INTRODUCTION TO SHIP INVESTMENT ANALYSIS AND SHIP FINANCING

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WHY SHOULD ANYONE WANT TO BUY A SHIP?

Ships can either be ordered for building or they can be bought in the second hand market. When vessels can no longer trade they will eventually be scrapped. There is also a market for newbuilding contracts to be sold on to a new owner before the vessel is delivered from the yard. We therefore make the following distinction:

- **Newbuildings**
- **Re-sale of newbuildings**
- **Second hand vessels sold for further trading**
- **Second hand vessels sold for scrap.**

The life time of a ship depends on the type of ship, the yard where it was built and the trade where it has been employed. As a rough rule of thumb 20 years is a typical lifetime for dry bulk carriers and tankers. Reefer vessels and other specialised ships may reach 30 years and cruise and passenger ships may reach 40-50 years before they have to be scrapped.

In practise there are two types of potential buyers for a ship:

- The shipowners
- The cargo owners or shippers

A ship owner can have various motives for his investments: He can either buy in order to operate the vessels, or he can buy because he believes the value of the vessel is going up (asset speculation).

Most shipping companies own vessels in order to operate them and make money trading the ships and providing a transportation service. Such transportation service can range from a local ferry service to an international tramping of bulk carriers. But the focus is on providing transportation, selling such transportation service with a profit.

In cases where a company invests in a production facility, such as a factory, the value of the factory will gradually decrease over time. In the markets for ships this is not always the case because the business is cyclical, it may well be that the value of a ship increases after 2 to 3 years and therefore the ship owner sees an opportunity to make money by selling the ship for a profit. Shipowners focusing on such value fluctuations are called asset-traders.
WHY SHOULD ANYONE WANT TO BUY A SHIP?
Choosing the right vessel for investment is therefore of importance, and the questions open to investors are several: What is the best purchase: Newbuilding or second hand? What type of vessel has the best future?
Dry bulk carrier or tanker? It is in order to answer such questions that we need to carry out *Investment analysis.*

**The sales and purchase market**

Vessels are ordered, re-sold and scrapped continuously. Most of the transactions are done by the involvement of sale & purchase brokers. In some cases there is only one broker involved between the seller and the buyers, in other cases two or in more rare cases more than two brokers.

The S&P brokers are continuously circulating on fax and telex vessels that are for sale or may be “developed” for sale. On the basis of this information prospective buyers have to do their investment analysis and weighing the pros and cons for buying that particular vessel.

For standard type of vessels such as panmax bulkcarrier or suezmax tankers, the major broker houses such as Clarkson and Fearnleys every month publish figures for approximate values, so that prospective buyers can have an idea about the ball park area of what prices are to be expected.

There are principally three categories of sales transactions:

1) **Newbuildings or orders**

2) **Second hand sales**

3) **Sales for scrap**

1. **New buildings and Contracts**

New buildings are vessels ordered directly from the shipyard. Shipyards are competing on price, quality but also on the type of financing they can offer buyers. For many years a very tough competition between the yards worldwide has lead to attractive prices for the investors and quite often an eighty percent credit can be achieved.

Some owners prefer to work directly with shipyards that they may have done business with for many years. Chevron for example has a long record of ordering their tankers at Mitsubishi in Japan, Ugland of Norway has for many years been a good customer of Japanese yard Tsuneishi etc.

Smaller owners who may not have experience with a particular yard, may prefer to place newbuilding order through the intervention of a broker. In such case the broker may charge up to one percentage of the contracting price as commission.
When orders are placed, it may take 6 - 24 months for delivery of the vessel. The larger the vessel, the longer the lead time.

During October 1996 the following representative transactions were recorded:

Thenamaris ordered 2 x 150,000 dwt tankers at Korean shipyard Samsung for delivery in 1999 at a price of each 53 mill USD.

Korea Line ordered one 73,000 dwt bulk carrier at Korean yard Daedong for delivery in 1998 at USD 27 mill

The Singapore based Andhika Line ordered 3 x 45,000 dwt bulk carriers at Japanese yard Tsuneishi for delivery 1999 at a price of each USD 27 mill

(During the month of Oct 1996 Fearnleys recorded a total of 30 orders placed for newbuildings)

2. Second hand sales

Several owners prefer to buy vessels second hand rather than place orders for newbuildings. Traditionally the Scandinavian owners have always favoured newbuildings whereas the Greeks have favoured second hand ships. In Piraeus a famous saying is that “God gave the Saudis oil, but he gave the Greks the Norwegians”. This implies that greek owners through the years have bought many well kept modern ships from Norwegians and traded them for many years.

Vessels offered for sale are typically traded through a broker who send them to other brokers and so on. Typically a broker receives one percent commission on the sales price, and this is normally paid by the seller. Thus if a shipowner sells a vessel for 10 mill USD, he may have to knock of 2 % point or 0.2 mill USD to cover the brokers, thus receiving net 9.8 mill USD. Therefore when an owner is selling he is always looking for the NET PRICE after commissions, whereas the buyer will have to pay the full price.

Also during October 1996 the following sales were recorded:

The Capesize bulk carrier m/v KINOKAWA 179,618 dwt built in 1982 was sold to London based Zodiac for 11.5 mill USD

The handy size bulk carrier SANKO GRACE, 40,623 dwt built 1985 was sold to Turkey based Aslan for 12.7 mill USD

The turbine tanker TT AMAZON GLORY of 256,000 dwt built 1974 was sold to Norwegian based Nosvold Shipping for USD 11.75 mill.
3. Vessels sold for demolition

Vessels that are too old to continue trading or are too expensive to maintain will be sold for scrap. The price obtained for scrap is dependant on the amount of steel in the vessel. The more steel the higher the price. An important parameter for vessels sold for scrapping is therefore what is called the **Lightweight** measured in metric tons (ltd). The lightweight is the weight of the steel in the vessel.

There are a handful brokers who have specialised in scrap sales. Vessels are typically scrapped in Bangladesh or India. More rarely that are scrapped in Taiwan, or China and very seldom in Spain or Portugal.

When an owner sells a ship for scrap, he must take into account that to position the vessel for the scrap yard (or rather the scrap beach) can cost money. If the vessel has discharged in North Europe, the owner may have to tow or send the vessel out to a position near to India or Bangladesh.

During October 1996 there were about 14 vessels sold for scrapping, some of the representative sales were:

The Ore-Oiler PROSPERITY NO 1 of 127,209 dwt built 1973 was sold to Bangladesh breakers at a price of USD 162/ltd. The lightweight of this vessel was 24,033, thus the owners received 3.9 mill USD for this ship

The handy size tanker m/t SATUCKET of 30,397 dwt built 1971 was sold on the basis of 186 USD/lwd. With a lightweight of 8,242 tons, the owners received 1.5 mill USD for this vessel

m/v “Iloilo Victory” a bulk carrier of 38,323 dwt built in Japan 1980 was sold to greek buyers for USD 5.5 mill

**Exercise: Investment criteria newbuilding**

Consider the Suezmax newbuilding ordered by Thenamaris at a price of USD 53 mill for delivery in 1999. What do you think is the basis for someone ordering this ship? Which factors do we need to know in order to say whether this is a good or bad investment? How much should this vessel earn during the next 10 years, if this should be a good investment?

**Exercise: Investment criteria second hand vessels**

Take the The Capesize bulk carrier m/v KINOKAWA 179,618 dwt built in 1982 that was sold to Zodiac for 11.5 mill USD. What expected lifetime can this vessel have? What is the scrap value of this ship if the lightweight is about 35,000 tons? Is this investment riskier that a newbuilding Suezmax tanker?
WHAT IS INVESTMENT APPRAISAL?

The key issues

Investment appraisal or analysis is concerned with shipping investors' decisions about whether, when and how to spend money on buying ships; or also when to sell ships.

