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# 6 Costs, Revenue and Cashflow

*Annual income twenty pounds, annual expenditure nineteen nineteen six, result happiness.*
*Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery*

(Mr Micawber in *David Copperfield*)

## 6.1 CASHFLOW AND THE ART OF SURVIVAL

### The impact of financial pressures on shipowners' decisions

In this chapter we look at shipping economics from the perspective of the individual shipping company. Every company faces the challenge of navigating its way through the succession of booms, recessions and depressions which characterize the shipping market. During prosperous periods when funds flood in, it must meet the challenge of investing wisely for future growth and a commercial return on capital. The seeds of future problems are often sown under the heady influence of market sentiment at the peak of a cycle. In recessions the challenge is to keep control of the business when the market is trying to force surplus capacity out of the system by squeezing cashflow and take advantage of the opportunities. During these periods the shipping market is like a marathon race in which only a limited number of entrants are allowed to finish. The race has no fixed length, it goes on lap after lap until enough competitors drop out from exhaustion, leaving the surviving runners to pick up the prizes.

In the last resort what sorts out the winners from the losers is financial performance. The risks faced by shipping companies are illustrated by a ship sale decision reported in *Lloyd's List* during the 1980s recession (Figure 6.1). This was at a time when the freight market was very depressed, and the article reviews the considerations that entered into the decision by a shipping company to sell a VLCC from its fleet. Although this recession occurred many years ago, the circumstances are timeless and illustrate the issues facing shipping company management during depressions. The company was losing money – $14.5 million in the previous year – and the ship was laid up and generating a negative cashflow. For several years the company had accepted this drain

# Lofs is poised to sell 'London Pride'

By Tony Gray, Business Editor

FLEET pruning looks set to continue at
1 London & Overseas Freighters, the UK tanker owner which suffered a loss of £14.5 million last year.

After yesterday's annual meeting Lofs managing director Mr. Miles Kulundis disclosed that the group was actively considering the sale of the VLCC *London Pride*.

2 This 12-year old 259,182-tonnes deadweight tanker is the group's largest and oldest vessel, and has been a drain on the group's financial performance.

For some years, Lofs harboured the belief that it would be able to cash in on the *London Pride's* earning potential once the market picked up. But, the depression in the tanker market has persisted, and the heavily over tonnaged VLCC size range has been the worst affected.

A hint that the *London Pride's* future in the Lofs fleet was in doubt came in the recent annual report.

The chairman's statement disclosed
3 the group's disenchantment with the vessel: "Our VLCC *London Pride*, is still laid-up and, with the benefit of hindsight, it is evident that our hopes for the future of the VLCC were ill-founded."

4 The *London Pride* has, in fact, been laid-up since December 1981. As she is turbine-powered, it seems likely that the vessel will be scrapped if Lofs proceeds with a sale. In current market conditions, a
5 demolition sale may bring in around £4m for Lofs.

6 A sale for further trading could involve an additional $0.5m. Whatever the price achieved, it is likely to be below the
7 sterling book value – of £3.56m at Mar 31 1983 – and a loss being carried into the current year's accounts.

However, the sale would have a
8 beneficial impact on the group's cash flow.

The departure of the *London Pride* would leave Lofs with a fleet comprising five tankers: the two 61,000-tonnes general purpose tankers *London Spirit* and *London Glory*: and the three 138,000-tonners – one of which is jointly owned – *London Glory*, *London Enterprise*, and *Overseas Argonaut*.

Lofs hopes that this will remain its core fleet for the anticipated recovery in freight rates later this year and next as oil re-
9 stocking takes effect. The group placed all its eggs in one basket through the sale earlier this year of its dry bulk fleet to the Onassis group for $20.55m.

Lofs is not alone in discerning a more imminent recovery in the tanker market rather than for bulk carriers. Some fear the dry bulk market could be facing problems of a similar scale to those that have plagued tanker owners for so long.

It is vital for Lofs, after many years of losses and strain on the company's cash resources, that the tanker market does improve this winter.

Lofs has a versatile fleet that should be able to capitalise quickly on a rise in freight rates. A phase of oil re-stocking is expected to particularly benefit medium-sized tankers, and the group's 61,000 and 138,000-tonne vessels fit the bill.

**Figure 6.1**
Newspaper report illustrating the commercial influences on a scrapping decision
Source: *Lloyd's List*, July 1983
*Notes*: Influence on scrapping decision: 1 financial performance of the owner, 2 age and size of vessel, 3 market expectations, 4 operating costs (turbines use a lot of fuel), 5 scrap prices, 6 state of second-hand market, 7 book value of vessel in relation to its scrap or resale price, 8 cashflow of company, 9 management policies and attitudes

on its cashflow, in the hope that the market would improve, but the board had now decided that 'with the benefit of hindsight it is evident that our hopes for the future of the VLCC were ill-founded' and had decided to sell the vessel. Its sale would mean writing off as a loss the remainder of its book value not covered by the selling price, so the company would have to announce a large loss, but the proceeds from the sale would improve the cashflow.

Since the vessel was turbine powered and had been laid up for several years it was considered likely that at prevailing market prices the vessel would be sold for scrapping. In the final paragraph the article discusses a further significant decision by the group to sell its dry bulk fleet and concentrate entirely on the tanker market – a strategic decision to sacrifice one part of the business to provide cash to allow the remainder to continue, based on a belief that the prospects for the tanker market were better than those for the dry cargo market.

On the basis of this example, the challenge is to create sufficient financial strength when times are good to avoid unwelcome decisions such as selling ships for scrap when times are bad. It is the company with a weak cashflow and no reserves that gets pushed out during depressions and the company with a strong cashflow that buys the ships cheap and survives to make profits in the next shipping boom. It is not therefore the ship, the administration, or the method of financing that determines success or failure, but the way in which these are blended to combine profitability with a cashflow sufficiently robust to survive the depressions that lie in wait to trap unwary investors.

## 6.2 FINANCIAL PERFORMANCE AND INVESTMENT STRATEGY

If financial performance is the key to survival in the shipping market, then how is it achieved? The three key variables with which shipowners have to work are:

- the revenue received from chartering/operating the ship;
- the cost of running the ship;
- the method of financing the business.

The relationship between these cashflow items is shown diagrammatically in Figure 6.2. Revenue, represented by the box on the left, is received from trading the ship. Although shipowners do not generally control the price they receive per tonne of cargo, there are various ways of squeezing more revenue out of the ship. Increasing cargo capacity to achieve economies of scale is one solution. A few thousand tonnes of extra revenue-earning capacity can make all the difference. Increased productivity by operational planning, reducing backhauls, minimizing time off hire, improved deadweight tonnage utilization and cutting cargo-handling time are other possibilities. From the revenue earned by the ship must be deducted running costs and capital payments shown by the boxes in the centre of Figure 6.2. The costs include operating, voyage and cargo–handling costs, while capital repayments cover interest and periodic maintenance of the ship. What is left after these charges may be subject to taxes, though few shipowners are subject to this particular cost. The residual is paid out in dividends or retained within the business.

As we shall see, the way shipping companies manage these cost and revenue variables significantly influences the financial performance of the business. More specifically:

- The choice of ship influences the running cost. Day-to-day cash costs are higher for old ships with ageing machinery requiring constant maintenance; a rusty hull requiring regular steel replacement; and high fuel consumption. Modern vessels with fewer crew, more reliable fuel-efficient machinery and negligible maintenance cost less to run.
- Running a successful shipping operation is not just a matter of costs. It also involves squeezing as much revenue as possible out of the ship. Revenue may be steady on a long-time charter or irregular on the spot market. It may be increased

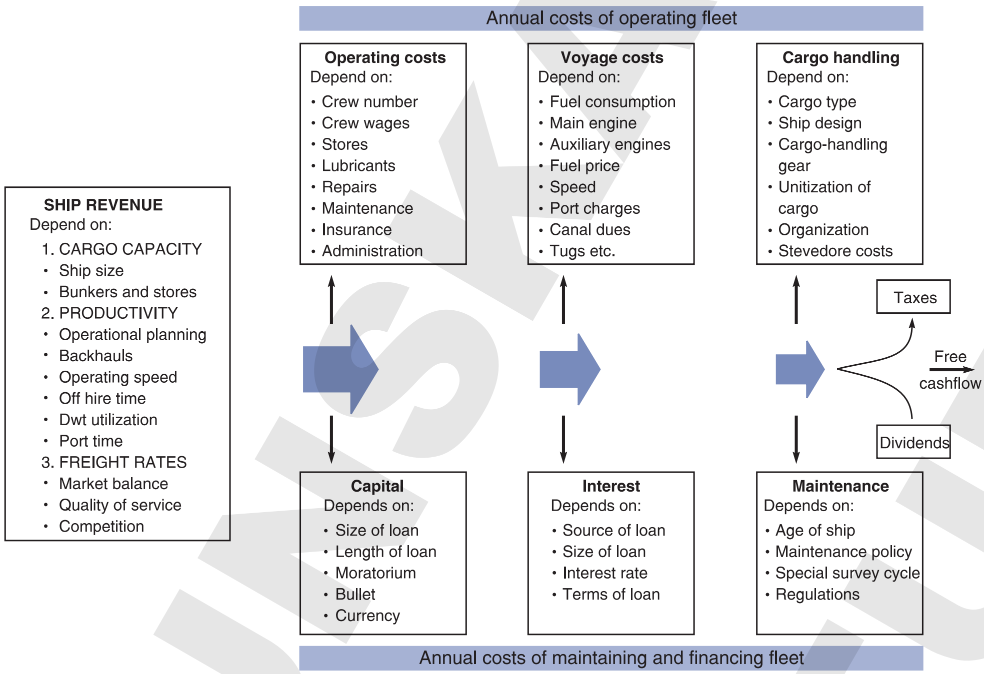


**Figure 6.2**
Shipping cashflow model, showing the revenue, operating and capital payments

by careful management, clever chartering and flexible ship design to minimize time in ballast and ensure that the vessel is earning revenue for a high proportion of its time at sea.

- Financing strategy is crucial. If the vessel is financed with debt, the company is committed to a schedule of capital repayments, regardless of market conditions. If the ship is financed from the owners' cash reserves or outside equity finance there are no fixed payments to capital. In practice if a shipping company has only limited equity capital, the choice is often between an old ship with high running costs but no debt and a new ship with low running costs and a mortgage.

The trade-off between new and old tonnage, single-purpose or sophisticated multi-purpose tonnage, and debt or equity financing offers an enormous range of possible ship investment strategies. Each shipping company makes its own choice, giving it a distinctive style of operation which soon becomes well known in the shipping market. However, once a fleet has been purchased and financed, many of these parameters are fixed and the options open to shipowners become more restricted.

The result can be a striking difference between the culture and approach of shipping companies. For example, some companies specialize in operating older tonnage with low debt and high equity. The low fixed capital cost makes it possible to lay the ships up during depressions with minimum cashflow and earn good profits during booms, often by the sale of the ship itself. However, the company must have the 'hands on' skills to manage old ships and deal with the problems of maintenance and reliability which an old fleet is likely to encounter. Other companies specialize in modern, highly sophisticated ships, which give the maximum revenue-earning potential through their high flexibility and ability to carry special cargoes. This strategy is capital-intensive and often involves a high degree of debt financing, with the result that the ships have to be operated continuously throughout depressions. Getting value for the investment involves strong management skills to build client relationships, careful quality management and often a corporate structure. This approach focuses on minimizing unit costs on a continuous basis, whereas the other is more concerned with cost minimization. Both carry cargo in ships, but they are worlds apart.

## The classification of costs

If we start with the basics, the cost of running a shipping company depends on a combination of three factors. First, the ship sets the broad framework of costs through its fuel consumption, the number of crew required to operate it, and its physical condition, which dictates the requirement for repairs and maintenance. Second, the costs of bought-in items, particularly bunkers, consumables, crew wages, ship repair costs and interest rates, are subject to economic trends outside the shipowner's control. Third, costs depend on how efficiently the owner manages the company, including the administrative overheads and operational efficiency.

Unfortunately the shipping industry has no internationally accepted standard cost classification, which often leads to confusion over terminology. The approach used in the present volume is to classify costs into five categories:

- Operating costs, which constitute the expenses involved in the day-to-day running of the ship – essentially those costs such as crew, stores and maintenance that will be incurred whatever trade the ship is engaged in.
- Periodic maintenance costs are incurred when the ship is dry-docked for major repairs, usually at the time of its special survey. In older ships this may involve considerable expenditure, and it is not generally treated as a part of operating expenses. Under international accounting standards an assessment must be made of the total periodic cost over the maintenance cycle and this is capitalized and amortized. The costs when actually incurred are treated as cash items separately from operating costs.
- Voyage costs are variable costs associated with a specific voyage and include such items as fuel, port charges and canal dues.
- Capital costs depend on the way the ship has been financed. They may take the form of dividends to equity, which are discretionary, or interest and capital payments on debt finance, which are not.
- Cargo-handling costs represent the expense of loading, stowing and discharging cargo. They are particularly important in the liner trades.

By analysing these different categories of costs we can develop a more thorough understanding of the market economics discussed in Chapter 5. In particular they provide an important insight into the shape of the short-run supply curve and decision process which drives the adjustment of supply and demand described in Figure 4.15. There are two central cost-related principles which we must explore, first the relationship between cost and age, and second the relationship between cost and size.

## Ship age and the supply price of freight

Within a fleet of similar sized ships, it is usual to find that the old ships have a different cost structure from the new ones. Indeed, this relationship between cost and age is one of the central issues in shipping market economics, since it defines the slope of the short-run supply curve shown in Figure 4.12 in Chapter 4. As the ship ages its capital cost reduces, but its operating and voyage costs increase relative to newer ships which are more efficient due to a combination of technical improvement since the ship was built (e.g. more efficient engines) and the effect of ageing.

An illustration of the way the cost profile changes with age is provided by the comparison of the annual costs of three Capesize bulk carriers, one 5-years-old, one 10 years and one 20 years, shown in Figure 6.3. All three ships are trading under the Liberian flag using the same crewing arrangements and charging capital at 8% per annum. The overall cost per day works out at about the same for the 5-year-old and 10-year-old ships but on these assumptions the 20-year-old ship is about 13% cheaper. However, the structure of costs of the new and old ships is quite different. If we consider only the direct cash costs and exclude capital costs and periodic maintenance, the modern ship is much cheaper to run, with operating expenses of only 18% compared with 31% for the old ship and bunkers 40% compared with 33% for the modern ship. This differential is due to the old ship's higher operating costs, larger crew, more routine maintenance and lower fuel efficiency (remember the owner trading spot gets paid per tonne of cargo, so fuel is an out-of-pocket expense). However, when we look at capital the position is very different, accounting for 47% of the cost of the modern ship but only 11% of the cost of the old ship. The obvious conclusion is that owners of new and old ships are in very different businesses.

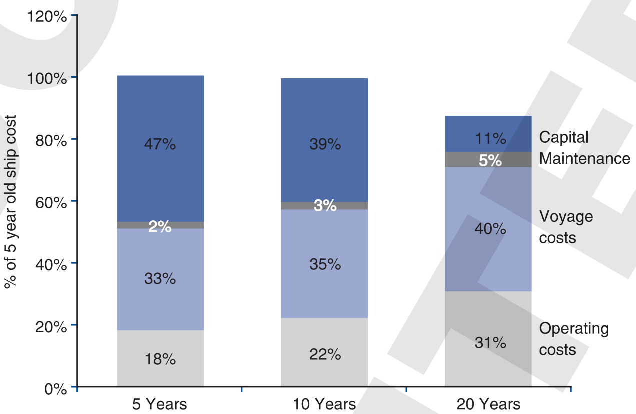


**Figure 6.3**
Capesize bulk carrier cost and age
Source: Clarkson Research Studies, Capesize Quality Survey (1993)

This cost differential plays an important part in the cashflow 'race'. If we ignore capital costs and periodic maintenance, the modern vessel can survive at freights which are way below the lay-up point for older ships. It is this differential which determines the slope of the supply curve. Because spot earnings have to cover operating and fuel costs, for any given spot rate the old ship generates less cash than the new ship. If gross earnings for a Capesize (i.e. before bunker costs) fall to the operating costs of the 20-year-old ship for any length of time, the owner of the 20-year-old ship, will probably lay it up, since revenue does not cover operating and voyage costs, but the modern ship with its lower operating expenses will be able to go on trading. Will the old ship come out of lay-up? This is where periodic maintenance costs come into play. Although these costs can be postponed, they cannot be deferred indefinitely. In this example, when the fourth special survey arrives at about 20 years, the ship faces a bill for, say, $2.2 million. This must be paid if the ship is to continue trading, so the owner must decide whether the repair is worthwhile. If he is pessimistic about the future and he expects more bills to follow, he may decide to sell for scrap. This is how the scrapping mechanism works. But if the market is strong he may decide to patch it up for a couple more voyages. For example, if he can convince himself that the rates will be $6,000 per day above operating costs for a year, that would pay the repair cost in full. So by adjusting rates the market can adjust the flow of ships leaving the market in response to the balance of supply and demand, and it relies on the astuteness of owners in estimating what will happen next to fine-tune this process. It is a very efficient system for squeezing the maximum economic value out of the ships, though in the end it is not a mechanical relationship, it depends on what owners and their financiers decide to do.

