it was clear that the level of economic activity, measured by GNP, was by far the most important. Two other explanatory variables, the size (area) of the country, and its natural resources, make a small contribution, explaining about a quarter of the variation in trade volume. This does not mean they are unimportant, but rather that their impact on trade cannot be reduced to a simple general rule. Population size, it seems, has no explanatory value whatsoever. In conclusion, we must expect sea trade to go hand in hand with economic growth, but modified by the availability of natural resources.

We then turned to trade theory for an explanation of why countries trade. The theory of absolute advantage shows that countries enjoy a higher living standard if they trade because it allows them to focus their scarce resources in the products they are most efficient at producing. Trade increases efficiency and everyone is better off. Taking this explanation a step further, the theory of comparative advantage shows that countries are better off with trade even if their competitors are more efficient at producing everything. All that is needed for trade to be beneficial is that they are relatively better at producing some goods than their competitors. Countries that fear that they will be reduced to poverty by foreign competition are wrong, though in a changing world, adjusting to new competitors can be painful and expensive for some parts of the economy.

What, then, determines the comparative advantage of a particular country? There are several different explanations. The Heckscher-Ohlin theorem argues that if goods require different factor inputs and there are diminishing returns when factors are substituted for each other, the comparative advantage is determined by the distribution of factors of production. Thus countries specialize in the goods which make the best use of their most abundant resources. Differences in technology, tastes, transport costs and cyclical surpluses and shortages are other reasons why countries trade.

We discussed the commodity supply and demand model which is often used for the analysis and forecasting of trade. The basic tool is supply–demand analysis, but we also examined the role of prices and substitution in this model, in particular the demand function which recognizes the impact of price changes on consumer demand and income (the Slutsky equation) and on the factor substitution by manufacturers.

We should expect the trade of a country to change over time. Starting from the proposition that GNP drives trade, we looked at the composition of GNP which we divided into nine categories. Some of these activities, especially manufacturing, make extensive use of sea transport, while others, such as services, do not. In practice, we find that as a country grows the structure of its economy changes. The early stages of growth tend to use large quantities of physical materials – infrastructure developments such as roads, railways, ports, and building a stock of cars, ships and industrial plant.

Consequently, there is a rapid expansion of import trade, matched by a corresponding export trade in primary produce or simple manufactures to pay for the imports. Whilst the early stages favour the bulk shipping business, when the economy reaches maturity, the liner business gains from the almost unlimited potential for shipping components and finished goods between developed markets.

The trade development cycle summarizes this dynamic relationship between the sea trade and economic growth. Each country has its own unique cycle which depends on its factors of production as well as cultural and commercial considerations. At the earliest stages of development, imports of manufactures are paid for by cash crop exports. As industry expands, raw materials generate demand for sea transport. The imports of countries with few natural resources slow down, but in countries which were initially resource-rich the depletion of domestic supplies may lead to growing imports of some commodities. Imports and exports of manufactures continue to grow as domestic import and export markets widen. Thus the trade development cycle has different implications for the bulk and liner businesses.

Finally, we explored some of the economics of shipping logistics that will enter into the discussion of the bulk, specialized and liner trades in the following chapters.