Buying ships represent major cash outlays and thus require a careful analysis to make sure the investor can cover expected cash outlays and also make a satisfactory return on his investment.

Should we invest in this vessel?

Suppose for instance that an investor is considering to order a newbuilding VLCC for USD 77 mill which is the prevailing prices as of November 1996. What the investor has to consider is how profitable this investment will be compared to other shipping investments or to the less risky decision of retaining his equity in the bank earning interests.

The essence of any investment appraisals is to measure the worthwhileness of proposals to spend money, by comparing the benefits with the costs. Financial institutions and individuals provide money for shipping investments in the expectation of a reasonable rate of return.

Decisions based on intuition or financial models

Some people are able to measure the worthwhileness of shipping investments by sheer intuition and gut feel. These decisions makers reflect long term experience in the shipping markets and intuitively comparing a range of various market factors such as changes in...
demand/supply and probably more important the "psychology of the market."

There are however, very few companies that have such expertise available. In Norway, John Fredriksen is probably one of the more astute examples of successful investors who have a "nose for shipping".

For other investors, it is most often necessary to build simple or more complex financial models to analyse shipping projects. This presentation, will also rely on such a financial model, and examples and cases will refer to this model which has been continuously under development by this author since 1973 and is currently used by more than 100 shipping firms and banks world-wide in their appraisal of projects.

The availability of spreadsheet models have also meant that analysts and investors can tailor-make their models according to need. Yet a number of principles have to been considered, and this is the purpose of this presentation.
In most shipping companies there are more proposals for new projects than the company is able or willing to invest in. Some proposals are good, others are poor, and methods must be developed to distinguish between the good and the poor.

The objective is to rank the proposals and determine how far down the ranked list to go.

Essential for any analysis of investment is to budget future expenses and incomes. Because shipping projects often have a time frame of 10 - 20 years, such estimating is necessarily associated with a great deal of risk.

The two aims of this presentation are to identify the various items to include in cash flows and to examine the available techniques which will tell us whether the investment is worthwhile or not.
An Investment will generate cash flows

The instinctive nature of any investment decision is the spending of money now in the expectation of getting more money back in the future. No investment is worthwhile that does not recover the original sum invested and provide a reasonable return on the reducing capital outstanding each year.

Before we can analyse any investment, we must estimate or forecast future events. These future events will be either cash inflows or cash outflows.

Vessels can be employed on voyage charter or time charter

Before we can calculate cash flow from a vessel's operation, we should realise that a vessel can be employed on different terms that pay the owner in different ways:

We have the following four employment alternatives:

- Liner service or Liner terms
  - Voyage Charter
  - Time Charter
  - Bareboat Charter

Out of these, the two most important types of employment are: Voyage charter and Time charter:

Voyage Charter:

Owner of vessel ships a cargo from A to B
receives a freight per ton of cargo

Payment: e.g. $10 per ton of cargo

Time charter:

The owner of a vessel, charters (rents) out the
vessel to e.g. an oil company for a given
period of time. The owner provides and pays
for the crew and maintenance of the ship.
The charterer decides what cargoes to carry,
which ports to call and therefore pays for
bunkers and port costs.

Payment: e.g. $12,500 per day
Cash flow from a ship’s operation

It is important to notice that we distinguish between two groups of cost:

• **Operating Costs (also referred to as Running Costs)**

• **Voyage Cost**

Operating Costs are in most cases constant over a period of a year, and operating costs are independent of where the ship is trading. Major items are: Crew costs, Insurance premiums (P&I and Hull and Machinery Insurance), Maintenance and Repairs (M&R), Dry-docking costs and Administration costs.

Voyage Costs are costs which depend on where the vessels is sailing: Such costs are typically bunkers costs, port costs and canal costs.

After deducting Voyage costs from the gross freight we get a result that we refer to as *Result on timecharter basis* or also called *Time charter equivalent*.

When we deduct operating costs from Result on time charter basis we get what we call *Operating Result, Operating Cash flow or Cash flow from Operations*.
Cash flow from a voyage charter

Example: A Panmax bulk carrier starting in Rotterdam, ballasts to New Orleans to load a cargo of 50,000 mt of grain to be discharged in Rotterdam. Freight rate is 15 $/mt. The round-trip takes 40 days. Costs for bunkers is $ 80,000. Total PORTCHARGES is $ 150,000. Total operating costs amount to $4,000 pr day.

Ex: Panmax bulkcarrier
On a 40 days grain voyage USG/ROTT

As we can see, Result on Timecharter basis amounted to $520,000, Operating costs to $160,000 and the Cash flow from operations $360,000. This cash flow was earned during one voyage which in this example was said to last 40 days.

Assuming that the vessel is active for 360 days a year (Assume 5 days so-called off-hire where the vessel is out of operation, dry-docking or otherwise not able to operate), the vessel could make a total of nine such voyages during a full year.

If the vessel continued on the same type of employment and freight rates and cost items were unchanged, on an annual basis the vessel would earn: $ 3,240,000.

(If we should have been precise, we would have said that operating costs apply for the full 365 days and not only for 360 days, but we will discuss this at a later stage)
An investment will generate cash flows

**Ex: Panmax bulkcarrier**

*On a 40 days grain voyage USG/ROTT*

\[
\text{Annual Cashflow} = \frac{360 \text{ days p.a.}}{40 \text{ days trip}} \times 9 \text{ trips p.a.} \times \$360,000
\]

\[
\text{Result on tc basis} = \$520,000 - \text{Operating costs} - \$160,000
\]

Exhibit 3: Annual Cashflow from trading on 40 days trips USG/Rott

**Cash flow from a Time Charter**

In another case, where the vessel is on timecharter, the calculations may look as follows:

In this case our annual cash flow from operations would amount to $2,520,000.

**Cash flow from Operations is what we have available to pay for all Capital Costs.**

Cash flow from Operations is what we have available to pay for any capital costs. Capital costs are costs associated with raising money for the investment. If we bought the ship with 100% our Capital Costs would be the return we expect on our investment. If we have borrowed money, our capital costs will also include interests on the loan and instalments.

**Cost items under various employment terms**

In order to complete the picture, the following exhibit lists what items are paid by whom under the four different employment terms:
An investment will generate cash flows

### Distribution of Costs Between Owner and Charterer Under Various Charter Forms

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>Bareboat</th>
<th>Time Charter</th>
<th>Voyage Charter</th>
<th>Liner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interests</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Installments</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Return on Equity</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Admin costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Repairs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td><strong>Voyage Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port charges</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Canal costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Bunkers cost</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td><strong>Cargo Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loading costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Discharging costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
<tr>
<td>Stevedoring costs</td>
<td>Owner</td>
<td>Charterer</td>
<td>Owner</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- Distribution of costs between owner and charterer under various charter forms.
Time value of money

**A million $ today or a million $ in a year**

Assume that one day, you received a letter from the US government saying that you were one of a few individuals who had won a great lottery ticket in the US government’s world competition for the "Lucky shipping executive of the year". In the letter it offered you a choice:

Would you be in doubt as to what option to choose? Probably not. You would prefer to receive the one mill USD today. Most would say that $1m today is worth more than $1m tomorrow. Why? Either you can invest the money in shares, buy a new house, buy a ship - or you could of course put the money in the bank and earn interest.

**Future Value of money**

Let us assume you put the money immediately in a bank account and the bank offered you 10 % interest p.a.. At the end of the first year your interests are 10 % of $1m or $100,000. This amount will be added to
your bank account, thus at the end of the first year your balance is $1.1 m.. So if you chose one mill USD today, this will have grown to $1.1 after a year, clearly a much better decision that to wait one year and receive just one mill USD. In other words the Future Value of $1m is $1.1m

\[ FV = PV \times (1 + r)^n \]

Let us assume that the letter you received gave you two other options:

Remember that the offer is from the US government and that there is no risk that you will not get your money, even after one year. Now, what would your response be?