It is not just old ships that are on trial during recessions. Capital costs cannot just be written out of the picture. Ships financed with bank loans have a fixed cashflow which may exceed operating costs by a considerable margin. In these circumstances it is the owner of the modern ship who is on trial. If the freight is not enough to cover financing costs and the owner defaults, the bank may enforce its mortgage rights, seize the ship and sell it to cover the outstanding debt. In this way the market filters out the substandard owners as well as the substandard ships.

## Unit costs and economies of scale

Another economic relationship which dominates shipping economics and complicates life for shipping economists is the relationship between cost and ship size, usually referred to as economies of scale. Shipping is about moving cargo, so the economic focus of the business is unit cost, the cost per ton, per TEU or per cubic metre. That is where we will start. We define the annual cost per deadweight tonne of a ship as the sum of operating costs, voyage costs, cargo-handling costs and capital costs incurred in a year divided by the deadweight of the ship:

$$C_{tm} = \frac{OC_{tm} + PM_{tm} + VC_{tm} + CHC_{tm} + K_{tm}}{DWT_{tm}} \quad (6.1)$$

where $C$ is the cost per dwt (or other capacity measurement e.g. M3) per annum, $OC$ the operating cost per annum, $PM$ the periodic maintenance per annum, $VC$ the voyage costs per annum, $CHC$ the cargo-handling costs per annum, $K$ the capital cost per annum, *DWT* the ship deadweight, *t* is the year, and *m* stands for the *m*th ship.

This relationship is particularly important because operating, voyage and capital costs do not increase in proportion to the deadweight of the vessel, so using a bigger ship reduces the unit freight cost. For example, a VLCC of 280,000 dwt requires the same number of crew as a 29,000 dwt products tanker, and uses only a quarter as much fuel per deadweight tonne. Similarly, for dry bulk carriers in 2005 the annual cost for a 170,000 dwt Capesize bulker was about $74 per cargo tonne compared with $191 per cargo tonne for a 30,000 dwt vessel, as can be seen in Table 6.1. Capital, operating expenses and bunker costs all contributed to this. Provided the cargo volume and port facilities are available, the owner of a large ship has a substantial cost advantage, and can generate a positive cashflow at rates that are uneconomic for smaller ships. In this example, a hire of $44 per dwt per annum would cover a Capesize's operating and bunker expenses, but would only pay operating expenses for a 30,000 dwt bulk carrier, with nothing left for bunkers.

This explains why cargo ships tend to get bigger. In 1870 brokers talked about a 'handy' (i.e. flexible) vessel of 2,000 tons, but 130 years later a Handy vessel was approaching 50,000 tons. Since ships have grown steadily bigger over the years, in practice age/cost differentials and economies of scale have worked together. The penalty of size is the loss of flexibility, which impacts on the revenue side of the equation by limiting the ports that can be entered and making it more difficult to reduce ballast time by obtaining backhaul cargoes. Investors in the next generation of bigger ships always face the risk that they have overstepped the mark.

**Table 6.1** Economies of scale in bulk shipping (including bunkers)

| | Assumptions | | | Unit Costs ($/dwt p.a.) | | | | |
|---|---|---|---|---|---|---|---|---|
| Cargo capacity dwt | Investment $m[a] | Bunker cons tons/day | Operating $m p.a. | Operating cost | Bunker costs[b] | Capital cost[c] | Total cost $/dwt p.a. | Memo[d] daily cost $000/day |
| 30,000 | 26 | 21 | 1.2 | 40.6 | 56.7 | 93.5 | 191 | 11,494 |
| 47,000 | 31 | 24 | 1.4 | 30.3 | 41.4 | 71.4 | 143 | 13,657 |
| 68,000 | 36 | 30 | 1.8 | 26.0 | 35.7 | 58.2 | 120 | 16,360 |
| 170,000 | 59 | 50 | 2.0 | 12.0 | 23.8 | 38.2 | 74 | 24,374 |
| *Memo:* cost of 170,000 dwt ship as % 30,000 dwt ship | | | | | | | | |
| 567% | 231% | 238% | 168% | 30% | 42% | 41% | 39% | |

Source*:* various

[a]Cost of newbuilding in December 2005

[b]December 2005, assuming 270 days at sea per annum at 14 knots and bunkers at $300/tonne

[c]Capital costs at 5% depreciation plus interest at 6% p.a. over 365 days

[d]Time-charter rates are used for the economy of scale calculations

The history of freight cycles is an economic struggle between the big modern ships and earlier generations of smaller ships with outdated technology. Usually the combination of small size, which reduces revenue, and increasing maintenance cost makes the ship uneconomic when it reaches 20 or 25 years old, forcing it from the market. However, when the size of ships stops growing, as happened in the tanker market during the 1980s and 1990s, the economic advantage of the modern ships becomes less clearly defined, extending the economic life of ships.[1]

## 6.3 THE COST OF RUNNING SHIPS

The costs discussed in the previous section illustrate the general principles involved, but in practice all costs are variable, depending on external developments such as changes in oil prices and the way the ship's owner manages and finances the business. To understand ship investment economics we must look in much greater detail at the structure of costs. Figure 6.4 summarizes the key points we will consider. Each box in the diagram lists a major cost category, the variables which determine its value, and the percentage cost for a 10-year-old ship. In the remainder of this section we examine how the four main cost groups – operating costs (14%), periodic maintenance (4%), voyage costs (40%) and capital costs (42%) – are built up to determine an overall financial performance of the ship. Taken together these costs determine the cost of sea transport and they are extremely volatile, as is evident from the trends in fuel, capital and other costs shown in Figure 6.5. Between 1965 and 2007 the ship cost

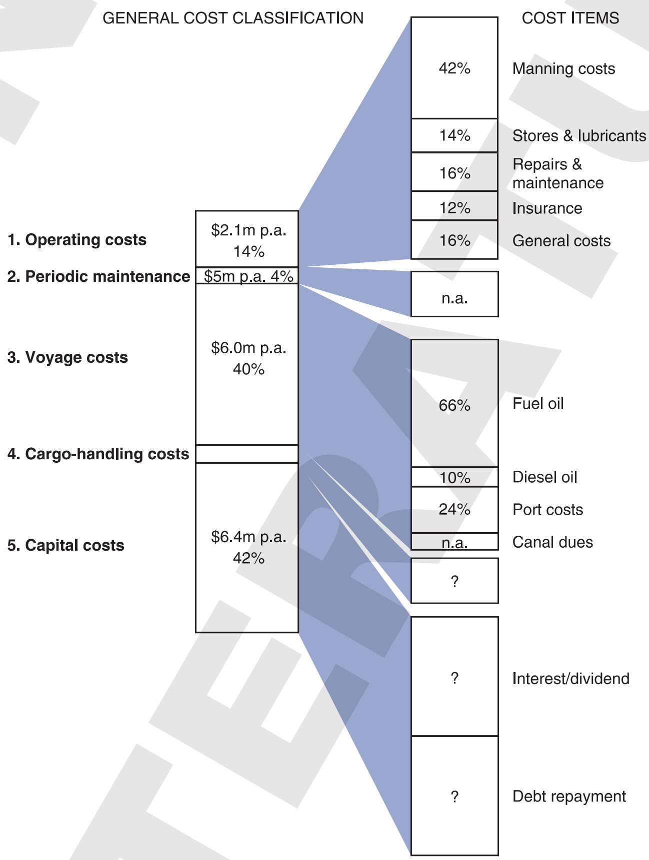


**Figure 6.4**
Analysis of the major costs of running a bulk carrier
Source: Compiled by Martin Stopford from various sources
*Note*: This analysis is for a 10-year-old Capesize bulk carrier under the Liberian flag at 2005 prices. Relative costs depend on many factors that change over time, so this is just a rough guide.

index increased by 5.5% per year, compared with 4.6% for the US consumer price index. However, the ship cost index was far more volatile, driven by the wild swings in fuel and capital costs which together account for close to two–thirds of the total.

## Operating costs

Operating costs, the first item in Figure 6.4, are the ongoing expenses connected with the day-to-day running of the vessel (excluding fuel, which is included in voyage costs), together with an allowance for day-to-day repairs and maintenance (but not major dry dockings, which are dealt with separately). They account for about 14% of total costs. The principal components of operating costs are:

$$OC_{tm} = M_{tm} + ST_{tm} + MN_{tm} + I_{tm} + AD_{tm} \tag{6.2}$$

where $M$ is manning cost, $ST$ represents stores, $MN$ is routine repair and maintenance, $I$ is insurance and $AD$ administration.

An example of the operating cost structure of a Capesize bulk carrier is shown in Table 6.2, subdivided into these categories. In summary, the operating cost structure depends on the size and nationality of the crew, maintenance policy and the age and insured value of the ship, and the administrative efficiency of the owner. Table 6.2 shows the relative importance of each of these components in operating costs and compares them for ships of three different ages, 5, 10 and 20 years.

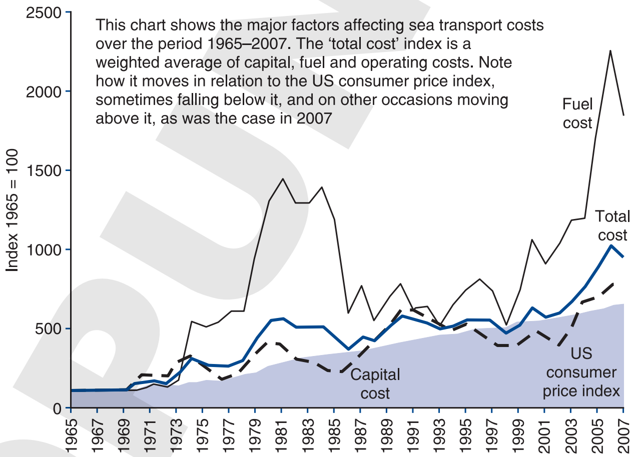


**Figure 6.5**
Inflation in shipping costs, 1965–2007
Source: Fuel costs based on marine bunker price 380 cSt, Rotterdam; capital costs based on Aframax tanker newbuilding price (in $); other costs based on US consumer price index

### CREW COSTS

Crew costs include all direct and indirect charges incurred by the crewing of the vessel, including basic salaries and wages, social insurance, pensions, victuals and repatriation expenses. The level of manning costs for a particular ship is determined by two factors, the size of the crew and the employment policies adopted by the owner and the ship's flag state. Manning costs may account for up to half of operating costs, depending on the size of the ship.

**Table 6.2** Operating costs of Capesize bulk carriers by age ($000 per annum)

| Age of ship | 5 Years | 10 Years | 20 Years | % Total Average |
|---|---|---|---|---|
| **Crew cost** | | | | |
| Crew wages | 544 | 639 | 688 | 30% |
| Travel, insurance etc | 73 | 82 | 85 | 4% |
| Victualling | 46 | 54 | 64 | 3% |
| Total | 743 | 871 | 956 | 41% |
| % | 32% | 31% | 26% | |
| **Stores & Consumables** | | | | |
| General stores | 129 | 144 | 129 | 6% |
| Lubricants | 148 | 148 | 219 | 8% |
| Total | 277 | 292 | 348 | 15% |
| % | 12% | 11% | 9% | |
| **Maintenance & Repairs** | | | | |
| Maintenance | 90 | 169 | 10 | 4% |
| Spares | 74 | 169 | 181 | 7% |
| Total | 164 | 338 | 393 | 14% |
| % | 9% | 15% | 13% | |
| **Insurance** | | | | |
| Hull & machinery & war risks | 133 | 148 | 303 | 9% |
| P&I | 63 | 94 | 120 | 4% |
| Total | 196 | 243 | 423 | 14% |
| % | 32% | 32% | 44% | |
| **General Costs** | | | | |
| Registration Costs | 17 | 17 | 17 | 1% |
| Management Fees | 255 | 223 | 255 | 12% |
| Sundries | 57 | 57 | 57 | 3% |
| Total | 330 | 298 | 330 | 15% |
| % | 14% | 11% | 9% | |
| Total per annum | 1,710 | 2,041 | 2,450 | 100% |
| Daily Costs (365 days) | 4,685 | 5,591 | 6,712 | 100% |

Source: Ten-year old ship, Moore Stephens, V Ships; 5- and 20-year-old ship costs estimated from various sources

The minimum number of crew on a merchant ship is usually set by the regulations of the flag state. However, it also depends on commercial factors such as the degree of automation of mechanical operations, particularly the engine room, catering and cargo handling; the skill of the crew; and the amount of on-board maintenance undertaken. Automation and reliable monitoring systems have played an important part in reducing crew numbers.[2] It is now common practice for the engine room to be unmanned at night, and various other systems have been introduced such as remote control ballast, single-man bunkering, rationalized catering and improved communications which remove the need for a radio officer. As a result crew numbers declined from about 40–50 in the early 1950s to an average of 28 in the early 1980s. Current levels of technology on modern ships allow a basic crew of 17 in a deep-sea vessel, while experimental vessels have been operated with a crew of 10. Under some flags manning scales govern the numbers of personnel required on the various types and sizes of vessels, and any reductions must be agreed between the shipowners' organization and the seamen's unions.

An idea of the basic manning cost in 2005 is provided in Table 6.2. The figure for annual crew wages of $544,000 for a 5-year-old ship covers direct wages and employment-related costs. An additional $119,000 per annum is required to cover travel; manning and support; medical insurance and victualling; and the basic management costs that apply to crewing – crew selection, rotation, making travel arrangements, purchase of victuals and ship supplies. In total these add 16% to the crew cost for a 5-year-old ship.

**Table 6.3** Crew costs on 160,000 dwt bulk carrier, 2007 ($ per month)

| | | | | | | Totals[c] | | |
|---|---|---|---|---|---|---|---|---|
| Rank | Note | Basic | Consolidated Allowances | Bonus (officers) | Provident Fund[b] | 2007 | 1993 | % ch |
| Master | India | 1,967 | 3,933 | 300 | 35 | 6,235 | 3,644 | 171% |
| Chief officer[a] | | 1,294 | 3,206 | 200 | 35 | 4,735 | 3,025 | 157% |
| 2nd officer | | 1,077 | 1,773 | — | 35 | 2,885 | 2,338 | 123% |
| 3rd officer | | 1,030 | 1,320 | — | 35 | 2,385 | 1,650 | 145% |
| Radio officer | | radio officer no longer required in 2007 | | | | | 1,650 | 0% |
| Chief engineer | | 1,760 | 3,990 | 300 | 35 | 6,085 | 3,575 | 170% |
| 1st asst engr | 2nd eng. | 1,294 | 3,206 | 200 | 35 | 4,735 | 3,025 | 157% |
| 2nd asst engr | 3rd eng. | 1,077 | 1,773 | — | 35 | 2,885 | 2,338 | 123% |
| Bosun | Philippines | 670 | 649 | — | 182 | 1,501 | 1,521 | 99% |
| 5AB | | 558 | 542 | — | 171 | 6,353 | 6,479 | 98% |
| 3 oiler | | 558 | 542 | — | 171 | 3,812 | 3,888 | 98% |
| Cook/std | chief cook | 670 | 649 | — | 182 | 1,501 | 1,596 | 94% |
| Std | 2nd cook | 558 | 542 | — | 171 | 1,271 | 1,296 | 98% |
| Messman | | 426 | 378 | — | 158 | 962 | 1,071 | 90% |
| Total crew number modern ship: 20 | | | | | | 45,344 | 37,094 | 122% |
| *Additional crew for 10-year-old ship* | | | | | | | | |
| 3rd asst engr | India | 1,030 | 1,320 | — | 35 | 2,385 | 1,650 | 145% |
| Electrician | Elec. off. | 1,077 | 1,823 | — | 35 | 2,935 | 2,338 | 126% |
| AB | Philippines | 558 | 542 | — | 171 | 1,271 | 1,296 | 98% |
| 1 oiler | | 558 | 542 | — | 171 | 1,271 | 1,296 | 98% |
| Total crew number 10-year-old ship: 24 | | | | | | 53,205 | 43,673 | 122% |
| *Additional crew for 20-year-old ship* | | | | | | | | |
| 2 ordinary seamen | Philippines | 426 | 378 | — | 158 | 1,925 | 2,142 | 90% |
| 1 oiler | | 558 | 542 | — | 171 | 1,271 | 1,071 | 119% |
| 1 messman | | 426 | 378 | — | 158 | 962 | 1,071 | 90% |
| Total crew number 20-year-old ship: 28 | | | | | | 57,362 | 47,956 | 120% |
| | | Annual crew cost for 20-year-old ship | | | | 688,344 | 575,475 | 120% |

Notes

[a]Senior Officer based on 5 yr senority & Junior Officers 3 yrs seniority.