The important issue is that when comparing the two alternatives, you must measure the value of the money at the same point in time. We have two possibilities: We can either refer all evaluations to today or one year from today.

**Compare alternatives by looking at Future Value**

We already know that $1m today is worth $1.1m one year from today. This is the Future value of Alternative 1.

The Future Value of alternative 2 is already given: $1.2 m. By comparing the two, we find that the highest Future Value is obtained by choosing Alternative 2: Accept the offer of $1.2 mill in one year's time.

**Compare alternatives by calculating Present Value**

We could also do the comparison by evaluating the alternatives expressed in Today’s money or Present Value.
The issue that you are faced with is: "I know what $1m today is worth, but what is the equivalent Present Value of $1.2m received one year from today?"

To find the answer to this question, assume you had X mill USD today, you put this amount into the bank, earned interest, and after one year it had grown to $1.2m.

You already know that you can deposit the money at 10% interest rate, thus if you start out with X mill USD, and you add 10% or 0.1*X, then after one year you would have 1.1 * X. This amount should now be equal to $1.2m:

1.1 * X = $1.2m,

If you solve for X, you get:

X = 1.2/1.1 = $1.09m (rounded off to two decimals)

In other words, if you have $1.09m today, put it into the bank at 10% interest rate, after one year it will be worth $1.2m. So we can conclude that:

The Present Value of $1.2 m is $1.09m.

And we can compare the two options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Present Value = Value today</th>
<th>Future Value After one year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1</td>
<td>$1.0m</td>
<td>$1.1m</td>
</tr>
<tr>
<td>Alt. 2</td>
<td>$1.09m</td>
<td>$1.2m</td>
</tr>
</tbody>
</table>

Ranking of the alternatives will be the same whether we use Present Value or Future Values, but the important thing is to bring all payments either forward to the same point in time or back to Today.
Compounded Interest

The compound interest merely implies that interest paid on an investment is added to the principal; as a result, interest is earned on interest.

We saw that our deposit of $1m increased to $1.1 after one year. If we keep the money for another year we earn 10% interest on $1.1m and at the end of the second year we have a total of $1.21m. If we continue keeping the deposit, we get the following values:

**THE COST OF CAPITAL**

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount at beginning of the year</th>
<th>10% interest</th>
<th>Amount at end of year = FUTURE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1.0</td>
<td>$0.1</td>
<td>$1.1</td>
</tr>
<tr>
<td>2</td>
<td>$1.1</td>
<td>$0.11</td>
<td>$1.21</td>
</tr>
<tr>
<td>3</td>
<td>$1.21</td>
<td>$0.121</td>
<td>$1.332</td>
</tr>
<tr>
<td>4</td>
<td>$1.332</td>
<td>$0.1332</td>
<td>$1.4641</td>
</tr>
</tbody>
</table>

The cost of capital should be considered the company's opportunity cost of making a particular investment. That is, if the company does not make a particular investment it "saves" the cost of the investment, and it can invest these funds in other projects. In many cases it would be normal to estimate the cost of capital as the interest rate one can achieve by depositing the money in a bank. I.e. if the current rate of interest the firm can get by putting the funds in a bank is 12% p.a., the opportunity cost of any shipping project is also 12%.

**Future Value formula**

The formula that calculates the Future Value (FV) as a function of the Present Value (PV), at the end of any year $T$ is found as:

$$ FV = PV \times \left(1 + \frac{p}{100}\right)^T $$

where

- FV Future Value
- PV Present Value
In the following graph we have shown Future Values of $1$ million for varying interest rates. We see that if the interest was zero, the Future Value would at any time be equal to the Present Value or put in other words, the value of the money is not dependant on time. As the interest rate increase, the higher is the Future Value. The shape of the curves shown in the graph are called exponential growth curves.

Exercise: Which amount is worth more at 7 percent: $1$ million today or $2$ million after 10 years?

Exercise: At a growth rate of 8 percent, how many years does it take a sum to double?

Exercise: If you deposit $2$ million in the bank today and the interest is 5% p.a., how much is the balance after 4 years?

Exercise: In November 1993, TT ESSO FREEPORT, 256,712 dwt built 1974 was sold to Mosvold for $10.4$ million USD. Assuming that the vessel is laid up for three years, and no costs occur, what expected price should you get after three years in order to get 12% rate of return.
The Present Value formula - Discounting

Finding Present Values (or discounting, as it is commonly called), is simply the reverse of compounding, and the formula we had for FV, can easily be transformed into a present value formula:

\[
PV = \frac{FV}{(1 + \frac{p}{100})^T}
\]

where

- PV: Present Value
- FV: Future Value
- p: Interest rate p.a.
- T: Number of years

The exhibit below shows how Present Value (or Discount factor) decrease as the discounting period increases. The graph also shows that if a high discount rate apply, funds due in the future are worth very little today.

Exercise: What is the Present Value of $5 mill received in 3 years at an interest rate of 15 %?
Exercise: Which gives a higher PV, $2 mill received 3 years from now or $2.5 mill received 4 years from today? Use an interest rate of 12% p.a.

One mill $ today or two mill $ in three years

Let us again consider that the letter offered us two choices as follows:

1. Receive $1m today
2. Receive $1.5m three years from today

We can now either calculate the Future Value of $1m or we can calculate the Present Value of $1.5m

Calculating the Future Value of $1m

We know that if we placed the money in the bank at 10% interest rate, it would have grown to $1.1m after one year. If we left this amount for a second year, assume we again earned 10% interest, and the amount would have grown to $1.21m, now if we left this amount for a third year at 10% interest rate, the balance at the end of the third year would be $1.331m.

We cut put this into the following table:

<table>
<thead>
<tr>
<th>FV</th>
<th>PV p</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ FV = PV \times \left(1 + \frac{P}{100}\right)^T = 1.0 \times \left(1 + \frac{10}{100}\right)^3 = 1.331 \]

Calculating the Present Value of $1.5m

Thus if we want to calculate the PV of $1.5m received after three years, we can put the figures into the formula as follows:

\[ PV = \frac{1.5}{\left(1 + \frac{10}{100}\right)^3} = \frac{1.5}{1.1^3} = \frac{1.5}{1.331} = 1.1270 \]

We can now see that whether we use the Present Values or Future Values for ranking of our preference, we find that alternative 2 is a better choice.
<table>
<thead>
<tr>
<th>Option</th>
<th>Present Value = Value today</th>
<th>Future Value After three years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt. 1</td>
<td>$1.0m</td>
<td>$1.331m</td>
</tr>
<tr>
<td>Alt. 2</td>
<td>$1.1270m</td>
<td>$1.5m</td>
</tr>
</tbody>
</table>
Analysing shipping investment projects is a complex process where in practice a number of these analytical methods will be focused on. We will state already here that there is no simple way to analysing projects, there is no such thing as THE ONE AND ONLY METHOD to look at projects. In most cases all or several of the factors outlined above have to be taken into consideration, and it is the total trade-off between these factors which will tell the investor to go ahead or not.

1. **PRICE/CASH FLOW RATIO**

The Price/Cash Flow ratio (P/CF) is the ratio between the cost of the vessel and the first year's annual cash flow.

2. **PAYBACK PERIOD:**

Number of years required to return the original investment. In principle the same as Price/cashflow assuming even annual cashflows

3. **RATE OF RETURN**

The rate of return is the annual profit as a percentage of the vessel price. An average profit is calculated by taking the total profits earned on the investment over the whole of its life and dividing by the expected life of the project in years.

4. **CAPITAL RECOVERY FACTOR**

Capital Recovery Factor is the inverse of the Price/Cashflow ration. I.e. if a project gives a PRICE/CASHFLOW of 10, the Capital Recovery Factor is 1/100 or 10%.

5. **NET PRESENT VALUE (NPV)**

Present Value of future returns discounted at the appropriate cost of capital, minus the cost of investment.

6. **INTERNAL RATE OF RETURN (IRR)**

The IRR is the interest rate which equates the present value of future returns to the investment outlay.
SUPPORTING ANALYSIS

7. BREAK EVEN RATES

Break even rates are the daily rates required to cover cash expenditures such as running costs, interests on debt and instalments on loans.

8. NECESSARY RATES

Necessary rates are the rates required to yield a specific return on either total capital or equity.

9. ACCUMULATED CASH FLOW

Accumulated cash flow in the project will tell the investor how much capital is tied up in the vessel.

10. REQUIRED RESIDUAL VALUES (required sales price)

Required residual values will tell the investor how much he has to sell the vessel for after certain time periods (given an assumed income in the period he keeps the vessel) in order to yield a specific return on his investment.

Future returns, are in all cases defined as the net profits after taxes, plus depreciation, that result from an investment. In other words, returns are synonymous with cash flow from investments.

We will discuss three main criteria for analysing an investment proposal:

- PRICE/CASH FLOW (or PAYBACK PERIOD)
- NET PRESENT VALUE
- INTERNAL RATE OF RETURN

PRICE/CASH FLOW = PAYBACK PERIOD

The payback period is the number of years it takes the company to recover its original investment from net cash flows.

Example:

In June 1993, the reported second hand price of a one year old suezmax tanker the *m/t Front Rhapsody* was reported at $39m. This
vessel at that time could probably be fixed for a 12 months timecharter at 20,000 $/day. Costs of running and operating the ships would probably amount to 7,000 $/day. Thus operating cash flow would be:

<table>
<thead>
<tr>
<th></th>
<th>$/DAY</th>
<th>DAYS P.A.</th>
<th>$ MILL P.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T/C RATE</td>
<td>20000</td>
<td>350</td>
<td>7.00</td>
</tr>
<tr>
<td>OPERATING EXPENSES</td>
<td>7000</td>
<td>365</td>
<td>2.56</td>
</tr>
<tr>
<td>OPERATING CASH FLOW</td>
<td>13000</td>
<td></td>
<td>4.44</td>
</tr>
</tbody>
</table>

**PAYBACK PERIOD**

**CONSTANT ANNUAL CASH FLOW**

The payback period is the number of years it takes to pay back the total investment.

If we could assume that the annual cash flow would be the same for year 2, 3 etc. then:

<table>
<thead>
<tr>
<th>Year</th>
<th>Oper. Cash flow p.a. $ mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.44</td>
</tr>
<tr>
<td>2</td>
<td>4.44</td>
</tr>
<tr>
<td>3</td>
<td>4.44</td>
</tr>
<tr>
<td>4</td>
<td>4.44</td>
</tr>
</tbody>
</table>

The number of years it takes to repay this investment would be:

PAYBACK PERIOD = INITIAL INVESTMENT/ANNUAL CASH FLOW

PAYBACK PERIOD = 8.78 YEARS

If the payback period calculated is less than some maximum acceptable payback period, the proposal is accepted.

Exercise: As of November 1993, we could list various second-hand vessels as follows:
### Vessel type

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>Year of build</th>
<th>Second hand value (MILL USD)</th>
<th>12 months timecharter rate (USD/DAY)</th>
<th>Operating Costs (USD/DAY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suezmax tanker</td>
<td>1975</td>
<td>10</td>
<td>15,000</td>
<td>8,000</td>
</tr>
<tr>
<td>135,000 dwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suezmax tanker</td>
<td>1990</td>
<td>40</td>
<td>18,000</td>
<td>6,000</td>
</tr>
<tr>
<td>140,000 dwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aframax tanker</td>
<td>1980</td>
<td>16</td>
<td>14,000</td>
<td>7,000</td>
</tr>
<tr>
<td>80,000 dwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panmax bulker</td>
<td>1977</td>
<td>9</td>
<td>11,000</td>
<td>4,500</td>
</tr>
<tr>
<td>65,000 dwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panmax bulker</td>
<td>1989</td>
<td>22</td>
<td>11,500</td>
<td>3,500</td>
</tr>
<tr>
<td>70,000 dwt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handy size bulker</td>
<td>1984</td>
<td>16</td>
<td>9,500</td>
<td>3,000</td>
</tr>
</tbody>
</table>

Calculate the PAYBACK period of these vessels. How can you best compare payback periods for vessels of different age? Make a ranking of the projects that you think look best.

**VARYING ANNUAL CASH FLOW**

If cashflow for each year varies, the payback period is the number of year when the sum of cashflow reaches the total investment.

**LIMITATIONS**

The method is easy to calculate, and is alright for a very rough ranking of various projects, but it could also lead to wrong decisions. As our example shows it ignores income beyond the payback period such as residual value.

And the payback methods has some limitations. To illustrate, consider two investment alternatives in vessels m/v ANNA and m/v BETTY, each costing $3 mill and each having the following projected cash flow:
Both projects have a two-year payback period, hence both would appear equally desirable. However, we know that a dollar today is worth more than a dollar next year, so investment X with its faster cash flow, is certainly more desirable.

The use of the payback method is sometimes defended on the grounds that returns beyond three or four years are fraught with such great uncertainty that it is best to disregard them altogether in a planning decision.

Another defence of the payback method is that a company which is short of cash must necessarily give great emphasis to a quick return of its funds.

Many companies use payback in combination with one of the discounted cash flow procedures described below. The NPV or IRR method is used to appraise a project's profitability, while the payback is used to show how long the initial investment will be at risk, that is, payback is used as a risk indicator.
**NET PRESENT VALUE METHOD**

The discounted cash flow (CF) techniques takes into account the time value of money. One such discounted cash flow technique is called "the net present value method", or sometimes simply "the present value method".

To implement this approach:

1) Find the present value of the expected net cash flows of an investment, discounted at the cost of capital

2) Subtract from the initial cost outlay of the investment.

If we have an investment with three cash flows, the Present Value of these would be:

$$PV = \frac{R_1}{(1 + \frac{p}{100})} + \frac{R_2}{(1 + \frac{p}{100})^2} + \frac{R_3}{(1 + \frac{p}{100})^3}$$

By deducting the initial investment, we get the Net Present Value:

$$NPV = \frac{R_1}{(1 + \frac{p}{100})} + \frac{R_2}{(1 + \frac{p}{100})^2} + \frac{R_3}{(1 + \frac{p}{100})^3} - I_0$$

where:

- \(R_1\): Cashflow for year 1
- \(R_2\): Cashflow for year 2
- \(R_3\): Cashflow for year 3
- \(p\): Interest Rate
- \(PV\): Present Value
- \(I_0\): Initial Investment

If the net present value is positive, the project should be accepted, if negative, it should be rejected. If two investments are mutually exclusive, the one with the higher net present value should be chosen.
**Case: M/V Anna**

**Step 1: Investment of $3 mill today**

<table>
<thead>
<tr>
<th>Today</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mill</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Step 2: Cashflow of $2m after 1 year**

- $1 m after 2 years
- $1 m after 3 years

<table>
<thead>
<tr>
<th>Today</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 mill</td>
<td>1 mill</td>
<td>1 mill</td>
<td></td>
</tr>
</tbody>
</table>

**Step 3: Net Profit**

<table>
<thead>
<tr>
<th>NET PROFIT</th>
<th>Today</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.0</td>
<td>3 mill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Step 4:** Calculate PV of the first cashflow

**Case: M/v Anna**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cashflow</th>
<th>PV Factor</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2 million</td>
<td></td>
<td>+1.82</td>
</tr>
<tr>
<td>1</td>
<td>1 million</td>
<td>1.10</td>
<td>+1 million</td>
</tr>
<tr>
<td>2</td>
<td>1 million</td>
<td>1.10^2</td>
<td>+0.83</td>
</tr>
<tr>
<td>3</td>
<td>1 million</td>
<td>1.10^3</td>
<td>+0.75</td>
</tr>
</tbody>
</table>