[b]Includes social costs

[c]1993 data from Stopford (1997, Table 5.3)

Source: V Ships

A more detailed breakdown of the crewing arrangements of three Capesize bulk carriers, one 5 years old, one 10 years old and one 20 years old, is provided in Table 6.3. The modern vessel has a crew of, comprising the master, four officers, three engineers, a bosun, eight seamen and three catering staff. The 10-year-old ship, where the maintenance workload is beginning to increase, might require a crew of 24, while a 20-year-old ship might have a crew of 28. The extra crew includes an additional engineer, an electrician, four seamen and one messman. They are needed to handle the repair and maintenance workload which is a continuous cycle on an old ship and can be carried out more cheaply at sea while the ship continues to trade. The total annual cost is $688,344 per year for the 20-year-old ship, a 20% increase on the costs in 1993.

The wages paid to the crews of merchant ships have always been controversial. The International Transport Workers' Federation (ITF) lays down minimum basic monthly rates of pay for all ranks, as well as paid leave, as part of its world-wide and Far East wage scale, but these are not universally accepted. There are, in fact, wide disparities in the rates of pay received by crews of different nationalities. The nationality of the crew is often governed by national statute of the country of registration and under some flags shipowners are prevented from employing non-nationals on their vessels. The cost per crew member may be 50% higher for a vessel registered under a European flag than for a comparable vessel 'flagged out' to one of the countries of open registration such as Liberia, Panama and Singapore, where employment regulations are less stringent. As the practice of flagging out became more widely accepted the cost differentials narrowed and quality became as much an issue as cost.

These costs are certainly not standards. Shipowners have far more opportunity than land-based businesses to determine manning costs by operating under a flag that allows the use of a low-wage crew and by shopping around the world for the cheapest crews available. Exchange rates will be an important factor here if wages are paid in a currency other than the one in which revenue is earned. Although shipping is a dollar-based business, shipping companies typically find themselves handling cashflows in many different currencies.

### STORES AND CONSUMABLES

Another significant cost of operating a vessel, accounting for about 15% of operating costs, is expenditure on consumable supplies. These fall into two categories, as listed in Table 6.2: General stores including cabin stores and the various domestic items used on board ship; and lubricating oil which is a major cost (most modern vessels have diesel engines and may consume several hundred litres of lube oil a day while at sea).

### REPAIRS AND MAINTENANCE

Routine maintenance, which accounts for 14% of operating costs, covers the routine repairs needed to maintain the vessel to the standard required by company policy, its classification society and the charterers of the vessel who choose to inspect it (it does not include periodic dry docking which is not generally considered an operating expense and is dealt with under 'periodic maintenance' below). Broadly speaking, maintenance covers the cost of routine maintenance, including breakdowns and spares:

- *Routine maintenance*. Includes maintaining the main engine and auxiliary equipment, painting the superstructure and carrying out steel renewal in those holds and cargo tanks which can be safely accessed while the ship is at sea. As with any capital equipment, the maintenance costs of merchant ships tend to increase with age.
- *Breakdowns*. Mechanical failure may result in additional costs outside those covered by routine maintenance. Work of this type is often taken by ship repair yards on 'open order' and is therefore likely to be expensive. Additional costs are incurred owing to loss of trading time.
- *Spares*. Replacement parts for the engine, auxiliaries and other on-board machinery.

The typical maintenance costs for a Capesize bulk carrier listed in Table 6.2 cover visits to repair yards, plus the cost of riding crews and work carried out on board. All items of maintenance costs increase substantially with age, and a 20-year-old vessel may incur twice the costs of a more modern one. Expenditure on spare parts and replacement equipment is also likely to increase with age.

### INSURANCE

Typically insurance accounts for 14% of operating costs, though this is a cost item which is likely to vary from ship to ship. Two-thirds of the cost is to insure the hull and machinery, which protects the owner of the vessel against physical loss or damage, and the other third is third party insurance, which provides cover against third party liabilities such as injury or death of crew members, passengers or third parties, pilferage or damage to cargo, collision damage, pollution and other matters that cannot be covered in the open insurance market. Additional voluntary insurance may be taken out to cover against war risks, strikes and loss of earnings.

Hull and machinery insurance is obtained from a marine insurance company or through a broker who will use a policy backed by underwriters in one of the insurance markets. Two important contributory factors in determining the level of hull and machinery insurance are the owner's claims record and the claimed value of the vessel. Ship values fluctuate with the freight market and the age and condition of the vessel.

The third party insurance required by shipowners falls under four headings: P&I cover, which is generally obtained through a club; collision liability cover; war P&I cover; and the provision of certificates of financial responsibility required to trade into the United States.

The P&I clubs, of which there are 13, are mutual insurance societies which settle third party claims for their members. They investigate claims on behalf of their shipowner members, provide advice during any negotiations or legal dispute over the claim and hold reserve funds to settle the claims on their members' behalf. This reserve is replenished through a subscription (known as the 'call') from members which varies, depending on the level of claims settled. The subscription for an individual member depends on the company's claims record and other factors such as the intended trading area, the cargo to be carried, the flag of registry and the nationality of the crew. Since settlement takes time, there may be a supplementary call on members and members changing clubs generally pay a 'release call' to settle their outstanding liabilities with the old club and an 'advance call' to the new club.

Because of the potential size of third party claims, the P&I clubs reinsure their exposure to very large claims. In 2005 individual clubs had a maximum liability exposure of $5 million. A pool of clubs covered larger claims of $5–$20 million, and claims of $20 million to a maximum of $4.25 billion were reinsured in the insurance market. The P&I clubs also obtain credit ratings from the rating agencies, which assist in marketing their services to members. Unlike other forms of insurance, P&I cover cannot be assigned to a mortgagee, though a comfort letter may be obtained. It is also subject to retrospective cancellation, for example if the club member goes bankrupt.

#### GENERAL COSTS

A registration fee is paid to the flag state, the size of which depends on the flag. In Table 6.2 a fee of $17,000 per annum for a single ship is included under general costs.

Included within the annual operating budget for the ship is a charge to recover shore-based administrative and management charges, communications, owners' port charges, and miscellaneous costs. The overheads cover liaison with port agents and general supervision. The level of these charges depends on the type of operation. For a small tramping company operating two or three ships they may be minimal, whereas a large liner company will carry a substantial administrative overhead. With improved communications, many of these functions can now be undertaken by shipboard personnel in tramping companies. It is also an increasingly common practice for day-to-day management to be subcontracted to specialists for a predetermined fee.

### Periodic maintenance

Periodic maintenance, the second major cost item in Figure 6.4, involves a cash payment to cover the cost of interim dry docking and special surveys. It accounts for about 4% of costs, though this depends on the age and condition of the ship. To maintain a ship in class for insurance purposes, it must undergo regular surveys with a dry docking every 2 years and a special survey every 4 years to determine its seaworthiness. At the special survey the vessel is dry-docked, all machinery is inspected and the thickness of the steel in certain areas of the hull is measured and compared with acceptable standards. These measurements become more extensive with age and all defects must be remedied before a certificate of seaworthiness is issued. In older ships these surveys often necessitate considerable expense, for example in replacing steelwork that, owing to corrosion, no longer meets the required thickness standards. In addition, dry docking allows marine growth, which reduces the operating efficiency of the hull, to be removed.

**Table 6.4** Standard Capesize, lifetime periodic maintenance costs (1993 dollar prices)

| | Age of ship | | | | |
|---|---|---|---|---|---|
| | 0–5 | 6–10 | 11–15 | 16–20 | |
| **Time out of service (days)** | **20** | **23** | **40** | **40** | |
| **Time in drydock (days)** | **10** | **14** | **23** | **18** | **Total** |
| Cost Items (USD) | | | | | |
| Dry-dock charges | 62,000 | 68,000 | 81,500 | 74,000 | 285,500 |
| Port charges, tugs, agency | 70,000 | 73,300 | 92,000 | 92,000 | 327,300 |
| General services | 80,000 | 92,000 | 160,000 | 160,000 | 492,000 |
| Hull blast, clean & painting | 102,800 | 128,800 | 183,600 | 99,000 | 514,200 |
| All dry-dock paint | 164,100 | 175,500 | 207,000 | 194,100 | 740,700 |
| All steel replacement | 70,000 | 350,000 | 1,190,000 | 840,000 | 2,450,000 |
| Cargo spaces | 22,200 | 64,200 | 126,000 | 150,000 | 362,400 |
| Ballast spaces | 36,400 | 23,200 | 26,000 | 47,400 | 133,000 |
| Hatch covers & deck fittings | 28,000 | 56,320 | 60,560 | 60,560 | 205,440 |
| Main engine and propulsion | 46,000 | 42,000 | 48,000 | 48,000 | 184,000 |
| Auxiliaries | 27,000 | 34,000 | 134,000 | 44,000 | 239,000 |
| Piping & valves | 18,000 | 37,000 | 50,000 | 34,000 | 139,000 |
| Navigation & communications | 9,000 | 11,000 | 11,000 | 11,000 | 42,000 |
| Accommodation | 6,000 | 8,000 | 7,000 | 7,000 | 28,000 |
| Surveys & surveyors | 70,000 | 78,500 | 113,000 | 108,000 | 369,500 |
| Miscellaneous | 100,000 | 100,000 | 100,000 | 100,000 | 400,000 |
| Spare parts & subcontractors | 70,000 | 100,000 | 100,000 | 120,000 | 390,000 |
| Owner's attendance | 23,800 | 25,600 | 35,800 | 35,800 | 121,000 |
| Estimated total | 1,005,300 | 1,467,420 | 2,725,460 | 2,224,860 | 7,423,040 |
| Averaged annual cost | 201,060 | 293,484 | 545,092 | 444,972 | |
| Averaged daily cost | 551 | 804 | 1,493 | 1,219 | |

Source: Clarkson Research, Capesize Quality Survey (1993)

Table 6.4 shows how the periodic maintenance schedule for a Capesize bulk carrier evolves as the vessel ages. The sums shown cover the cost of both the interim dry dockings and the special surveys.[3] Eighteen cost areas are covered, some of which, such as the cost of using the dry dock ($62,000) vary only slightly with age, whilst others, such as steel replacement and work on the hatch covers, increase very sharply as the ship gets older. In this example the periodic cost increases from $1 million for the two surveys in the first five years to $2.7 million in the 11–15-year period. Naturally this depends on the ship. The average daily cost increases from $551 per day to $1493 per day. Owners who operate preventive maintenance policies may incur lower costs, while for ships in poor condition the costs may be much higher.

## Voyage costs

We now turn to voyage costs, the third cost item in Figure 6.4, which accounts for 40% of the total costs. These are the variable costs incurred in undertaking a particular voyage. The main items are fuel costs, port dues, tugs, pilotage and canal charges:

$$VC_{tm} = FC_{tm} + PD_{tm} + TP_{tm} + CD_{tm} \qquad (6.3)$$

where *VC* represents voyage costs, *FC* is the fuel costs for main engines and auxiliaries, *PD* port and light dues, *TP* tugs and pilotage, and *CD* is canal dues.

### FUEL COSTS

Fuel oil is the single most important item in voyage costs, accounting for 47% of the total. In the early 1970s when oil prices were low, less attention was paid to fuel costs in ship design and many large vessels were fitted with turbines, since the benefits of higher power output and lower maintenance costs outweighed their high fuel consumption. However, when oil prices rose during the 1970s, the whole balance of costs changed. During the period 1970–85, fuel prices increased by 950% (Figure 6.5). Leaving aside changes in the fuel efficiency of vessels, this meant that, if fuel accounted for about 13% of total ship costs in 1970, by 1985 it had increased to 34%, more than any other individual item. As a result, resources were poured into designing more fuel-efficient ships and operating practices were adjusted, so that bunker consumption by the shipping industry fell sharply. In 1986 the price of bunkers fell and the level of interest in this aspect of ship design reduced, but in 2,000 bunker prices started to increase again (see Figure 6.5) and the importance of fuel costs increased.

The shipping industry's response to these extreme changes in bunker prices provides a good example of how the design of ships responds to changes in costs. Although shipping companies cannot control fuel prices, they have some influence on the level of fuel consumption. Like any other piece of complex machinery, the fuel a ship burns depends on its design and the care with which it is operated. To appreciate the opportunities for improving the fuel efficiency of ships it is necessary to understand how energy is used in the ship. Take, for example, a typical Panamax bulk carrier, illustrated in Figure 6.6. At a speed of 14 knots it consumes 30 tons of bunker oil and 2 tons of diesel oil in a day. Approximately 27% of this energy is lost in cooling the engine, 30% is lost as exhaust emission,

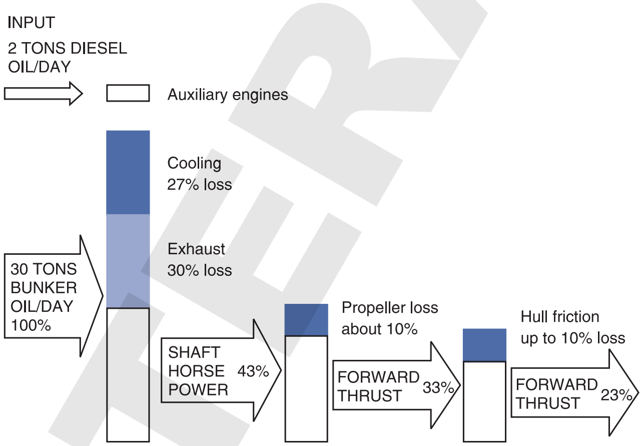


**Figure 6.6**
Energy losses in typical 1990s built Panamax bulk carrier, 14 knots design speed
Source: Compiled by Martin Stopford from various sources

10% is lost at the propeller, and hull friction accounts for an additional 10%. Only a residual 23% of the energy consumed is actually applied to propelling the vessel through the waves. Whilst this is a simplified view of a complex process, it identifies the areas where technical improvements can, and have, been made – the main engine, the hull and the propeller. The extent of the improvement can be judged from the fact that ships built in the 1970s typically consumed 10 tons per day more fuel than ships built in later years to achieve the same speed.

The design of the main engine is the single most important influence on fuel consumption. Following the 1973 oil price rises, and particularly since 1979, there were major improvements in the thermal efficiency of marine diesel engines. Between 1979 and 1983 the efficiency of energy conversion in slow-speed marine diesel engines improved from about 150 grams per brake horsepower per hour to around 127 grams per brake horsepower per hour. In addition to lower fuel consumption, engine operating speeds were reduced to below 100 rpm, making it possible to use more efficient large-diameter, slow-speed propellers without installing a gear box. The ability to burn low-quality fuel was also improved. In some cases the fuel savings achieved were quite spectacular. Diesel-powered 300,000 dwt VLCCs built in 2005 consumed 68 tons of bunkers a day at 15 knots, compared with fuel consumption of 130–150 tons per day by turbine-powered vessels built in the 1970s.

It is also possible to improve the fuel efficiency of a ship by fitting auxiliary equipment. One method is to install waste heat systems, which use some of the heat from the exhaust of the main engines to power a boiler that drives the auxiliary engines when the main engine is running, thus saving diesel oil. An alternative method is to use generators driven direct from the main engine while the vessel is at sea. This means that auxiliary power is obtained from the more efficient main engine rather than a small auxiliary engine burning expensive diesel fuel.

In operation, the ship's fuel consumption depends on its hull condition and the speed at which it is operated. When a ship is designed, naval architects optimize the hull and power plant to a prescribed design speed which may be, for example, 15 knots for a bulk carrier or 18 knots for a small container ship. Operation of the vessel at lower speeds results in fuel savings because of the reduced water resistance, which, according to the 'cube rule', will be approximately proportional to the cube of the proportional reduction in speed:

$$F = F^* \left( \frac{S}{S^*} \right)^a \tag{6.4}$$

where $F$ is the actual fuel consumption (tons/day), $S$ the actual speed, $F^*$ the design fuel consumption, and $S^*$ the design speed. The exponent $a$ has a value of about 3 for diesel engines and about 2 for steam turbines. It follows from the cube rule that the level of fuel consumption is very sensitive to speed. For example, for a Panamax bulk carrier a reduction in the operating speed of 16 knots to 11 knots results in a two-thirds saving in the tonnage of fuel burnt per day, as shown in Table 6.5.

For any given speed, fuel consumption depends on hull design and hull smoothness. According to work carried out by British Maritime Technology, a reduction in hull roughness from 300 micrometres to 50 micrometers can save 13% on the fuel bill. Between dry docking, marine growth on the hull of the ship increases its water resistance, reducing the achievable speed by 2 or 3 knots in extreme cases. Even with regular dry docking, as the ship ages its hull becomes less smooth as the hull has been scraped and repainted many times. Self-polishing coatings and anti-fouling, which release a poison to kill marine growth and reduce hull fouling between dry dockings, are now widely used but are expensive to apply and have a limited life.

**Table 6.5** How speed affects fuel consumption for a panamax bulk carrier

| Speed knots | Main engine fuel consumption tons/day |
|---|---|
| 16 | 44 |
| 15 | 36 |
| 14 | 30 |
| 13 | 24 |
| 12 | 19 |
| 11 | 14 |

As a result of these factors there can be a wide disparity between the fuel consumption of vessels of a similar size and speed. For example, the fuel consumption of two Panamax bulk carriers operating at the same speed could differ by 20–30% depending on age, machinery and hull condition. Obviously the cost importance of this difference in efficiency depends on the price of fuel.

## PORT CHARGES

Port-related charges represent a major component in voyage costs and include various fees levied against the vessel and/or cargo for the use of the facilities and services provided by the port. Charging practices vary considerably from one area to another, but, broadly speaking, they fall into two components – port dues and service charges. Port dues are levied on the vessel for the general use of port facilities, including docking and wharfage charges, and the provision of the basic port infrastructure. The actual charges may be calculated in four different ways, based on: the volume of cargo; the weight of cargo; the gross registered tonnage of the vessel; or the net registered tonnage of the vessel. The service charge covers the various services that the vessel uses in port, including pilotage, towage and cargo handling.

The actual level of port costs depends on the pricing policy of the port authority, the size of the vessel, the time spent in port and the type of cargo loaded or discharged. For example, the typical port cost for a Panamax bulk carrier loading 70,000 tonnes of coal in Australia in 2007 and discharging in Europe would be about $147,000, roughly $2 per tonne. By convention, the allocation of port charges differs for different types of charter. Under a voyage charter, all port dues and charges related to the vessel are charged to the shipowner, while all charges on the cargo are generally paid for by the charterers, except for cargo-handling charges, which are generally agreed under the charter terms. Under a trip charter or time charter, all port charges are carried by the charterer.

### CANAL DUES

The main canal dues payable are for transiting the Suez and Panama canals. The toll structure of the Suez Canal is complicated since it is based on two little-known units of measurement, the Suez Canal net ton and Special Drawing Rights (SDRs). Tariffs are calculated in terms of these. The Suez Canal net tonnage of a vessel is a measurement based on late nineteenth-century rules that were intended to represent the revenue-earning capacity of a vessel. It broadly corresponds to the cargo-carrying space below deck, though it is not directly comparable to the more normal measurement of cargo capacity (net tonnage).

The Suez Canal net tonnage of a vessel is calculated either by the classification society or by an official trade organization which issues a Suez Canal Special Tonnage Certificate. For vessels wishing to transit the canal that do not have a certificate, the calculation is provisionally done by adding together the gross and net tonnage, dividing by two and adding 10%. Tariffs are then calculated on the basis of SDRs per Suez net ton. SDRs were chosen as the currency unit in an attempt to avoid losses owing to fluctuations in exchange rates, as their value is linked to a number of major national currencies. Suez Canal toll charges per Suez net ton vary for different types and sizes of ships. For the Panama Canal a flat rate charge per Panama Canal net ton is used (see Chapter 8 for more details on the Suez and Panama canals).

## Cargo-handling costs

Finally, we come to cargo–handling costs, the fourth major cost item in Figure 6.4. The cost of loading and discharging cargo represents a significant component in the total cost equation, and one to which considerable attention has been paid by shipowners, particularly in the liner business. Cargo-handling costs are given by the sum of loading costs, discharging costs and an allowance for the cost of any claims that may arise:

$$CHC_{tm} = L_{tm} + DIS_{tm} + CL_{tm} \qquad (6.5)$$

*where* $CHC$ is cargo-handling costs, $L$ is cargo loading charges, $DIS$ is cargo discharge costs, and $CL$ is cargo claims.

The level of these costs may be reduced by investment in improved ship design – to facilitate rapid cargo handling, along with advanced shipboard cargo-handling gear. For example, a forest products carrier with open holds and four cranes per hold can achieve faster and more economical cargo handling than a conventional bulk carrier relying on shore-based cranes.

## 6.4 THE CAPITAL COST OF THE SHIP

The fifth component in the cost equation for our ‘typical’ ship in Figure 6.4 is its capital cost. This accounts for 42% of total costs, but in economic terms it has a very different character from the other costs. Operating and fuel costs are necessities without which the ship cannot trade. Crew and bunker suppliers are generally the first creditors to be paid off in a financial crisis, because without them the ship is marooned. In contrast, once a ship is built, its capital costs are obligations which have no direct effect on its physical operation. That is why the costs are not specified in Figure 6.4. In practice these obligations take three forms as far as the shipping company's cashflow is concerned. First, there is the initial purchase and the obligation to pay the shipyard; second, there are the periodic cash payments to banks or equity investors who put up the capital to purchase the vessel; and third, cash received from the sale of the vessel. How these obligations appear in the cashflow is not determined by the ship's trading activities – as, for example, fuel costs are – they are the result of financing decisions made by the ship's owner, and there are many ways this can be handled as we will see in Chapter 7 which discusses financing ships and shipping companies.

### The distinction between profit and cash

Before discussing this process in detail we need to be clear about the distinction between cash and profit. Profit is a concept used by accountants and investment analysts to measure the financial return from a business. It is calculated by taking the total revenue earned by the business during an accounting period (e.g. a year) and deducting the costs which the accounting authorities consider were incurred in generating that revenue. The cashflow of a company, in contrast, represents the difference between cash payments and receipts in the accounting period. In surviving shipping recessions cash is what matters, while for companies with equity investors, providing a commercial return on assets is equally important. The main reason why cashflow differs from profit in a particular year is that some costs are not paid in cash at the time when the accountant considers them to have been incurred. In shipping the best example is the timing of payment for the ship. The cash transaction takes place when the ship is built and each year the ship grows older and loses a proportion of its value.

To give investors a fair account of whether the business is making money, accountants have developed procedures for reporting large capital items in the profit and loss account. When a capital item is purchased, its full cost does not appear in the profit and loss account. If it did, shipping companies would report a massive loss whenever they bought a new ship. Instead the cost of the ship is recorded in the company's balance sheet as a 'fixed asset' and each year a percentage of its value (e.g. 5%) is charged as a cost in the profit and loss account to reflect the loss of value during the accounting period. This charge is known as *depreciation* and is not a cash charge. The ship was paid for in cash long ago. It is just bookkeeping, so profit will be lower than cashflow by that amount.

If a merchant ship is depreciated (or written off) over 20 years on a linear basis (there are several methods, but this is the most common), it means one-twentieth of its original cost is included in the company's overhead costs each year for 20 years. For example, if the ship was purchased for $10 million cash and depreciated at the rate of $1 million per annum, the position might be as shown in Table 6.6. In each of the first two years

**Table 6.6** Example of profit (loss) account and cashflow for shipping company purchasing vessel for cash (equity) ($ million)

| | Profit (loss) account | | Cashflow | |
|---|---|---|---|---|
| | Year 1 | Year 2 | Year 1 | Year 2 |
| 1 Freight revenue | 10 | 10 | 10 | 10 |
| 2 Less: operating costs | 5 | 5 | 5 | 5 |
| 3 voyage costs | 3 | 3 | 3 | 3 |
| 4 depreciation[a] | 1 | 1 | 0 | 0 |
| 5 Total operating profit/cashflow | 1 | 1 | 2 | 2 |
| 6 Less capital expenditure on ship | None[a] | None | 10 | 0 |
| 7 Total profit/cashflow | 1 | 1 | (8) | 2 |

[a]Captal expenditure is covered by the depreciation item (see text)

the company has the same profit of $1 million, which is calculated by deducting costs, including depreciation, from the total revenue earned. However, the cashflow profile is quite different. The operating cashflow at line 3 is $2 million in each year because depreciation is not a cash item – it is simply a bookkeeping entry, so it does not appear in the cashflow calculation. From this is deducted the cash payment for the ship in year 1, giving a negative cashflow of $8 million in year 1 and a positive cashflow of $2 million in year 2.

However, this is not the whole story. Not many shipping companies buy their ships for cash. A particularly important aspect of cashflow is the method used to pay for the ship. In Table 6.6 the company pays cash on delivery and that shows up as a 'lump' in the cashflow, following which there is nothing more to pay for capital. If the ship is purchased with a loan, the cashflow profile changes because the cashflow now includes payment of interest and repayment of the loan. This situation is illustrated in Table 6.7

**Table 6.7** Example of profit (loss) account and cashflow for shipping company purchasing vessel on five-year loan ($ million)

| | Profit (loss) account | | Cashflow | |
|---|---|---|---|---|
| Line | Year 1 | Year 2 | Year 1 | Year 2 |
| 1 Freight revenue | 10 | 10 | 10 | 10 |
| 2 LESS: operating costs | 5 | 5 | 5 | 5 |
| 3 voyage costs | 3 | 3 | 3 | 3 |
| 4 depreciation[a] | 1 | 1 | 0 | 0 |
| 5 Total operating profit/cashflow | 1 | 1 | 2 | 2 |
| 6 LESS interest at 10% | 1 | 0.8 | 1 | 0.8 |
| 7 Profit/cashflow after interest | 0 | 0.2 | 1 | 1.2 |
| 8 LESS capital repayment | None | None | 2 | 2 |
| 9 Total profit/cashflow | 0 | 0.2 | (1) | (0.8) |

[a]Captal expenditure is covered by the depreciation item (see text)

which shows what happens if, instead of paying cash, the ship is financed with a five-year loan. Although the company generates a positive operating cashflow of $2 million (line 5), after deducting interest (line 6) and capital repayments (line 8) it has a net cash outflow in both years. If the company has sufficient funds available, this negative cashflow required to meet finance payments may not present a serious problem. The problems arise if there is a negative cashflow but no cash reserves to meet it.

## Estimating a ship's depreciation

Equity investors in public shipping companies face a different problem. If they are investing for the long term they need to estimate how much profit the company is making, and that depends crucially on how much depreciation is deducted to arrive at a fair estimate of the profit earned. Eventually the ship wears out, so its cost must be deducted from profits at some point and the usual approach used by accountants is 'straight-line depreciation'. The ship is written off in equal proportions over its expected life. The longer it lasts, the less depreciation can be deducted each year. An example illustrates two important points about the depreciation of merchant ships. If we analyse the Panamax bulk carrier sales shown in Figure 6.7, we find that the relationship between year of build and sale price is approximately linear. The regression coefficient is 0.93, indicating a relatively good fit, suggesting that the depreciation curve is linear, and the expected life is about 25 years.

That is very typical because the fifth special survey involves heavy repairs, though market conditions are also influential. For example, between 1995 and 2000, a period of generally weak market conditions, bulk carriers were on average scrapped at 25.2 years of age and tankers at 24.7 years, but in 2006, a year of high earnings, the average scrapping age was 28 years for tankers and 30 years for bulk carriers. Specialized ships have longer lives, notably cruise ships which averaged 43.8 years, livestock carriers 33.9 years and passenger ferries 30 years. In these cases shipping companies may choose to refurbish their vessels rather than demolish them. This calls for a word of caution in determining the life expectancy of these specialized ships. Steel ships can be repaired at almost any stage in their life and there are examples of ships


**Figure 6.7**
Market value and age of Panamax bulk carriers
Source: Clarkson Research Studies (1993)

operating in protected markets such as the United States coastal trades or the Great Lakes for more than 50 years. A shipowner may choose to refurbish an old vessel rather than build a new one, but it can be very costly and is all a matter of economics. So although specialist ships may appear to last more than 25 years we need to take the cost of life extension and refitting into account.

## Cashflow costs and gearing

Capital is the cashflow item over which the owner has the most control at the outset. Operating and voyage costs can be adjusted marginally, depending on the ship he buys, but the cash payments associated with capital can be very high or non-existent, depending on how the ship is financed. The initial purchase of the ship may be paid for with cash, either from reserves or, in the case of very large companies, from cashflow. In that case there is a one-off capital payment and no further cashflow relating to capital until the ship is sold. A shipowner who follows this route and purchases his ships for cash has no further cash costs and can survive on a freight rate equal to operating and voyage costs. For the 5-year-old Panamax bulk carrier in Table 6.1 the operating and bunker costs are $11,820 per day.[4] If instead of paying cash the shipowner borrows the full purchase price from a bank over 20 years the capital repayments would be $11,155, almost doubling the daily payments the company is committed to making to $22,975 a day. In a volatile market like shipping that would present a problem, since the company often would not be able to meet the payments out of trading income. That is why banks rarely advance the full capital cost of the vessel, requiring the borrower to meet a portion of the purchase price of the ship from equity. The ratio of debt to equity is referred to as *gearing*; the higher it is, the riskier it is.

## Security and bank lending policy

The terms on which bank loans are made available, and in particular the gearing they permit, are very important. We will discuss debt finance in Chapter 7, but it is worth previewing the way banks approach the repayment of interest and principal on a shipping loan. Since most commercial banks lend money at only 1 or 2 percentage points above the rate at which they borrow, there is little margin for risk – the bank must be sure before it lends that it will receive repayment of capital and interest in full. For this reason a major consideration in ship finance is the security against the loan. A shipowner borrowing money must be able to satisfy the lender that if he defaults the loan can be recovered. The following methods are used to provide security:

- Assignment of earnings, insurances, etc.
- The lender takes a first mortgage on the ship being purchased, giving him the first claim on the proceeds of the sale should the borrower default.

- A mortgage on other ships or assets may be offered. As with any security the bank must be convinced that in a forced sale the assets will realize sufficient cash to cover the outstanding debt.
- The income from a long charter with a 'blue chip' company is assigned to the lender and provides assurance that the cashflow will be available to service the loan.
- A guarantee of the loan may be given by the owner, shipping company, the shipbuilding company constructing the vessel or a government agency such as the UK's Export Credit Guarantee Department.

The choice of finance, and the obligations that arise as a result, have a tremendous impact on the shipowner's cashflow commitments. During recessions shipowners who fund investment with equity are safe so long as freight revenue is sufficient to cover operating and voyage costs. The ship may not be profitable, but at least the owner remains in control. The shipowner who has financed his investment from debt faces a very different situation. He must make regular payments to his banker to cover interest and capital repayments. If the freight rate only covers operating and voyage costs, as often happens during depressions, he must meet his financing costs from elsewhere or lose control of the business to his bankers. Thus two shipowners running identical vessels with similar operating and voyage costs face radically different cashflows during a depression if one has financed his fleet on an equity basis and the other using debt.

## Taxation

Taxation does not figure prominently in the accounts of most bulk shipping companies. The international nature of the business makes it possible to avoid tax by registering a company under one of the many open registry flags (see Section 16.5) which exempt shipping companies from tax. During the recession of the 1980s many shipping companies switched to flags of convenience which charged only a nominal tonnage tax; in 2005, 49% of world tonnage was registered in this way (see Table 16.4). In response some European countries started, with the approval of the European Union, to offer special taxation schemes for shipping companies registered under their domestic flag. These schemes had three components: a tonnage tax approximating to zero corporation tax; a reduction in social contributions for seafarers and shipping companies; and a reduction to zero of personal income tax for national seafarers.

For example, the Danish International Shipping Register (DIS), which was set up in 1988, exempted crew from national tax and in 2002 a tonnage tax scheme was introduced, basing taxation on the tonnage of ships the company was operating, at a specified rate per tonne, with no regard to the actual operating profits of the company. Germany, the Netherlands, Norway, the UK, Belgium and Greece have all introduced schemes. Other reasons for registering in a particular country are to take advantage of investment incentives available to local businesses, or where other business activities make this route economic.