Sum of the 3 Present Values is $3.40m

**Step 5:**

**Case: M/v Anna**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cashflow</th>
<th>PV Factor</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2 million</td>
<td></td>
<td>+1.82</td>
</tr>
<tr>
<td>1</td>
<td>1 million</td>
<td>1.10</td>
<td>+1 million</td>
</tr>
<tr>
<td>2</td>
<td>1 million</td>
<td>1.10^2</td>
<td>+0.83</td>
</tr>
<tr>
<td>3</td>
<td>1 million</td>
<td>1.10^3</td>
<td>+0.75</td>
</tr>
</tbody>
</table>

**Step 6:**

**Case: M/v Anna**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cashflow</th>
<th>PV Factor</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-3 million</td>
<td></td>
<td>-3 million</td>
</tr>
<tr>
<td>1</td>
<td>1 million</td>
<td>1.10</td>
<td>+1.82</td>
</tr>
<tr>
<td>2</td>
<td>1 million</td>
<td>1.10^2</td>
<td>+0.83</td>
</tr>
<tr>
<td>3</td>
<td>1 million</td>
<td>1.10^3</td>
<td>+0.75</td>
</tr>
</tbody>
</table>

**NET PRESENT VALUE (MILL USD)**

Net Present Value = $3.00 + $1.82 + $0.83 + $0.75 + $0.40 = $4.80
Case: M/V Betty

If we now calculate the NPV for m/v Betty, we see that:

<table>
<thead>
<tr>
<th>PRESENT VALUE</th>
<th>TODAY</th>
<th>1 YEAR</th>
<th>2 YEARS</th>
<th>3 YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 3.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 1.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 0.31</td>
<td>3 mill</td>
<td>1.10</td>
<td>1.10²</td>
<td>1.10³</td>
</tr>
</tbody>
</table>

NET PRESENT VALUE (MILL USD)

Conclusion: Choose m/v Anna

If we now compare m/v Anna with m/v Betty, we will see that m/v Anna has a higher NPV and would therefore be preferred to m/v Betty.

<table>
<thead>
<tr>
<th>Vessel:</th>
<th>Net Present Value (NPV)</th>
<th>Decision:</th>
</tr>
</thead>
<tbody>
<tr>
<td>m/v Anna</td>
<td>$ 0.40m</td>
<td>Invest</td>
</tr>
<tr>
<td>m/v Betty</td>
<td>$ 0.31m</td>
<td>Do not buy</td>
</tr>
</tbody>
</table>
The NPV Formula

The equation for the net present value (NPV) is:

$$NPV = \frac{R_1}{\left(1 + \frac{p}{100}\right)^1} + \frac{R_2}{\left(1 + \frac{p}{100}\right)^2} + \frac{R_3}{\left(1 + \frac{p}{100}\right)^3} + \ldots + \frac{R_T}{\left(1 + \frac{p}{100}\right)^T} - I_0$$

where:

- $R_i$: Cashflow for year $i$
- $p$: Interest Rate = Cost of Capital
- PV: Present Value
- $I_0$: Initial Investment
- $T$: Project lifetime (years)

Net Present Value as a function of the discount rate

The NPV of a project will decrease with increasing discount rate. To take the example of m/v Anna, let us calculate NPV for various interest rates:

<table>
<thead>
<tr>
<th>Discount rate (%)</th>
<th>m/v Anna NPV (MILL $)</th>
<th>m/v Betty NPV (mill $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>5</td>
<td>0.68</td>
<td>0.63</td>
</tr>
<tr>
<td>10</td>
<td>0.40</td>
<td>0.31</td>
</tr>
<tr>
<td>15</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>20</td>
<td>-0.06</td>
<td>-0.20</td>
</tr>
<tr>
<td>25</td>
<td>-0.25</td>
<td>-0.41</td>
</tr>
<tr>
<td>30</td>
<td>-0.41</td>
<td>-0.59</td>
</tr>
</tbody>
</table>

If we put this into a graph:
Exercise: In Nov. 1993 TT ESSO FREEPORT, 256,712 dwt, built 1974 was sold for 10.4 mill USD. Assuming that the ship can earn on tc basis 20,000 USD/day the first year and 25,000 USD/day the second year. Running costs first year is 10,000 USD/day and second year 13,000 USD/day. If you want to sell the ship after these two years, how much do you need as a Residual Value in order to give 12 % return on the money. Assume vessel is bought with 100 % equity - i.e. no loans.

Onhire days 350 days p.a. for each year.
The internal rate of return (IRR) is defined as the interest rate that equates the present value of the expected future cash flows, or receipts, to the initial cost outlay.

The equation for calculating the internal rate of return is

\[
NPV = 0 = \frac{R_1}{1 + \frac{p}{100}} + \frac{R_2}{(1 + \frac{p}{100})^2} + \frac{R_3}{(1 + \frac{p}{100})^3} + \ldots + \frac{R_T}{(1 + \frac{p}{100})^T} - I_0
\]

Here we know the value of \(I_0\) and also the values of \(R_1, R_2, \ldots, R_T\), equation with one unknown, and we can solve for the value of \(p\). Some value of \(p\) will cause the sum of the discounted receipts to equal the initial cost of the vessel, making the equation equal to zero, and that value of \(p\) is defined as the internal rate of the project. That is, the solution value of \(p\) is the IRR.

If we look at the NPV-curve we produced for the case of m/v Anna, we would see that the curve crosses the x-axis at a point where the discount rate is between 15 % and 20 %. If we look carefully at the graph we would assume the point to be abt 18 %. Thus for the case of m/v Anna the IRR was abt 18 %.

Internal Rate of Return (IRR) is the discount factor that gives a NPV=0

To find the internal rate of return, we may either

1) Use an algorithm based on trial and error:
2) Draw a graph of the NPVs as a function of discount rate, and graphically read off where the curve crosses the x-axis.

3) Use a hand calculator with an built-in function (e.g., Hewlett Packard HP 10)

4) Use a spreadsheet program such as Lotus 123 or Excel 4

**Find IRR by trial and error**

STEP 1: First compute the present value of the cash flows from the investment, using an arbitrarily selected interest rate. (Since the cost of capital for most companies is in the range of 10 - 15 percent, projects will hopefully promise a return of at least 10 percent. Therefore 10 percent is a good starting point or most problems.)

STEP 2: The compare the calculated present value with the investment's cost. If the present value is higher than the cost figure, try a higher interest rate and go through the procedure again. Conversely, if the present value is lower than the cost, lower the interest rate and repeat the process. Continue until the present value of the flows from the investment is approximately equal to its cost. **The interest rate that brings about this equality is defined as the internal rate of return.**

**Aspects of IRR**

What is so special about the particular interest rate that equates the cost of a project with the present value of its receipts? Suppose that an owner obtains all its capital by borrowing from a bank and that the interest cost of this debt is 6 percent.

If the internal rate of return on a particular project is calculated to be 6 percent, the same as cost of capital, then the company would be able to invest in the project, use the cash flow generated by the investment to pay off the principal and interest on the bank loan and come out exactly even on the transaction.

If the internal rate of return exceeds 6 percent the project would be profitable. If the internal rate of return is less than 6 percent, taking on the project would result in losses. It is this "break-even" characteristic that makes us interested in the internal rate of return.

**Internal rate of return: A cautionary tale**

Tempted by a project with a high internal rate of return? Better check the interim cash flows again.
Maybe finance managers just enjoy living on the edge. What else would explain their weakness for using the internal rate of return (IRR) to assess capital projects? For decades, finance textbooks and academics have warned that typical IRR calculations build in reinvestment assumptions that make bad projects look better and good ones look great. Yet as recently as 1999, academic research found that three-quarters of CFOs always or almost always use IRR when evaluating capital projects.