## 6.5 THE REVENUE THE SHIP EARNS

### The classification of revenue

The first step is to define how revenue is received. As we saw in Chapter 5, there are several different ways a shipowner can earn revenue, each of which brings a different distribution of risk between the shipowner and the charterer and a different apportionment of costs. The risks are shipping market risk, which concerns the availability of cargo and the freight rate paid, and operational risk, arising from the ability of the ship to perform the transport. The costs are those discussed in the previous section. Each of the revenue arrangements deals with these items differently:

- *Voyage charter*. This system is used in the voyage-charter market, the specialist bulk market and in a rather different way in the liner trades. The freight rate is paid per unit of cargo transported, for example $20 per ton. Under this arrangement, the shipowner generally pays all the costs, except possibly cargo handling, and is responsible both for managing the running of the ship and for the planning and execution of the voyage. He takes both the operational and the shipping market risk. If no cargo is available, if the ship breaks down, or if it has to wait for cargo he loses out.
- *Time charter*. The charter hire is specified as a fixed daily or monthly payment for the hire of the vessel, for example $5,000 per day. Under this arrangement, the owner still takes the operational risk, since if the ship breaks down he does not get paid. The charterer pays fuel, port charges, stevedoring and other cargo-related costs. He takes the market risk, paying the agreed daily hire regardless of market conditions (unless the charter rate is linked to the market in some way).
- *Bare boat charter*. This is essentially a financial arrangement in which the charter hire only covers the financing cost of the ship. The owner finances the vessel and receives a charter payment to cover expenses. All operating costs, voyage costs and cargo-related costs are covered by the charterer, who takes both the operational and the shipping market risk.

A discussion of these revenue concepts can be found in Table 5.1. For simplicity the discussion in this chapter assumes that revenue is earned as a unit freight rate per ton mile of cargo carried.

### Freight revenue and ship productivity

The basic revenue calculation involves two steps: first, determining how much cargo the vessel can carry in the financial period, measured in whatever units are appropriate (tons, ton miles, cubic metres, etc.); and second, establishing what price or freight rate the owner will receive per unit transported. In more technical terms, the revenue per deadweight of shipping capacity can be viewed as the product of the ship's productivity, measured in ton miles of cargo transported per annum, and the freight rate per ton mile, divided by the ship's deadweight:

$$R_{tm} = \frac{P_{tm}.FR_{tm}}{DWT_{tm}} \tag{6.6}$$

where $R$ is the revenue per dwt per annum, $P$ the productivity in ton miles of cargo per annum, $FR$ the freight rate per ton mile of cargo transported, $t$ the time period and $m$ the ship type.

The concept of a ship's 'productivity' is useful because it measures overall cargo-carrying performance, encompassing operating performance in terms of speed, cargo deadweight and flexibility in terms of obtaining backhaul cargoes. For example, a combined carrier potentially has a much higher productivity than a tanker because it can carry a backhaul of dry cargo if one is available. The analysis of productivity can be carried further by subdividing into its component parts as follows:

$$P_{tm} = 24 \cdot S_{tm} \cdot LD_{tm} \cdot DWU_{tm} \tag{6.7}$$

where $S$ is the average operating speed per hour, $LD$ is the number of loaded days at sea per annum, and $DWU$ is deadweight utilization. This definition states that ship productivity, measured in terms of ton miles of cargo transported in year $t$, is determined by the distance the vessel actually travels in 24 hours, the number of days it spends loaded at sea in a year, and the extent to which it travels with a full deadweight of cargo. By further examination of each of these components a precise definition of productivity can be obtained.

### OPTIMIZING THE OPERATING SPEED

When a vessel is earning unit freight revenue, the mean operating speed of the ship is important because it determines the amount of cargo delivered during a fixed period and hence the revenue earned.

In a high freight rate market it pays to steam at full speed, whereas at low freight rates a reduced speed may be more economic because the fuel cost saving may be greater than the loss of revenue. This certainly happens in practice. For example, in early 1986 the VLCC fleet was operating at a speed of around 10 knots, but when freight rates rose in 1988–9 it speeded up to almost 12 knots. For the same reasons, a substantial increase in bunker prices will change the optimum operating speed for a particular level of freight rates because it increases the cost saving for a given reduction in fuel consumption.

The financial logic behind the optimum operating speed calculation can be illustrated with a simple example in Table 6.8 which shows the effect of speed on the cashflow of a ship for different fuel prices and freight rates. By slowing down from 14 knots to 11 knots, the amount of fuel used in a year is more than halved, from 33.9 tons per day

**Table 6.8** Effect of speed on cashflow for high and low freight and bunker costs

| Ship speed knots | Fuel consumption tons per day | FUEL COST SAVING by slowing down | | REVENUE LOSS by slowing down | |
|---|---|---|---|---|---|
| | | $/day | $/day | $/day | $/day |
| 14 | 33.9 | — | — | — | — |
| 13 | 27.2 | 2,697 | 674 | 1,440 | 4,320 |
| 12 | 21.4 | 5,016 | 1,254 | 2,880 | 8,640 |
| 11 | 16.5 | 6,979 | 1,745 | 4,320 | 12,960 |

*Assumptions:* 70,000 ton cargo; 300 days a year at sea; 10,000 mile round voyage

| | bunker assumptions | | freight assumptions | |
|---|---|---|---|---|
| | high $400/ton | low $100/ton | low $10/ton | high $30/ton |



to 16.5 tons per day, bringing a saving in bunker costs that depends on the level of fuel prices. There is, however, a corresponding loss of revenue, because at the lower speed less cargo is delivered. The size of this loss depends on the level of freight rates. As a result the shipowner is confronted by a trade-off between lower costs and lower income, and the balance will determine his decision.

To illustrate this point we can examine the circumstances set out in Table 6.8 under which it would pay the shipowner to slow down to 11 knots. Bunker costs are $400/ton (high) and $100/ton (low), whilst freight ranges from $30/ton (high) to $10 per ton (low).

- *Case 1*: fuel cost $100/ton and low freight rates – he would save $1.745 million on bunkers but would lose $4.3 million revenue, so it is not worth slowing down.
- *Case 2*: fuel cost $400/ton and low freight rates – he would save $6.9 million and lose $4.3 million revenue so it is worth slowing down.
- *Case 3*: fuel cost $400/ton and high freight rates – he would save $6.9 million costs but would lose $12.9 revenue, so it is not worth slowing down.

In fact, for any level of freight rates and fuel costs there is an optimum speed.

### MAXIMIZING LOADED DAYS AT SEA

A ship's time is divided between 'productive' loaded days at sea and unproductive days spent in ballast, in port, or off hire. A change in any of these variables will affect the number of loaded days at sea, *LD*, as follows:

$$LD_{tm} = 365 - OH_{tm} - DP_{tm} - BAL_{tm} \tag{6.8}$$

where *OH* is the number of days off hire per annum, *DP* the number of days in port per annum, and *BAL* the number of days in ballast per annum.

*Days off hire* reflect time spent for repairs, breakdowns, holidays, etc. A survey of bulk carriers showed an average of 24 days per annum off hire, though this figure can be expected to vary with conditions in the freight market. Owners will always attempt to minimize the time the vessel is not earning, but during periods of low freight market activity the ship may spend substantial time waiting for cargo, this being one of the major costs incurred during a market recession. For example, a ship that waits 12 days for a cargo with daily operating costs of $6,000 will have lost $72,000.

*Port days* depend upon the type of ship, the loading facilities available and the cargo being loaded. The more time the ship spends in port the less it spends carrying cargo. Homogeneous cargoes such as iron ore and grain can load very quickly where good facilities are available – iron ore loading rates of 6,000 tons per hour are common. Difficult cargoes such as forest products and general cargo may take weeks rather than days to load under some circumstances. Ships handling bagged sugar can spend a month loading or discharging.

*Days spent in ballast* is the third and most important determinant of loaded days at sea. For tankers and other single cargo ships it is a simple calculation, since backhauls are not generally available and the ship spends half its sea time in ballast. For combined carriers, most bulk carriers, reefers and liners the calculation is more difficult because these vessels can carry a wide range of different cargo types, and are often able to pick up backhaul cargo. Relatively little statistical information is available about the average time spent in ballast. A rule of thumb is 'the bigger the ship, the more time in ballast'. For example, a 30,000 dwt bulk carrier is always better placed to obtain a backhaul than a 160,000 dwt vessel since draught restrictions may limit the larger vessel's ability to pick up part cargoes.

The financial impact of obtaining a backhaul cargo can be illustrated by the example in Table 6.9 of a Panamax bulk carrier operating in the coal trade from Hampton Roads, USA, to Japan during the shipping depression in 1985. At a freight rate of $15 per ton this vessel would have a negative cashflow of $500,000 per annum when operating on a 50% ballast basis. However, by picking up a backhaul of coal from Newcastle, New South Wales, to Norway at a rate of $15 per ton, the vessel would generate a positive cashflow of $19,000 per annum.

### DEADWEIGHT UTILIZATION

This refers to the extent to which the vessel travels with a full payload of cargo. In other words, it is the ton mileage of cargo carried divided by the ton mileage of cargo that the

**Table 6.9** The effect of the backhaul on cashflow

| | Cargo 000 tons per year | Freight per ton $ | Annual revenue $m | Annual cost $m | Cashflow $'000 |
|---|---|---|---|---|---|
| Backhaul | 308 | 15 | 4.62 | 4.43 | 19 |
| No backhaul | 252 | 15 | 3.78 | 4.28 | (500) |

vessel could have carried if it had always obtained a full payload. In practice, the deadweight cargo capacity of a vessel represents a physical maximum, and it is a commercial decision whether this capacity is fully utilized. The shipowner always has the option to accept a part cargo and it is common practice in both the dry bulk and the tanker markets, especially during recessions. The change was particularly noticeable in the tanker market after the 1973 oil crisis, when the oil companies were no longer able to match cargo parcels to ships. Conversely during the 2003–7 boom there was enormous pressure to use ships as efficiently as possible by obtaining a full cargo.

An interesting example of deadweight utilization is the grain trade between the US Gulf and Japan. In the 1970s this trade was shipped in 25,000 dwt bulk carriers, but during the 1980s it was taken over by Panamax bulk carriers. Because the parcel size is restricted to 55,000 tons by the water depth in the Panama Canal, a 65,000 dwt Panamax cannot load a full deadweight, but in a relatively weak freight environment Panamax owners were prepared to settle for a part cargo. But by 2007 three things had happened. Handymaxes had edged up in size to 55,000 dwt; Panamaxes had increased to 75,000 dwt; and freight rates were much higher. As a result the part cargo trade was less attractive to the Panamaxes, but ideal for Handymaxes, which took it over. An unusual exception to the rule that ship sizes increase with time.

Products tankers also carry many part cargoes. Two popular parcel sizes in this trade are 33,000 and 40,000 tonnes, neither of which fills the popular 37,000 dwt and 47,000 dwt products tankers. The matter is further complicated by the high cubic of naphtha, a common oil products cargo (see Table 11.5). As a result products tankers often trade with a part cargo. With this in mind, some shipyards design products tankers with scantlings of 47,000 dwt and a hull optimized to 40,000 dwt, a reminder that the issue is not filling the ship, but making a profit.

In conclusion, investors face many decisions concerning the trade-off between revenue and cost variables. A combined carrier offers the shipowner the option to obtain very high deadweight utilization by carrying alternate cargoes of oil and dry cargo, while incurring higher capital and operating costs. Containerization involves heavy investment in cargo-handling efficiency, whereas the ro-ro combines some of the benefits of containerization with a higher degree of cargo flexibility. But many of the decisions are less dramatic but equally important – for example, paying extra for a faster bulk carrier that can make more trips during a boom, or a bigger products tanker that has the edge in long-haul trades even if it often carries part cargoes.

## 6.6 SHIPPING ACCOUNTS – THE FRAMEWORK FOR DECISIONS

So far we have focused on the cost and revenue relationships which determine how a shipping company or investment project performs financially. Now it is time to pull this together using the accounting framework which shipping companies and their investors use to take financial decisions.

### What company accounts are used for

First a brief note about the comparability of financial information. Shipping companies register in many countries around the world and different financial reporting standards mean that financial information is not always in a comparable form. However in recent years significant progress has been made in coordinating financial reporting standards through the International Accounting Standards Board (IASB). In 2003 the IASB published the first International Financial Reporting Standard (IFRS 1). This was adopted by the European Union for public companies in 2004 and by 2008 about 100 countries complied with this standard.

Company accounts are compiled for three quite different purposes, each calling for a different presentation of the information. One is to show the financial standing of the company. Potential creditors need to know if the company is financially sound and likely to meet its commitments. Most jurisdictions impose strict rules regarding the provision of this type of financial information, obliging limited liability companies to publish accounts and as noted above there are now international guidelines setting out what company accounts must contain. For example since January 2005 listed companies in the European Union must comply with the International Financial Reporting Standards (IFRS1). Naturally companies, know these accounts will be read by their competitors as well as their suppliers and generally prefer to reveal as little as possible.

The second purpose of accounts is for the assessment of tax. The tax authorities lay down rules for what is and is not permissible in a particular country regarding the calculation of the profit upon which tax is raised. This means that the published accounts of a company registered in that country reflect the accounting conventions of the local tax system, which may make them quite different from, and much less useful than, the accounts published by the company's internal management for the purposes of running the business.

Finally we have the 'management accounts', which are compiled to help the management of the company in their decision-making. This is the aspect of financial reporting we are most interested in. Three separate, but connected, financial statements are generally used by the accounting profession to supply information for management purposes; income statement, the balance sheet, and the cashflow statement. Each has its own 'slant' on the business.

In this section we will review these financial statements. Since shipping is a dollar denominated business we will use as an example the accounts of a company listed in the USA. Our aim is to understand the economics of the business but note that the accounts used, which were selected to illustrate the type of financial issues shipping companies deal with, predate IFRS 1.

### The income statement

The income statement, referred to in the UK as the profit and loss account, shows how much profit (net revenue) the company made during the accounting period. This tells us how much wealth the company created, a crucial piece of information since a company generating profits is increasing in value, whilst a company losing money is on the slippery slope. If we think of the company as a stream of net revenue, then the income

**Table 6.10** Shipping company income statement

| | Year end ($millions) | | |
|---|---|---|---|
| | **2003** | **2002** | **2001** |
| **Operating Revenue** | 1,576 | 783 | 1,039 |
| *less* Operating expenses: | | | |
| Voyage expenses | 395 | 239 | 250 |
| Vessel operating expenses | 211 | 168 | 155 |
| Time-charter hire expense | 305 | 50 | 66 |
| Depreciation and amortization | 191 | 149 | 136 |
| General and administrative | 85 | 57 | 49 |
| *Sub-total* **Income from operations** | **390** | **119** | **383** |
| Write-offs & gains on vessel sales | –90 | | |
| Restructuring charge | –6 | | |
| Equity income from joint ventures | 7 | 5 | 17 |
| *Sub-total* **operating revenue** | **300** | **124** | **401** |
| Interest expense | –81 | –58 | –66 |
| Interest income | 4 | 3 | 9 |
| Other loss | –45 | –16 | –7 |
| **Net income** | **177** | **53** | **337** |
| ***Memo*** | | | |
| Earnings per share – basic | 4.43 | 1.35 | 8.48 |

Source: based on the published accounts of a public shipping company

statement tells us the rate of flow of the stream. Table 6.10 shows the income statement for a large shipping company for three accounting periods, 2001–3. In 2003 the company earned $1.58 billion operating revenue from its ships, including both timecharter and spot income. From this they deducted five cost items: $395 million voyage expenses; $211 million operating costs; $305 million for ships chartered in; depreciation of $191 million; and general and administration costs $85 million. That leaves $390 million income from vessel operations. However, it is then necessary to make some other adjustments that had nothing to do with vessel operations, but affected the company's wealth. A major item was the write-off of $90 million on ships which were sold during the year for prices below their book value. There was also a $6 million restructuring cost for closing some overseas offices and $7 million joint venture income. After taking account of these the operating income was $300 million. Finally, the interest payments and 'other losses' (mainly tax) are deducted to give the net income for the company in 2003 of $177 million.

## The balance sheet

The balance sheet shows the company's wealth at a specific point in time, in this case 31 December 2001, 2002 and 2003 which was the company's year end. It starts by reporting the total assets of the business (i.e. everything the company owns), and then deducts the liabilities (i.e. money owed to third parties). Analysts are also interested in the balance sheet because it tells them how the company is holding its wealth. It is all very well having spectacular profits, but if a company has all its wealth tied up in ships and no cash to pay the bills, it could be a very risky situation.

Usually the balance sheet divides the calculation of wealth into three components. First, the current assets of the business are funds that can be realized quickly without changing the basic structure of the business or incurring penalties. Second, there are the ‘fixed’ assets which, for a shipping company, include the value of the vessels the company owns and other assets such as buildings and investments in other companies. Valuing the vessels raises issues about whether they should be valued at book value (i.e. acquisition cost less depreciation) or market value since the two methods can produce very different results (see Section 6.4 for a discussion of the calculation of depreciation). Finally, we deduct the liabilities (i.e. the money owed) which usually takes the form of any outstanding bills, debt, bonds and other financial commitments that must be met at some time in the future. The fact that the capital value of the ships is so high and subject to extreme volatility makes it difficult to disentangle the underlying value of the business, taking one cycle with another, from the cyclical elements that depress or increase returns.

Table 6.11 provides an example of a relatively complex shipping company balance sheet. The layout is conventional, with the assets listed at the top of the table in sections 1.1–1.3 and the liabilities in the second half of the table in sections 2.1 and 2.2. In this case the total assets in 2003 were $3.588 billion, and the sum of long- and short-term liabilities was $1.921 million. The difference between these two is shareholders’ equity, which was $1.667 billion.

The current assets, shown in Section 1.1, include cash in the bank of $295 million, plus accounts receivable (i.e. invoices which have been presented, but not paid) of $147 million and some pre-paid expenses and other assets of $39 million, giving the company total current assets of $481 million. In section 1.2 the ships in the company’s fleet are valued at $2.4 billion, based on cost less accumulated depreciation. This method of valuation, known as ‘book value’, is not always a reliable guide to the market value of the vessels. In fact the income statement included a write-off of $90 million from the sale of ships whose sale price was lower than the book value. In addition to the ships the balance sheet reports some capital leases, which nowadays have to be declared, and advance payments on some tankers currently under construction. Section 1.3 includes various other assets totalling $533 million in 2003, including $96 million worth of shares in other shipping companies and an investment in some financial leases. Unusually for a shipping company, there are also some intangible assets and ‘goodwill’. Overall the company’s assets consist of 13% cash and working capital, 70% ships, and the remaining 17% is various odds and ends.

On the liabilities side, by far the biggest liability in 2003 was $1.5 billion of long-term debt. In addition, there are various short-term obligations listed in section 2.1.

**Table 6.11** Shipping company balance sheet

| | Year end ($ millions) | |
|---|---|---|
| | **2003** | **2002** |
| **1. ASSETS** | | |
| *1.1 Current Assets* | | |
| Cash and cash equivalents (note 1) | 295 | 289 |
| Accounts receivable | 147 | 71 |
| Prepaid expenses and other assets | 39 | 28 |
| Total current assets | 481 | 388 |
| *1.2 Vessels* | | |
| Vessels at cost less depreciation | 2,387 | 1,928 |
| Vessels under capital leases, at cost, | 38 | |
| Advances on newbuilding contracts (note 3) | 151 | 138 |
| Total vessels | 2,575 | 2,067 |
| *1.3 Other assets* | | |
| Marketable securities (note 2) | 96 | 14 |
| Restricted cash | | 5 |
| Deposit for purchase of company (note 4) | | 76 |
| Net investment in direct financing leases (note 5) | 73 | |
| Investment in joint ventures (note 6) | 54 | 56 |
| Other assets | 60 | 30 |
| Intangible assets and goodwill (note 7) | 249 | 89 |
| Total other assets | 533 | 269 |
| **TOTAL ASSETS** | **3,588** | **2,724** |
| **2. LIABILITIES** | | |
| *2.1 Current liabilities* | | |
| Accounts payable | 52 | 22 |
| Accrued liabilities | 120 | 84 |
| Current portion of long-term debt | 102 | 84 |
| Current obligation under capital lease | 1 | |
| Total current liabilities | 275 | 190 |
| *2.2 Long term liabilities* | | |
| Long-term debt | 1,498 | 1,047 |
| Obligation under capital lease | 35 | |
| Other long-term liabilities | 113 | 45 |
| Total long-term liabilities | 1,646 | 1,092 |
| **TOTAL LONG- & SHORT-TERM LIABILITIES** | **1,921** | **1,281** |
| **Stockholders' equity** | **1,667** | **1,442** |
| **TOTAL LIABILITIES** | **3,588** | **2,724** |

1. The company has loans which specify a minimum cash balance
2. Shareholding in two other shipping companies
3. Payments already made to shipyard on new ships under construction
4. 10% deposit paid against the purchase of another shipping company
5. Capitalized value of investment in financing leases
6. The appraised value of a 50% holding in a joint venture company
7. Goodwill purchased with companies

Source: based on the published accounts of a public shipping company

1. less accumulated depreciation of $1,034,747 (2002; $940,082)
2. less accumulated depreciation of $438 (2002: nil)

## The cashflow statement

Finally there is the cashflow statement, which tells the analyst exactly how much cash the company paid in or paid out during the period, where the cash that was spent came from, and where it went. Often the trigger of bankruptcy for shipping companies is not the multi-million dollar debts owed to the bank, it is the bunker supplier who, faced with an unpaid bill, decides to arrest a ship. So it is always important to have enough cash in hand. The cashflow statement is in many respects similar to the income statement, but it deals strictly with cash payments, excluding certain items such as depreciation which are not actually paid in cash.

The cash flow statement in Table 6.12 is divided into three sections, each dealing with a different aspect of the company's activities. Section 1 deals with the cash provided by operating activities; section 2 deals with the cashflow arising from financing activities; and section 3 deals with the cashflow from investing activities. If we take each of these in turn, we can see how the company's business was developing.

The operating activities in section 1 generated $456 million in 2003. The key point here is that the cash flow from operating activities is quite different from the net income reported in Table 6.10. That showed net income of $177 million in 2003, but in section 1.2 the cash statement adds back non-cash items which appeared in the income statement, including depreciation of $191 million, losses on the write-down of vessels of $92 million (a pure balance-sheet item), and various other non-cash items. Changes in working capital and expenditure for dry docking are then deducted to give positive net cashflow from operating activities of $456 million – more than twice the net income.

In section 2 we see the cashflow arising from financing activities. In 2003 this was also strongly positive, with $447 million of cash generated. This cash was generated mainly by refinancing – they raised $1.98 billion of new long-term debt, $25 million by issuing common stock, made $63 million scheduled debt repayments, and prepaid $1.47 billion of debt, leaving $447 million free cash.

The way the company used the cash raised from operating and financing is shown in section 3. Investments made by the company in 2003 cost $895 million. They paid $730 million for new companies and $372 million for new ships. The sale of old ships generated $242 million. There were various other minor investments, including the purchase of shares and some leases.

Pulling all this together, the company generated $456 million cash from operating its ships; topped it up with $447 million of additional external finance; and invested $895 million in buying companies and ships. But despite all this activity the company's cash balance changed by only $8 million in the year. Somebody has done good job of balancing the books!

Not all companies publish accounts in this form, but the above examples illustrate the general principles of financial accounting in shipping. Whether the company has 40 ships or 400 the operating activities are about increasing revenues and squeezing costs to generate income; the financing activities are about managing funds, whether from a bond issue or an investment by a high net worth relative so that the company can do what it needs to when it needs to do it; and the investment activities are about implementing the

**Table 6.12** Shipping company cashflow statement

| | Year end ($ millions) | | |
|---|---|---|---|
| | 2003 | 2002 | 2001 |
| Cash provided by (or used for): | | | |
| **1. OPERATING ACTIVITIES** | | | |
| 1.1 Net income | 177 | 53 | 337 |
| 1.2 Non-cash items (to add back): | | | |
| Depreciation and amortization | 191 | 149 | 136 |
| (Gain) loss on sale of assets | –2 | 1 | –1 |
| Loss on write-down of vessels | 92 | | |
| Other non-cash items | 44 | 4 | 20 |
| total | 325 | 154 | 155 |
| 1.3 Change in working capital | –4 | 7 | 28 |
| 1.4 Expenditures for drydocking | –43 | –35 | –20 |
| Net cash flow from operating activities | 456 | 180 | 500 |
| **2. FINANCING ACTIVITIES** | | | |
| Net proceeds from long-term debt | 1,981 | 255 | 688 |
| Scheduled repayments of long-term debt | –63 | –52 | –72 |
| Prepayments of long-term debt | –1,467 | –8 | –752 |
| Decrease (increase) in restricted cash | 6 | –1 | –8 |
| Proceeds from issuance of Common Stock | 25 | 4 | 21 |
| Repurchase of Common Stock | | –2 | –14 |
| Cash dividends paid | –36 | –34 | –34 |
| Net cash flow from financing activities | 447 | 163 | –171 |
| **3. INVESTING ACTIVITIES** | | | |
| Expenditures for vessels and equipment | –372 | –136 | –185 |
| Proceeds from sale of vessels and equipment | 242 | | |
| Purchase of companies | –705 | –76 | –182 |
| Purchase of intangible assets | –7 | | |
| Purchase of available-for-sale securities | –37 | | –5 |
| Proceeds from sale of available-for-sale securities | 10 | 7 | 36 |
| Decrease (increase) in investment in joint ventures | 26 | –26 | |
| Net investment in direct financing leases (note 3) | –20 | | |
| Other | –5 | –2 | 0 |
| Net cash flow from investing activities | –895 | –233 | –336 |
| Cash and cash equivalents, beginning of the period | 285 | 175 | 181 |
| Cash and cash equivalents, end of the period | 292 | 285 | 175 |
| Increase (decrease) in cash and cash equivalents | 8 | 110 | –6 |

Source: based on the published accounts of public shipping company

company's strategy. Cashflow does not make a good business, but well-managed cashflow certainly smooths the way for good businessmen to get on with what they are good at.

## 6.7 FOUR METHODS OF COMPUTING THE CASHFLOW

Our aim in this chapter is to focus on how costs can be controlled and how revenue can be increased within the overall constraints imposed by the ship, the business organization and the legal jurisdiction under which a company's vessels operate. At the beginning of this chapter we discussed the importance of cash management in navigating through the shipping cycles that are such a feature of the business and examined the cost and revenue items that underlie a shipping business's cashflow. It now remains to discuss the practical techniques for preparing operational cashflow calculations that can be used as a basis for decision-making.

In shipping the usual measure of cashflow is *earnings before interest, tax, depreciation and amortization* (EBITDA). This measures the 'cash in hand' generated by the business during a period of time and is calculated by deducting out-of-pocket expenses from revenue. Four methods of cashflow analysis are widely used in the shipping industry, each of which approaches the cashflow from a different perspective:

- *The voyage cashflow (VCF) analysis* is the technique used to make day-to-day chartering decisions. It computes the cashflow on a particular ship voyage or combination of voyages. This provides the financial basis for operational decisions such as choosing between alternative charter opportunities where there are several options, or in a recession deciding whether to lay up the ship or fix it.
- *The annual cashflow (ACF) analysis* calculates the cashflow of a ship or a fleet of ships on a year-by-year basis. It is the format most often used for cashflow forecasting. By projecting the total cashflow for the business unit during a full financial year, it shows whether, on specific assumptions, the business as a whole will generate enough cash to fund its operations after taking account of complicating factors such as tax liabilities, capital repayments and periodic maintenance.
- *The required freight rate analysis* is a variant on the annual cashflow analysis. It focuses exclusively on the cost side of the equation, calculating the level of costs which must be covered from freight revenue. This is useful for shipowners calculating whether a ship investment will be profitable and bankers carrying out credit analysis to decide how much to lend. It can also be used to compare alternative ship designs.
- *The discounted cashflow (DCF) analysis* is concerned with the time value of money. It is used for comparing investment options where the cashflows differ significantly over time. For example, a new ship involves a large initial investment but is cheap to run, whereas an old ship is cheap to buy but has higher costs later in its life. DCF analysis provides a structured way of comparing the two investments.

These methods are complementary and each approaches the cashflow in a different way appropriate to the needs of different decisions.

## The voyage cashflow analysis

The VCF analysis provides information about the cash that will be generated by undertaking a particular voyage or sequence of voyages. Typically the owner with a ship which is open on a particular date will have brokers' lists showing cargoes available in the relevant loading area. Sometimes there will be one obvious cargo, so the decision is easy.

In most cases, however, there will be several alternatives, all possible but none ideal, so a decision is needed about which cargo to take. This means having to decide whether to accept the grain cargo from the US Gulf to Japan, or from the US Gulf to Rotterdam, whether to fix now or wait a few days to see if the rates improve, and whether to lay up the vessel or to continue to trade. By providing an estimate of the profitability of a particular voyage, the VCF analysis plays an essential part in making operating decisions.

An example of a voyage cashflow analysis is shown in Table 6.13. A Panamax bulk carrier is on a multi-leg voyage from the US Gulf to Japan with grain, then ballasting down to Australia, where it picks up another cargo of coal to deliver to Europe before returning in ballast to East Coast North America to reload grain. The aim is to estimate how much cash the voyage will actually generate.

This table is in a summarized form, and in practice a more detailed voyage estimating programme would be used, but it covers the main issues. The four sections of the table are reviewed below:

1 *Ship information*. Details of the ship size, speed, bunker consumption, etc. In this case the speed is 15 knots on the loaded and ballast voyages and a 5% sea margin is deducted to allow for weather conditions and other delays. The ship, which is relatively modern, burns 33 tons per day on the laden voyage and 31 tons on the ballast voyage. Operating costs are shown as a daily rate assuming 350 days a year on hire (note that the cashflow attributable to operating costs will not necessarily fall within the time-scale of the voyage). The bunker price is $338 per ton for bunker oil and $531 per ton for diesel oil for the auxiliaries. Bunker prices vary around the world and a bunkering plan will be considered, to ensure that the ship bunkers in the cheapest location.

2 *Voyage information*. This section shows details of the voyage – port days, distance, cargo carried, and the freight rate for each leg of the voyage. The port time of 3 days loading and 2 days discharging includes time waiting for a berth, documentation, loading and discharging cargo, bunkering and a day for transiting the Panama Canal. It is not always easy to estimate port times precisely. In this case the cargo is 54,000 tons of grain on leg 1 and 70,000 tons of coal on leg 3. A ship of this type would probably carry about 3,500 tons of bunkers and stores, leaving an available cargo capacity of 71,500 tons, so the vessel is not fully loaded on the first leg. On this voyage the ballast legs are much shorter than the cargo legs, which is good – the shorter, the better. The round voyage is calculated from the speed, less the sea margin for good weather, the voyage distance on loaded and ballast legs, and the port times. In addition, a congestion provision is shown in line 2.6 which could cover port time, delays at certain ports such as loading coal, or congestion at known chokepoints such as the Dardanelles for tankers leaving the Black Sea. In total the voyage is 31,089 miles, takes 116 days (90.9 days at sea and 25 days in port), transports 124,000 tons of cargo and the freight is $5.75 million.

3 *Voyage cashflow*. The freight earnings are repeated in line 3.1. From this are deducted the broker's commission, and voyage costs which include bunkers, diesel

**Table 6.13** Voyage cashflow analysis for 75,000 dwt bulk carrier (with backhaul), 4 May 2007

| **1. SHIP INFORMATION** | | | | | |
|---|---|---|---|---|---|
| **Ship Type** | **Speed (knots)** | | | **Bunkers (tons/day)** | |
| | **Design speed** | **Sea margin** | **voyage speed** | **Main** | **Auxiliary** |
| 1.1 Bulk carrier, 75,000 dwt | | | | | |
| 1.2 Laden voyages | 15 | 5.0% | 14.25 | 33 | 1 |
| 1.3 Ballast voyages | 15 | 5.0% | 14.25 | 31 | 1 |
| 1.4 Operating cost $/day | | 5,620 | At 350 days on hire pa | | |
| 1.5 Bunker price $/ton | | | | 338 | 531 |
| **2. VOYAGE INFORMATION** | **col (1)** | **col (2)** | **col (3)** | **col (4)** | **col (5)** |
| **Route** | **Distance (miles)** | **Days at sea** | **Days in port** | **Cargo (tons)** | **Freight $/ton** |
| 2.1 Port days/voyage - loading | | | 3 | | |
| 2.2 Port days/voyage - discharge | | | 2 | | |
| 2.3 Voyage details: | | | | | |
| Leg 1: US Gulf–Japan | 9,123 | 26.7 | 5 | 54,000 | 56.0 |
| Leg 2: Japan–Australia | 4,740 | 13.9 | 0 | Ballast | |
| Leg 3: Australia–Europe | 12,726 | 37.2 | 10 | 70,000 | 39.0 |
| Leg 4: Europe–East Coast North America | 4,500 | 13.2 | 0 | Ballast | |
| 2.4 Total loaded voyages | 21,849 | 63.9 | | | |
| 2.5 Total ballast voyages | 9,240 | 27.0 | | | |
| 2.6 Port congestion provision | | | 10 | | |
| 2.7 Total round voyage | 31,089 | 90.9 | 25 | 124,000 | 5,754,000 |
| **3. VOYAGE CASHFLOW** | **$** | **Notes** | | | |
| 3.1 Freight earnings $ | 5,754,000 | From row 2.7 above | | | |
| 3.2 *less* Broker's commission | 86,310 | At 1.5% | | | |
| 3.3 *less* Voyage costs | | | | | |
| Bunker oil for main engine | 995,674 | Days at sea *consumption*price | | | |
| Diesel oil for auxiliaries | 48,270 | Days at sea *consumption*price | | | |
| Port costs | 418,000 | Cost of four port calls | | | |
| Canal dues | 80,000 | One Panama canal transit | | | |
| Total | 1,541,944 | | | | |
| 3.4 less operating costs | 651,378 | days on voyage * operating cost/day | | | |
| 3.5 Voyage cashflow | 3,474,369 | Cash generated by voyage (less OPEX) | | | |
| **4. VOYAGE EARNINGS** | | | | | |
| 4.1 memo: Days on the voyage | 116 | From line 2.7 including congestion | | | |
| 4.1 Time-charter equivalent $/day | 35,596 | Equals (line 3.5/line 4.1) + row 1.4 | | | |

Note: Freight rates shown are as on 4 May 2007

for auxiliaries, port and canal costs. Operating costs are then deducted in line 3.4 to calculate the net voyage cash flow.