Our own research underlined this proclivity to risky behavior. In an informal survey of 50 executives at shipping companies, we found only 4 who were fully aware of IRR's most critical deficiencies. Our next surprise came when we reanalyzed ten actual investments that one company made on the basis of attractive internal rates of return. If the IRR calculated to justify these investment decisions had been corrected for the measure's natural flaws, management's prioritization of its projects, as well as its view of their overall attractiveness, would have changed considerably.

When managers decide to finance only the projects with the highest IRRs, they may be looking at the most distorted calculations—and thereby destroying shareholder value by selecting the wrong projects altogether. Companies also risk creating unrealistic expectations for themselves and for shareholders, potentially confusing investor communications and inflating managerial rewards.

Managers must either avoid using IRR entirely or at least make adjustments for the measure's most dangerous assumption: that interim cash flows will be reinvested at the same high rates of return.

**The trouble with IRR**

Practitioners often interpret internal rate of return as the annual equivalent return on a given investment; this easy analogy is the source of its intuitive appeal. But in fact, IRR is a true indication of a project's annual return on investment only when the project generates no interim cash flows—or when those interim cash flows really can be invested at the actual IRR.

When the calculated IRR is higher than the true reinvestment rate for interim cash flows, the measure will overestimate—sometimes very
significantly—the annual equivalent return from the project. The formula assumes that the company has additional projects, with equally attractive prospects, in which to invest the interim cash flows. In this case, the calculation implicitly takes credit for these additional projects. Calculations of net present value (NPV), by contrast, generally assume only that a company can earn its cost of capital on interim cash flows, leaving any future incremental project value with those future projects.

IRR's assumptions about reinvestment can lead to major capital budget distortions. Consider two different, mutually exclusive ships, A and B, with identical cash flows, risk levels, and durations—as well as identical IRR values of 38 percent. Using IRR as the decision yardstick, an executive would feel confidence in being indifferent toward choosing between the two projects. However, it would be a mistake to select either project without examining the relevant reinvestment rate for interim cash flows. Suppose that Project B's interim cash flows could be redeployed only at a typical 4 percent cost of capital, while Project A's cash flows could be invested in an attractive follow-on project expected to generate a 38 percent annual return. In that case, Project A is unambiguously preferable.

Even if the interim cash flows really could be reinvested at the IRR, very few practitioners would argue that the value of future investments should be commingled with the value of the project being evaluated. Most practitioners would agree that a company's cost of capital—by definition, the return available elsewhere to its shareholders on a similarly risky investment—is a clearer and more logical rate to assume for reinvestments of interim project cash flows.

When the cost of capital is used, a project's true annual equivalent yield can fall significantly—again, especially so with projects that posted high initial IRRs. Of course, when executives review projects with IRRs that are close to a company's cost of capital, the IRR is less distorted by the reinvestment-rate assumption. But when they evaluate projects that claim IRRs of 10 percent or more above their company's cost of capital, these may well be significantly distorted.

Ironically, unadjusted IRRs are particularly treacherous because the reinvestment-rate distortion is most egregious precisely when managers tend to think their projects are most attractive. And since this amplification is not felt evenly across all projects, 3 managers can't simply correct for it by adjusting every IRR by a standard amount.

John C. Kelleher and Justin J. MacCormack wrote an article in The McKinsey Quarterly, Web exclusive, August 2004 where they had analysed the use of IRRs in major US firms:
“How large is the potential impact of a flawed reinvestment-rate assumption? Managers at one large industrial company approved 23 major capital projects over five years on the basis of IRRs that averaged 77 percent. Recently, however, when we conducted an analysis with the reinvestment rate adjusted to the company's cost of capital, the true average return fell to just 16 percent. The order of the most attractive projects also changed considerably. The top-ranked project based on IRR dropped to the tenth-most-attractive project. Most striking, the company’s highest-rated projects—showing IRRs of 800, 150, and 130 percent—dropped to just 15, 23, and 22 percent, respectively, once a realistic reinvestment rate was considered (Exhibit 2). Unfortunately, these investment decisions had already been made. Of course, IRRs this extreme are somewhat unusual. Yet even if a project’s IRR drops from 25 percent to 15 percent, the impact is considerable.”

What to do?

The most straightforward way to avoid problems with IRR is to avoid it altogether. Yet given its widespread use, it is unlikely to be replaced easily. Executives should at the very least use a modified internal rate of return. While not perfect, MIRR at least allows users to set more realistic interim reinvestment rates and therefore to calculate a true annual equivalent yield. Even then, we recommend that all executives who review projects claiming an attractive IRR should ask the following two questions.

1. What are the assumed interim-reinvestment rates? In the vast majority of cases, an assumption that interim flows can be reinvested at high rates is at best overoptimistic and at worst flat wrong. Particularly when sponsors sell their projects as “unique” or “the opportunity of a lifetime,” another opportunity of similar attractiveness probably does not exist; thus interim flows won’t be reinvested at sufficiently high rates. For this reason, the best assumption—and one used by a proper discounted cash-flow analysis—is that interim flows can be reinvested at the company's cost of capital.

2. Are interim cash flows biased toward the start or the end of the project? Unless the interim reinvestment rate is correct (in other words, a true reinvestment rate rather than the calculated IRR), the IRR distortion will be greater when interim cash flows occur sooner. This concept may seem counterintuitive, since typically we would prefer to have cash sooner rather than later. The simple reason for the problem is that the gap between the actual reinvestment rate and the assumed IRR exists for a longer period of time, so the impact of the distortion accumulates.4
Despite flaws that can lead to poor investment decisions, IRR will likely continue to be used widely during capital-budgeting discussions because of its strong intuitive appeal. Executives should at least cast a sceptical eye at IRR measures before making investment decisions.

BASIC DIFFERENCES BETWEEN THE NPV AND IRR METHODS

In most cases NPV and IRR gives same ranking

As noted above, the NPV method (1) accepts all independent projects whose NPV is greater than zero and (2) ranks mutually exclusive projects by their NPV's selecting the project which give the higher NPV.

The IRR method calls for accepting independent projects where \( p \), the internal rate of return, is greater than \( k \), the cost of capital, and for selecting among mutually exclusive projects depending on which has the higher IRR.

It is apparent that the only structural difference between the NPV and IRR method lies in the discount rate used in the two equations - all the values in the equations are equal except for \( p \) and \( k \). Further we can see that if \( p > k \), then NPV > 0.

Accordingly, the two methods give the same accept-reject decisions for specific projects. If a project X is acceptable under the NPV criterion, it is also acceptable under the IRR method.

Situations where NPV and IRR methods give different ranking

However, under certain conditions the NPV and IRR methods can rank projects differently, and if mutually exclusive projects are involved or if capital is limited, then rankings can be important. The conditions under which different rankings can occur are as follows:

1) The cost of one project is larger than that of the other.

2) The timing of the projects' cash flows differ. For example the cash flows of one project may increase over time, while those of the other decrease.

3) The projects have different expected economical lifetime.

How should these conflicts be resolved? After all the NPV's measure the projects' contributions to the value of the company, so the one with the higher NPV must be contributing more to the company's value.

This line of reasoning leads to the conclusion that companies should, in general, use the NPV method for evaluating investment proposals.
If the cash flows from a project are level, or equal in each year, in essence such a project is an annuity: the firm makes an outlay I₀, and receives a stream of cash flow benefits Rₙ for a given number of years.