4 *Voyage earnings*. Finally, in line 4.1 we calculate the time-charter equivalent for the round voyage, which is $35,596 per day.

In this example the freight rates are taken from a period of very strong earnings in May 2007. The ship would earn more than enough to cover its full capital costs. To put the voyage time-charter equivalent into perspective, on the same date, 4 May 2007, the 3-year time-charter rate for a modern Panamax bulk carrier was $34,000 per day, but the 1-year-rate was $41,750 per day.

So what does the owner do in this situation? Basically, money is flooding in and the ship is generating almost $10 million a year. The owner will earn a very decent return if he accepts the voyage at this level of freight rates, but he could match it with less trouble if he puts the ship out on a 3-year time-charter at $34,000/day and if he puts the ship out on a 1-year time-charter at $41,750/day he could get more. It all depends on what he thinks will happen in future, and that means anything from the end of this voyage to the next three years. He may remember that five years earlier in August 2002 the rate for US Gulf–Japan grain was $19.40 per tonne and the backhaul from Newcastle, NSW to Europe was $10.20 per tonne. Admittedly bunkers were cheaper at $153 for fuel oil and $213 for marine diesel oil, but at those rates the voyage would only pay $6357 per day. Could it happen again? Should he take a time-charter while the rates are so good? It's the million-dollar decision that shipowners ponder every day.

For older ships strong markets like this are very profitable. A few voyages generating over $3 million each soon generate more cash than the ship is worth in a normal market. It is easy to see why in strong markets old ships are rarely scrapped unless they have serious physical problems. But if we rerun the voyage estimate for the August 2002 scenario the ship does not earn enough to cover its operating costs. This puts the owner in a very difficult position. If he accepts the charter in these circumstances he will lose money on the voyage, even if things go as planned. With old ships he knows that things do not always go as planned. However, if he refuses the cargo he will be even worse off. His operating costs must be paid whether the ship has a cargo or not. One option is to send the ship to lay-up, saving a large part of operating costs, but unless the vessel is carefully maintained during lay-up its future value can be badly affected.

In these circumstances it is easy to see how during recessions the business becomes totally preoccupied with the problem of obtaining enough cash to pay each day's bills as they come in and with cutting costs wherever possible. The lesson relearned by each generation of over-leveraged shipowners and their bankers is that once the recession has started it is too late. There are no real options. With a real effort the owner might cut his annual operating costs, using a cheaper crew, defer all but the most essential repairs and tighten up on administration costs. However, if he is highly leveraged, whether the ship is new or old, the $1,500 per day he might save will not make much difference to his cashflow. Indeed, if he cuts costs too much it could lead to expensive operational problems.

If cash is not available elsewhere and the bankers press for payment, the only option may be to sell assets to raise cash. This usually means selling a ship, and brings us back to the sale and purchase decision that we discussed at the beginning of the chapter in Figure 6.1. The problem is that a ship that cannot generate a positive cashflow, even when well managed, will not command a high price on the market. As desperate owners are driven to sell their ships in order to raise cash, and as few potential purchasers can be found, the price falls. For newer vessels, a speculative investor will almost always be found, but for old ships whose economic life may not span the depression the demolition yard may be the only willing purchaser.

The moral is that financially shipping is a business of feast and famine. When times are good, as they are in the example in Table 6.13, the challenge is to invest the funds wisely. But surviving depressions depends upon being able to generate cash when other shipowners are losing money and, as we saw in Chapter 3, recessions are a regular feature of the shipping market. By the time the voyage decision arrives, it is too late. Banks rarely lend money to customers who are in financial difficulties and if they do, it is usually on very disadvantageous terms. Financial planning for such contingencies must be undertaken before the ship is purchased, when rates are high, and the shipowner still has some room for manoeuvre. Cashflow planning is the technique to use.

### The annual cashflow analysis

ACF analysis is concerned with calculating the cashflow generated by the business as a whole over a period of time. In this sense it is less concerned with the ship as an operating unit than with the total cashflow that the business must finance over a period of time, either months or years.

There are several different methods of calculating the annual cashflow, but the simplest is the receipts and payments method shown in Table 6.14 (a simpler version of the cashflow statement in Table 6.12). The top of the table shows cash revenue, the lower half of the table shows cash costs, and the bottom line indicates the cashbook balance carried forward from one year to the next in the company's bank account. This simple example illustrates the ACF technique for a one-ship company trading over a four-year period. The figures are loosely based on actual market conditions between 1990 and 1995, and the freight rates, prices, operating costs and the outstanding loan are shown as a memo item at the bottom of Table 6.14. For simplicity, inflation and bunker price changes have not been included in the analysis.

The shipping company has an opening balance of $8.5 million (line 1). On the last day of year 0 it purchases a 1992 built tanker of 280,000 dwt for $22 million. A bank loan is used to finance 70% of the purchase price, to be paid back in equal annual instalments of $3.08 million per annum over 5 years. The remainder of the purchase price is paid from the company's own cash reserve. Receipt of the loan from the bank is shown in line 2.2 as a capital receipt of $15.4 million, while the payment for the ship is shown in line 4.4 as $22 million. In year 1, freight rates are running at $31,824 per day and the ship generates total revenue of $10.8 million (line 2.1), more than enough to cover operating costs, voyage costs and capital charges, so the company ends year 1 with a positive bank balance of $4.45 million. However, freight rates fall to $12,727 per day in year 2, $17,768 per day in year 3 and $10,107 per day in year 4. Each year the company's bank balance is slowly eroded, so that by the end of year 3 the strong positive balance has disappeared and the company needs to raise an additional $798,000 in cash just to meet day-to-day commitments.

**Table 6.14** Annual cashflow analysis Case 1: 280,000 dwt tanker built 1976 scrapped at 4th survey

| $000s | | Year 0 (1990) | Year 1 (1991) | Year 2 (1992) | Year 3 (1993) | Year 4 (1994) | Year 5 (1995) |
|---|---|---|---|---|---|---|---|
| 1 Opening balance | | 8,500 | 1,900 | 4,450 | 815 | (798) | (1,487) |
| 2 Cash receipts | | | | | | | |
| 2.1 Operating revenue (gross) | | 0.0 | 10,820 | 4,327 | 6,041 | 3,436 | |
| 2.2 Capital receipts | | 15,400 | | | | | |
| 2.3 Revenue from ship sale | | | | | | 6,300 | |
| 3 TOTAL RECEIPTS | | 15,400 | 10,820 | 4,327 | 6,041 | 9,736 | |
| 4 Cash payments | | | | | | | |
| 4.1 Operating costs | | | 3,650 | 3,650 | 3,650 | 3,650 | |
| 4.2 Dry docking | | | | | | | |
| 4.3 Voyage costs | | | | | | | |
| 4.4 Purchase of ship | | 22,000 | | | | | |
| 4.5 Loan repayments | | | 3,080 | 3,080 | 3,080 | 6,160 | |
| 4.6 Interest | | | 1,540 | 1,232 | 924 | 616 | |
| 4.7 Tax payments | | | | | | | |
| 5 TOTAL COSTS | | 22,000 | 8,270 | 7,962 | 7,654 | 10,426 | |
| 6 CASHBOOK BALANCE AT YEAR END | | 1,900 | 4,450 | 815 | (798) | (1,487) | (1,487) |
| *memo* | Charter rate / day | 22,883 | 31,824 | 12,727 | 17,768 | 10,107 | 15,789 |
| | Days trading | | 340 | 340 | 340 | 340 | 340 |
| | Second-hand price of ship | 22,000 | 20,000 | 9,500 | 11,000 | 8,000 | 10,000 |
| | Operating costs $/day | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| | Outstanding loan (year end) | 15,400 | 12,320 | 9,240 | 6,160 | 0 | 0 |
| | Asset cover | 1.426 | 1.6234 | 1.02814 | 1.7857 | | |

At the end of year 4 the company is only generating enough cash to pay its operating costs and, to make matters worse, in year 4 it faces its fourth special survey, with an estimated cost of $5 million. Faced with a negative cashflow it cannot fund from its own cash reserves the company would be forced to make some major decisions of the type discussed at the beginning of the chapter. One option would be to sell. The second-hand price for a VLCC in average condition shown in the memo section of Table 6.14 is $8 million. However, a ship due for its fourth special survey is not in average condition and would not attract even that price – a scrap sale at $6.3 million would be more likely. With $3.08 million of the original loan still outstanding and debts of $798,000, a sale for $6.3 million would leave the shipping company with a loss of $1.487 million, compared with an opening balance of $8.5 million. Obviously this option would suit the bank, which would be repaid in full, but the shipping company would have lost heavily on the deal. By selling the ship any hope of recovering the losses would be gone.

**Table 6.15** Annual cashflow analysis Case 2: 280,000 dwt tanker built 1976 traded past 4th survey

| $000s | Year 0 (1990) | Year 1 (1991) | Year 2 (1992) | Year 3 (1993) | Year 4 (1994) | Year 5 (1995) |
|---|---|---|---|---|---|---|
| 1 Opening balance | 8,500 | 1,900 | 4,450 | 815 | (798) | (9,707) |
| 2 Cash receipts | | | | | | |
| 2.1 Operating revenue (gross) | 0.0 | 10,820 | 4,327 | 6,041 | 3,436 | 5,368 |
| 2.2 Capital receipts | 15,400 | | | | | |
| 2.3 Revenue from ship sale | | | | | | 11,000 |
| 3 TOTAL RECEIPTS | 15,400 | 10,820 | 4,327 | 6,041 | 3,436 | 16,368 |
| 4 Cash payments | | | | | | |
| 4.1 Operating costs | | 3,650 | 3,650 | 3,650 | 3,650 | 3,103 |
| 4.2 Dry docking | | | | | 5,000 | |
| 4.3 Voyage costs | | | | | | |
| 4.4 Purchase of ship | 22,000 | | | | | |
| 4.5 Loan repayments | | 3,080 | 3,080 | 3,080 | 3,080 | 3,080 |
| 4.6 Interest | | 1,540 | 1,232 | 924 | 616 | 308 |
| 4.7 Tax payments | | | | | | |
| 5 TOTAL COSTS | 22,000 | 8,270 | 7,962 | 7,654 | 12,346 | 6,491 |
| 6 CASHBOOK BALANCE AT YEAR END | 1,900 | 4,450 | 815 | (798) | (9,707) | 171 |
| *memo Current account interest* | 190 | 445 | 82 | (80) | (971) | 17 |
| memo Charter rate / day | 22,883 | 31,824 | 12,727 | 17,768 | 10,107 | 15,789 |
| Days trading | | 340 | 340 | 340 | 340 | 340 |
| Second-hand price of ship | 22,000 | 20,000 | 9,500 | 11,000 | 8,000 | 11,000 |
| Operating costs $/day | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 8,500 |
| Outstanding loan (year end) | 15,400 | 12,320 | 9,240 | 6,160 | 3,080 | (0) |
| Asset cover | 1.4286 | 1.6234 | 1.0281 | 1.7857 | 2.5974 | |

The second option is to put the ship through survey and trade on. The cashflow in Table 6.15 shows what would happen in years 4 and 5 if the company followed this strategy. First, the owner would have to raise an overdraft of, say, $10.5 million cash to meet his negative cashflow in years 3 and 4. This will be difficult. Few bankers are willing to lend to a business with no assets and a negative cashflow. There is little that can be done to raise money within the business. Cost economies might be possible if the company is paying top rates to the crew and maintaining the vessel to a very high standard. Closing expensive offices is another source of economy. If rigorous cost-cutting saves $1,500 per day, that is worth $0.5 million in a full year. This might convince his bankers that he is determined to tackle the problem, but would not even pay the interest on his overdraft. The best the company can offer its bankers is a straight gamble on the market. Bankers do not generally gamble, but since the choice is between foreclosing and providing a $10.5 million overdraft, it is not so much a matter of gambling as choosing between unpalatable options. Such decisions test the concept of relationship banking which we discuss in Chapter 8.

On this occasion, if the bank decided to back the owner, it would pay off. The out-turn in year 5 (Table 6.15) shows how quickly a company's financial position can change in shipping. Freight rates increase to $15,789 per day in year 5, which brings in an extra $1.9 million income (line 2.1). In response to higher freights the market price of the ship goes up to $11 million. Since the ship has now passed survey, it would probably fetch this price if sold, so its real asset value has increased by 75% from $6.3 million to $11 million in a year, adding $4.7 million to the net worth of the company. Lower operating costs of $3.1 million contribute an extra $0.5 million, so the company's financial position has improved by $7.2 million. At the end of that year the last instalment on the loan is paid off, so there will be no more repayments. If the company sold the ship it would end the year with a balance of $17 million, from which it has to pay interest on its current account. However, the owner has no debt and the ship has passed its survey. He has survived and by taking a gamble he and his bankers have avoided taking a loss. If all goes well the owner will soon be a rich man and the banker will have a grateful client.

As always in recessions, the crucial issue is survival. By the time the unpaid bills start to pile up in year 4 it is too late to do very much – the right time to raise questions about costs, efficiency and working capital is before the ship is purchased. The example discussed in the preceding paragraphs shows how a realistic ACF analysis can provide the framework for thinking ahead and planning financial strategy in the shipping market. If the shipowner had borrowed less, or borrowed more and provided for emergency working capital at the outset, the problem would never have arisen. Or would it? We started this chapter by likening competition in a depressed shipping market to a marathon race with only a few prizes. Someone has to lose. It is through ACF analysis that shipping companies and their bankers can weigh up their fitness to finish the race, and identify those actions that can enhance their chances of future survival.

## The discounted cashflow analysis

So far we have concentrated on cashflow analysis which helps management to think through the implications of certain decisions in terms of the future cashflow of the business. But business is not just about surviving recessions. Staying in business also depends on making a commercial return on capital, and that calls for sound investment decisions. Often the decision facing management is a choice between investment projects where the future cashflows are well established, but different. For example, consider a shipowner who purchases a tanker for $45 million and is offered two different deals by oil companies, Big Petroleum and Superoil Trading:

- Big Petroleum offers to charter the ship for $18,000 per day for 7 years, trading 355 days a year. At the end of the charter the oil company guarantees to buy the ship for $35 million.

- Superoil Trading's proposal is a little more complex. To fit its trading patterns the company wants the owner to have the cargo tanks epoxy-coated. This will cost \$3 million, bringing the total price up to \$48 million. However, Superoil is willing to buy the ship at the end of the charter for \$45 million. Also, they want to escalate the daily charter rate by \$2,000 each year from \$12,000 per day in year 1 to \$24,000 per day in year 7.

The owner is particularly impressed by Superoil's contract. The charter revenue over the 7 years of \$44.3 million is exactly the same as for the Big Petroleum deal. However, the buyback terms are far better. He loses only \$3 million on the ship with Superoil, compared with \$10 million in the Big Petroleum deal. It seems he will be \$8 million better off with Superoil. Although this seems obvious, Superoil has a reputation for driving a hard bargain and the owner is worried. So he should be. He has ignored the time value of money.