The formula for calculating the PV of an annuity is as follows:

\[
PV = \frac{R_k}{\left(1 + \frac{p}{100}\right)} + \frac{R_k}{\left(1 + \frac{p}{100}\right)^2} + \frac{R_k}{\left(1 + \frac{p}{100}\right)^3} + ... + \frac{R_k}{\left(1 + \frac{p}{100}\right)^N}
\]

\[R_k : \text{Annuity or Constant Cashflow for each year}\]
\[p : \text{Interest Rate} = \text{Cost of Capital}\]
\[PV : \text{Present Value of Annuity}\]
\[N : \text{Number of years with equal cashflows}\]

We can also express this as:

\[
PV = R_k * \left(\frac{(10p^N - 1)}{10p^N * (10p - 1)}\right)
\]

Example: If you were selling an old 15,000 dwt liner vessels and had two firm offers:

a) Cash on delivery: $3 mill

b) The vessel to be paid as an annuity over 3 years $1.5 mill each year. Payments at the end of the year.

which buyer would you prefer assuming everything else is equal?

The first you have to decide is the cost of capital. Assume the firm's cost of capital is 12%, then the PV of alternative b) would be:
Thus, the alternative B) is preferred unless the company is short of cash.

**ANNUITY TABLE**

Modern hand calculators enable you to easily calculate annuities, but as a reference we are showing an annuity table below:

<table>
<thead>
<tr>
<th>Yrs</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
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<td>1.00</td>
<td>0.95</td>
<td>0.91</td>
<td>0.87</td>
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<td>2.00</td>
<td>1.86</td>
<td>1.74</td>
<td>1.63</td>
<td>1.53</td>
</tr>
<tr>
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<td>2.72</td>
<td>2.49</td>
<td>2.28</td>
<td>2.11</td>
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<tr>
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<td>3.55</td>
<td>3.17</td>
<td>2.85</td>
<td>2.59</td>
</tr>
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<td>5.00</td>
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<td>3.79</td>
<td>3.35</td>
<td>2.99</td>
</tr>
<tr>
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<td>6.00</td>
<td>5.08</td>
<td>4.36</td>
<td>3.78</td>
<td>3.33</td>
</tr>
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<td>4.87</td>
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<td>3.60</td>
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<tr>
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<td>7.11</td>
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<td>4.77</td>
<td>4.03</td>
</tr>
<tr>
<td>10</td>
<td>10.00</td>
<td>7.72</td>
<td>6.14</td>
<td>5.02</td>
<td>4.19</td>
</tr>
</tbody>
</table>

• **PRESENT VALUE OF AN ANNUITY OF $1 OVER N PERIODS. (PVIF)**

We can use this table to calculate Present Values of annuities by:

\[
PV = \text{Annuity} \times \text{PVIF}
\]

Example: The Present Value of $2 mill received over 5 years discounted at 10% is:
PV = $2 \text{ mill} \times 3.79 = $7.58 \text{ mill}

Example: The PV of an annuity of 1 mill $ over 10 years discounted at 15 % p.a. is $5.02 \text{ mill}.

**Required Cash flow pr year**

An important aspect of annuities is that we can now answer questions such as: If we invest $20 \text{ mill} in a dry bulk carriers, how much cash flow do we need every year in 10 years if our cost of capital is 10 %? Assuming that the cash flow received every year is an annuity (constant amount every year), we can simply write the formula as:

\[
\text{Annuity} = \frac{PV}{PVIF}
\]

What annual annuity is required for 10 years in order to give a 10 % return on a $20 \text{ mill} investment?

\[
\begin{array}{cccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\hline
20 \text{ mill} & x & x & x & x & x & x & x & x & x \\
\end{array}
\]

\[
X = \frac{\text{PV}}{\text{PVIF}} = \frac{$20 \text{ mill}}{6.14} = $3.26 \text{ mill p.a. for ten years}
\]

\[
\text{PVIF} = 6.14 - \text{See Annuity table}
\]

In our case PV = $20\text{ mill}$ and from the annuity table we find that PVIF=6.14; i.e.

\[
\text{Annuity} = \frac{20}{6.14} = $3.26 \text{ mill}.
\]

In other words by investing $20 \text{ mill} in a ship today and requiring 10 % rate of return for 10 years, we need an even cash flow of $3.26 \text{ mill every year for 10 years.}
**Required bareboat hire**

In shipping this annual cash flow would correspond to a necessary *Bareboat hire*. Thus if we were to calculate this figure on a daily basis, we would divide into 365 days: Required bareboat rate: $8,924 pr day constant for 10 years.

Required Bareboat hire for 10 years in order to give a 10 % return on a $20 mill investment?

\[ x \times x \times x \times x \times x \times x \times x \times x = $3.26 \text{ mill} \]

\[
\begin{array}{cccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10
\end{array}
\]

\[ \text{20 mill} \quad \text{Daily bareboat hire} = \frac{$3.26 \text{ mill}}{365 \text{ days p.a.}} = 8,932 \text{ $/day every day for 10 years} \]

**Required time charter hire**

By adding to the bareboat hire an expected operating cost pr day, we would arrive at the required tc hire:

E.g. If running costs is expected to be 4,000 $/day, we need a total tc rate of:

Required Time Charter hire for 10 years in order to give a 10 % return on a $20 mill investment?

\[ x \times x \times x \times x \times x \times x \times x \times x + \text{oper.cost} = $3.26 \text{ mill} \]

\[
\begin{array}{cccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10
\end{array}
\]

\[ \text{20 mill} \quad \text{Daily req. bareboat hire} = 8,932 \text{ $/day} \]
\[ + \text{Operating costs} = 4,000 \text{ $/day} \]
\[ = \text{Required TC hire} = 12,932 \text{ $/day} \]

Assumption: Operating cost is constant for 10 years
**Required Bareboat Rate when taking into account Vessel's Residual Value**

Residual Value is the anticipated value of a vessel at the end of the Project Horizon that we consider for a particular investment.

In our case, if we assume that the Residual Value of the bulker after ten years is $5 mill, we must first find the PV of this Residual Value:

$$\text{PV of Residual Value: } = \frac{5 \text{ mill}}{(1.10)^{10}} = 1.93 \text{ mill.}$$

Required Bareboat hire for 10 years in order to give a 10% return on a $20 mill investment - Res.value = $5 mill

<table>
<thead>
<tr>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

$$\text{PV of Res Value } = \frac{5 \text{ mill}}{(1.10)^{10}} = 1.93 \text{ mill}$$

$$\text{Required Annuity } = \frac{\text{PV}}{\text{PVIF}} = \frac{(20 - 1.93)}{6.14} = 2.94 \text{ mill p.a.}$$

$$\text{Required bareboat hire } = \frac{2.94}{365} = 8,063 \text{ $/day}$$

If we now are to find the required Bareboat rate for the ten years period, we know that the Residual Value corresponds to a PV of $1.93 mill which we can therefore subtract from our initial price:

Annuity = (20 - 1.93)/PVIF

Annuity = $18.07/6.14 = $2.94 mill for ten years or 8,063 $/day every day for ten years. We see that the required bareboat rate is now less that in the case where we did not assume a residual value, but the effect is relatively small because the Residual Value is ten years into the future.