If we take the time value of money into account, we find that there is less difference between the two offers than there appears at first sight, as we will demonstrate using DCF analysis. The principle behind this analysis is that because investors can earn interest on their money, cash paid on a future date is worth less than the same amount of cash paid today. For example, \$1,000 invested today at 10% interest is worth \$1100 in a year, but \$1,000 paid in a year is worth \$1,000. So \$1,000 today is worth 10% more than \$1,000 in a year's time. Putting it another way, the 'present value' of \$1100 paid in a year is \$1,000.

DCF analysis converts future payments into a 'present value' by discounting them. The method is as follows. The first step is to determine the 'discount rate', which represents the time value of money to the company. There are several ways of doing this. The simplest way, if the company has a cash surplus, is to use the interest rate which the company would receive if it invested the cash in a bank deposit. Or the discount rate might be set at a level which reflects the average return on capital obtained from investments in other parts of the business. Many businesses use 15% per year. Finally, if the company has to borrow to finance the project, the marginal cost of debt might be more appropriate.

Once the discount rate has been agreed, we can discount the future cashflows. In Table 6.16 we do this for the two contracts, and the two parts of the table have the same layout. In row 1 we show the purchase price of the ship, in row 2 the time-charter revenue, and in row 3 the total cashflow. In row 4 we use 12% per annum to calculate a 'discount factor' for each year. Row 5 shows the discounted cashflow, calculated by multiplying the cashflow in each year by the discount factor for that year. Finally this discounted cashflow is summed over all years to produce the net present value (NPV) of each project shown in row 6 in the year 0 column.

For the Big Petroleum contract the NPV is –\$5,400. It seems he would be better off investing in stocks, though not by very much. However, the real surprise comes when we look at the Superoil Trading contract. The \$8 million extra return from this project has completely disappeared. The NPV is \$64,700, which on a \$48 million project is insignificant. The reason why this project looked so good is that all the extra revenue

**Table 6.16** Example of discounted cashflow (DCF) analysis for tanker charter options ($000)

| Row | | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 |
|---|---|---|---|---|---|---|---|---|---|
| *Big Petroleum* | | | | | | | | | |
| 1 | Ship purchase/sale | (45,000) | | | | | | | 35,000 |
| 2 | Timecharter revenue | | 6,390 | 6,390 | 6,390 | 6,390 | 6,390 | 6,390 | 6,390 |
| 3 | Cashflow | (45,000) | 6,390 | 6,390 | 6,390 | 6,390 | 6,390 | 6,390 | 41,390 |
| 4 | *Discount rate (at 12% pa)* | *1.00* | *0.89* | *0.80* | *0.71* | *0.64* | *0.57* | *0.51* | *0.45* |
| 5 | Discounted cash flow | (45,000) | 5,705 | 5,094 | 4,548 | 4,061 | 3,626 | 3,237 | 18,723 |
| 6 | Net Present Value (npv) | (5.4) | | | | | | | |
| | *memo: Time charter rate $/day* | | *18,000* | *18,000* | *18,000* | *18,000* | *18,000* | *18,000* | *18,000* |
| *Superoil Trading* | | | | | | | | | |
| 1 | Ship purchase/sale | (48,000) | | | | | | | 45,000 |
| 2 | Timecharter revenue | | 4,260 | 4,970 | 5,680 | 6,390 | 7,100 | 7,810 | 8,520 |
| 3 | Cashflow | (48,000) | 4,260 | 4,970 | 5,680 | 6,390 | 7,100 | 7,810 | 53,520 |
| 4 | *Discount rate (12% pa)* | *1.00* | *0.89* | *0.80* | *0.71* | *0.64* | *0.57* | *0.51* | *0.45* |
| 5 | Discounted cash flow | (48,000) | 3,804 | 3,962 | 4,043 | 4,061 | 4,029 | 3,957 | 24,210 |
| 6 | Net Present Value (npv) | 64.7 | | | | | | | |
| | *memo: Time charter rate $/day* | | *12,000* | *14,000* | *16,000* | *18,000* | *20,000* | *22,000* | *24,000* |

was received towards the end of the project and was heavily discounted. In financial terms Superoil's offer is not significantly better than the Big Petroleum deal.

### The internal rate of return

An alternative approach to calculating the return on investment projects is the internal rate of return (IRR). Whereas the NPV method starts from a net cashflow in current terms and calculates the value today, IRR technique works out the discount rate which gives an NPV of zero. The IRR in the two examples works out at 12% for both projects. This is exactly what we would expect since the NPV is close to zero in both cases using a 12% discount rate.

The calculation of the IRR is an iterative process, and rather more time-consuming than the NPV. Fortunately, most computer spreadsheet programs now have IRR functions which provide estimates quickly and easily.

## 6.8 VALUING MERCHANT SHIPS

### Estimating the market value of a ship

Valuing ships is one of the routine tasks undertaken by sale and purchase brokers. A merchant ship is a substantial physical asset and, as we have seen, values can change rapidly, so investors and bankers need to check how much the asset they are buying or financing is really worth. Valuation procedures are well established in the industry and merchant ships are bought and sold as 'commodities', so obtaining valuations does not usually present a particular problem. The banker, owner or investor can call up a broker and receive a valuation certificate within a few hours. However, like any valuation process there are hidden complexities which the prudent banker/investor takes into account.

The valuation establishes how much the ship is worth at a point in time and it has five common uses. The first is to establish the current market value of a vessel being purchased or offered as collateral against a loan. When drawing up a loan agreement, bankers seek an independent 'collateral value' of the ship. Second, loan documentation often includes a clause requiring the borrower to maintain collateral at a prescribed level. If a merchant ship is held as part of the collateral package, it is necessary to update the market value of the vessel to establish whether the collateral conditions are being met. A third use is to establish the market value of the fleet owned by a company making a public offering or issuing a bond, and the values will appear in the related documentation, for example the prospectus. Fourth, companies publishing their accounts may include a current market value of the fleet. Finally, an investor buying a second-hand ship may obtain a valuation as a check against the price, especially if there is not much else on the market.

Shipbrokers are the main source of valuations. For a fee, most shipbroking companies will issue a certificate indicating the market value of a named vessel. The first step in preparing a valuation certificate will be to consult the shipbroking company's reference databases to establish the ship's physical characteristics and recent sales of similar ships, including vessels currently in the market. During this process the valuer will note the following features of the ship:

- *Ship type.* For example, whether the ship is a tanker, bulk carrier, container-ship, chemical tanker, etc.
- *Ship size.* The size will normally be measured in the most appropriate unit – deadweight, TEU, cubic meter, cubic feet. Bigger ships are generally worth more than smaller ships.
- *Age.* The usual 'rule of thumb' is that ships lose about 4–5% of their value each year as they age, which is usually calculated from the year of build, not the anniversary of delivery. This suggests that the economic life of most merchant ships is about 20–25 years, by which time the vessel has depreciated to scrap value. Figure 6.7 shows the relationship between age and value for a sample of Panamax bulk carriers.
- *Yard of build.* The relationship between value and yard/country of build is difficult to establish. For ships built in Japan and Korea the yard of build does not make a great deal of difference. However, there are some countries whose ships sometimes sell at a discount. Brazil, Romania and China are three which come to mind. However, there are no hard and fast rules and this is more a caution rather than a prescription.
- *Specification.* The valuer will be looking for features of the ship which might affect its value because it does not match up to its peer group. Speed, fuel economy, cubic capacity, engine make, cargo-handling gear and tank coatings are areas where

differences may be found. For example, an unusual engine can be a problem, as can poor cubic capacity in a products tanker. This is all relative. Most small bulk carriers have cargo-handling gear so an ungeared Handy bulker may be more difficult to sell. Conversely there is no guarantee that a Panamax bulk carrier with cargo-handling gear will achieve a premium because most Panamaxes are not geared.

Valuers do not usually carry out a physical inspection of the vessel. Even if they have the time and resources to do so, shipbrokers are not usually qualified to carry out technical inspections and their valuation assumes the ship is ‘in good and seaworthy condition’. The responsibility for establishing the physical condition of the ship lies with the purchaser, owner or lender. The exception is that if a special survey is imminent, this may be taken into account if the valuer believes the market would do so.

Valuations are made on a ‘willing buyer, willing seller’ basis. Shipping is a small market and if no ‘willing buyer’ is available, prices may be heavily discounted. Although the ‘last done’ is taken into account, the valuation reflects the broker’s judgement of what the ship would sell for if put on the market at that date. This is important. In a rising market, the broker’s valuation will generally lead the historic statistics. Conversely, in a falling market the broker’s valuation may be lower. If there have been no sales of similar vessels for several months the valuation is entirely judgemental and two brokers may arrive at very different valuations, depending on how they believe the market would price the ship.

Although ship valuation is generally straightforward, problems arise from time to time due to the technical complexities of valuing a ship. One common issue is what to do if the ship has a current time charter. It is unrealistic to ignore the charter, but valuing it goes outside the normal shipbroking expertise. One method is to carry out an NPV calculation (see Section 6.7), based on the charter revenue and projected operating costs, but this raises two difficult questions – how to value the ship at the end of the charter and the creditworthiness of the charterer. Most brokers prefer to value vessels charter-free. Lack of liquidity is another problem. As mentioned above, some ship types are rarely sold, so differences of opinions as to the current market value are difficult to resolve. To deal with this problem bankers often ask for several shipbrokers to value the vessel and average their valuations. Complex ships are particularly difficult to value. For example, a chemical parcel tanker of 30,000 dwt may cost more than twice as much to build as a conventional products tanker of the same size. Because the market for specialized vessels is often thin, with only two or three buyers, brokers find it very difficult to provide valuations. A final issue is whether the valuation should reflect the ‘quality’ of the ship. Brokers are not in a position to judge the condition and quality of the ship. From a market viewpoint, quality ships generally sell more easily but do not necessarily obtain a better price, especially in a weak market. It is a difficult area and valuers usually fall back on the ‘average condition’ clause in the valuation certificate.

## Estimating the scrap value of a ship

Many banks and financial institutions valuing ships adopt a rule that after a certain age the ship is valued at its scrap value rather than its market value, also referred to as its demolition or recycling value. Sometimes the gap between market and scrap value may be very considerable. For example, a 20-year-old Panamax bulk carrier in August 2007 was worth $16 million, whilst its scrap value was only about $5 million. The rationale for valuing ships at scrap is that as the vessels become older the prices become more volatile. For example, a bank which lent an apparently prudent 50% against the $16 million Panamax bulk carrier could find that in less than 18 months the price has fallen to $5 million, which is insufficient to cover the outstanding loan.

Valuing at scrap involves two steps. Firstly the lightweight (lwt) tonnage of the ship must be established. This is the physical weight of the vessel (i.e. the amount of water it displaces). For example, a VLCC might have a lightweight of between 30,000 and 36,000 tons, depending on its method of construction. If the lightweight of the ship is not available it can be estimated by looking up the lightweight of similar ships, though this is not a precise process. Second the current scrap price for the ship must be established. Scrap prices are quoted in dollars per lightweight ton, and many brokers publish values and lists of ships sold for demolition. In practice, scrap prices are almost as volatile as second-hand ship prices. During the last 20 years the scrap price of tankers has swung between $100/lwt and $550/lwt. Finally, the scrap value is calculated by multiplying the lightweight of the ship by the scrap price. For example at a price of $430/lwt the scrap value of a Panamax bulk carrier of 12,300 lwt is $5.3 million.

## Estimating the residual value of a ship

So much for the current value of a ship, but what will it be worth in future, for example at the end of a 10-year lease? Since we cannot answer this question with certainty, we need an approach which gives an acceptable assessment of the likely value. The basic methodology is to use the three determinants of a ship's price: the depreciation rate, the rate of inflation and the market cycle. Take as an example a new bulk carrier costing $28 million in 1996 (see Table 6.17). If we assume that vessel depreciates at 5% per annum on a straight-line basis during the first 10 years of its life, by the end of 10 years its book value will have fallen to $14 million. However, during this time we assume that shipbuilding prices

**Table 6.17** Example of residual value calculation

| | Value $ million |
|---|---|
| Age at which residual value calculated | 10 |
| Initial cost of the ship | 28 |
| Depreciation rate (% per annum) | 5% |
| Book value after 10 years | 14 |
| Inflation rate (% per annum) | 3% |
| Expected residual value | 18.3 |
| Cyclical trough margin, say | 70% |
| Resale price at trough | 5.5 |
| Value at cyclical peak | 70% |
| Resale price at peak | 31.1 |

have increased by 3% per annum, so the replacement cost after 10 years would be \$18.3 million. This is the most likely value. However, we need to take account of the market cycle, which we have seen can affect the resale price by plus or minus 70%, if we take the most extreme price movements in Figure 5.9. A sale at the top of the market could bring a price of \$31 million, which is higher than the initial purchase price of the ship. If, however, the sale occurs at the bottom of a trough and we allow for a price 70% below the trend value, the minimum resale value would fall to US\$5.5 million, which is 20% of the initial cost.

This approach has many pitfalls. Depreciation rates and inflation are difficult enough to predict, but the market cycle is the real challenge. The cyclical value range of \$5.6 million to \$32 million is so wide that a view has to be taken on what cycles might lie ahead. This is pure shipping risk and it is up to the investor to decide what level of risk he is prepared to accept. For example, a cyclical trough margin of 70% has happened, but only in very extreme circumstances such as the mid-1980s depression. The view might be taken that this is unlikely to happen in the period under consideration, so a smaller residual value range would be appropriate. Study of the market cycles discussed in Chapter 3 and the market fundamentals in Chapter 4 can help to narrow the range, but will never entirely remove it. That is the judgement that no amount of statistical analysis will remove. Someone has to take a risk. That, after all, is what the shipping market is all about.

## 6.9 SUMMARY

In this chapter we have reviewed the shipowner's financial performance. We started by observing that shipping companies have a great deal of influence on their future cashflow when they frame their strategy. The choices between new ships and old, flexible ships and specialized, and debt and equity finance all make a difference. Once these major decisions are made an owner can use his management skills to optimize cashflow on a day-to-day basis through efficient ship management and resourceful chartering, but major cost and revenue items are beyond his control. They have already been determined by the initial investment decision. Once these particular decisions have been made, the owner is very much at the mercy of the market and his bankers.

Cash is the difference between costs and revenue. Costs are subdivided into operating costs (which represent the fixed costs of running a ship), voyage costs (which are variable, depending upon the way in which the ship is employed) and capital costs. Crew costs account for almost half of operating costs and the shipowner can reduce these by purchasing a highly automated ship, which reduces the number of crew required, or operating under a flag that allows the use of a low-cost crew. Voyage costs are dominated by bunker prices which can be controlled or reduced by investing in modern tonnage with the latest fuel-efficient machinery or by reducing the design speed. Both operating and voyage costs are likely to be substantially higher for an old ship than a new ship, while economies of scale lead to lower unit costs for bigger ships.

On the revenue side the owner can play the spot market, in which he accepts full market risk, or time charter, which shifts that risk to the charterer. Earnings also depend on the 'productivity' of the ship, that is, the number of tons of cargo it can carry in a year. Again we find that the initial investment decision has a part to play in determining productivity by investment for rapid cargo handling, greater cargo flexibility to enable the ship to pick up backhauls, and high speed (we will discuss this in Chapter 12, which deals with specialized shipping). Drawing these factors together with the influences on cost, we can deduce that in terms of the trading cashflow there are many options. Age, size, technical flexibility and cargo management all play a part in generating more revenue and cutting costs.

When we turn to the capital account, the picture changes substantially. The large modern ship financed by debt carries an annual cashflow for interest and debt repayment far in excess of its operating costs, whereas the small old vessel financed on equity would have no cashflow obligations on the capital account. As a result, during a depression the owner of a small, old vessel can afford to withdraw from the market and leave his vessel in lay-up until conditions improve, whereas the owner of the large, modern, debt-financed vessel faces a fixed capital charge that must be paid even if the ship is laid up.

We also discussed how the industry reports costs and revenues, covering the income statement (profit and loss account), the balance sheet and the cashflow statement. In addition, we reviewed cashflow forecasting techniques, including voyage cashflow analysis which addresses voyage decisions; annual cashflow analysis for longer-term planning; and discounted cashflow analysis for comparing projects when the timing of payments is an issue. Finally, we looked at methods for valuing ships and estimating their residual value.

The topics in this chapter may be dry, but they go to the heart of the business. In the last resort it is for the shipowner to blend the operating, commercial and financial aspects of the business into the business strategy that suits him best. The trade-off between cost minimization, revenue maximization and the approach to ship finance gives each shipping venture its own particular characteristics.