**Required Residual Value**

In cases where our initial investment and expected annuity is given, we can calculate what Residual Value we need in order to give a required rate of return on our investment.
Required Residual Value after 10 years in order to give a 10% return on a $20 million investment when annual bareboat hire is given

\[
x = \$3 \text{ million each year}
\]

\[
\text{Res. value} = ?
\]

\[
\begin{array}{cccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\hline
x & x & x & x & x & x & x & x & x & x
\end{array}
\]

20 million

\[
\text{PV of Annuity:} \quad = \text{Annuity} \times \text{PVIF}
\]

\[
\text{PV of Annuity:} \quad = \$3 \text{ million} \times 6.14 = \$18.42 \text{ million}
\]

Required PV of Res.value = (20 - 18.42) = $1.58 million

FV of $1.58 = 1.58 \times (1.1)^{10} = $4.10 million

Required Res.Value = $4.10 million

Assume that the annual cash flow is given as $3 million per year for ten years. This gives:

PV of ten years cash flow:

\[
\$3 \text{ million} \times 6.14 = \$18.42 \text{ million}.
\]

If our initial investment was $20 million, we need to achieve a PV from the Residual Value corresponding to:

\[
(20 - 18.42) = 1.58
\]

To find Future Value of this we must:

\[
\text{FV} = 1.58 \times (1.1)^{10} = \$4.10 \text{ million}
\]

Therefore, if an investment of $20 million gives us a bareboat hire of $3 million each year for ten years, we would need a Residual Value (Value of the vessel at the end of the ten years period) of $4.10 million in order to make 10% rate of return on the investment.
Financing of ships

Cash flow

We have noted that what is important in an investment analysis is the amount of cash flow that a vessel generates. We have explained that Cash flow from operations is the cash available after we have paid out Voyage Costs and Operating Costs. Cash flow from operations is what is available to pay for Capital Costs, provide a profit and yield a return on invested equity.

Equity

An owner who purchases a ship for $15 million from his own funds is said to be putting up equity.

This means that he is the sole owner of the ship, and is entitled to all profit made. The owner must rely on periods of profitability to compensate for periods of loss and provide adequate average return on capital.

An owner who has funded his investment through Equity has no Capital Costs.

Twenty years ago it was not unusual for shipowners to pay both newbuildings and second hand vessels "cash on delivery" - all paid out of the equity. However, in recent years ship financing has developed into a sophisticated market enabling owners to obtain various forms of credits.

Debt Financing

An alternative to pay for the ship through Equity, is for the owner to borrow money or use debt financing. Borrowing money is a way of reducing the amount of Equity which an owner has to put up at the time of buying a ship.

The two main alternative debt financing are:

- Traditional First Mortgage Finance
- Shipbuilder Credit

There are other alternative forms of ship financing such as corporate borrowing, operational lease, tax lease, bareboat lease, secured equity financing, mezzanine finance etc. These will not be discussed here.
Traditionally vessels have mostly been financed as *Projects* which in practice has meant that the lender takes a security in the particular ship that he finances. This is what is referred to as a Ship Mortgage Finance: The lender has a first mortgage (security) in the vessel.

There are relatively few banks globally that offer ship financing, but the major banks include:

- Den Norske Bank (DnB), Oslo
- Christiania Bank & Kreditkasse (CBK), Oslo
- AMRO bank, Rotterdam
- Bank Mees & Hope, Rotterdam
- Nedship Bank, Rotterdam
- Banque Indosuez, Paris
- Barclays Bank, London
- Chase Manhattan Bank, New York & London
- Chemical Bank, New York
- Citibank, New York & London
- Deutsche Schiffsbank, Bremen
- Schiffshypotekenbank zu Lubeck, Hamburg
- Hongkong Bank, Hong Kong

Under a debt finance scheme, the owner borrows part or all of the money to pay for the ship.

There are four major parameters describing the loan:

- Currency
- Loan Amount
- Interest Rate
- Repayment period
Additionally there will be several clauses in the loan agreement with regard to how the lender’s security is protected and other covenants.

**Currency**

An owner can determine what type of currency he wants to borrow in depending on his home base and how he wants to position himself vis a vis currency risks.

An owner based in the United States would normally borrow in US dollars (USD). Owners in Norway could choose to borrow in Norwegian Kroner (NOK) or any other currencies.

The normal attitude amongst owners is to finance the vessel in the currency where they have their income, and since most of freight rates are determined in USD, most ship borrowing are done in USD. This attitude implies that the owner does not take a currency risk.

However, more sophisticated finance directors would rather take an overall look at the currency markets and evaluate which currencies that are likely to weaken, and thus present an additional profit.

E.g. when some of the major Norwegian Cruise companies such as Anders Wilhelmsen & CO (Now RCCL) and Kloster Cruise built ships in France, they chose to finance the ships in French Francs, because they felt the Franc was likely to weaken in spite of the fact that most of their income from passengers was in USD and their home base was Norway.

**Amount of loan**

The amount of money an owner can borrow is normally seen in relation to the market value of a ship. Major ship finance banks will in 1993 normally not lend more than 50-60 % of the market value of the ship and the payback period will be carefully checked against the remaining lifetime of the particular ship.

*Financial leverage* is defined as the ratio of total debt to total assets. For example a company having total assets of 10 mill $ and a total debt of 5 mill $, would have a leverage of 50 %.

Without going into detail, we can state that:

In general, whenever return on assets exceeds the cost of debt, leverage is favourable, and the higher the leverage factor, the higher the return on equity.
Interest Rate

Interest rate in a loan agreement can either be fixed for the entire loan period or for parts of it, or the interest rate can be linked to a market indicator for interest rate such as US dollar LIBOR (London Inter bank Offered Rate).

Fixed Interest Rate

If the owner wants to know exactly how much he has to pay in interests, he can lock in the interest rate fixed for the entire period of the loan. In this case the owner pays the same interest rate regardless of what happens in the international interest rate markets.

In November 1993, if an owner wants to lock in an interest rate in USD for say seven years, he would probably have to pay an interest rate of abt 10%.

Banks are generally less interested in fixing interest rates for longer periods, and it is in practise rare to see fixed interest rates for anything more than 3-5 years.

LIBOR + SPREAD

More common in today is to fix the interest rate as a sum of the so-called LIBOR rate + an agreed margin or spread. In cases where the interest rate is linked to USD LIBOR, the agreement with state the margin to be paid as the percentage points above USD LIBOR that the borrower has to pay.

Example: The USD LIBOR rate is quoted by the major banks every day, and you can find the rate in any financial newspaper. As of October 18 1993, the USD LIBOR rate was:

<table>
<thead>
<tr>
<th>Period (months)</th>
<th>USD LIBOR (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.18750</td>
</tr>
<tr>
<td>3</td>
<td>3.37500</td>
</tr>
<tr>
<td>6</td>
<td>3.37500</td>
</tr>
<tr>
<td>12</td>
<td>3.50000</td>
</tr>
</tbody>
</table>

The spread that the banks quote for a loan will reflect the financial status of the borrower. A major first class publicly owned shipping company, will probably pay a spread between 0.5 and 1.5 percentage points. A medium sized company will pay 2 percentage points and a
less established company may pay a margin of say 3 percentage points.

Example: A first class owner has agreed to borrow money where the interest rate is determined as 3 months USD LIBOR + 1.5 percentage points. In our case this would mean a total interest rate of:

Interest rate: 3.37500 + 1.5000 = 4.8750 %

In practise this implies that the interest rate is fixed for a 3 months period, then at the end of the three months, the 3 months USD LIBOR applicable at that point in time is again noted, the spread is added and thus determines the interest rate to apply for the following period of 3 months.

### Repayment period

The repayment period will reflect the age of the vessel and the intended employment. A modern ship may be financed for unto ten years. If the ship is employed on a long-term contract which the bank views as a risk free trade, the finance can be matched against such employment. Thus if an owner has a 15 years timecharter with a major oil company, he would be able to finance the ships stretching over the entire tc period.

If a ship is to be employed on the spot market, the banks will be less prone to finance for any period longer than say five to seven years.

For older ships, the repayment period will be shorter.

### Instalments

It is normally agreed that a loan is repaid in a certain number of Instalments. These instalments can either be equal or they can be determined according to a prefixed Instalment table.

In ship finance normally the instalments are fixed as equal instalments to be paid once a year or twice a year. It is also normal practise that interests are paid at the same intervals.

### Moratorium or Grace Period

In certain cases the owner can make a loan agreement where he only pays interests for the first couple of years and then repays over the remaining years. The period where he only pays interests is called a moratorium or grace period.

E.g. An owner has a loan where during the first two years of the loan, he only pays interests and then repays the loan over say the following 5 years. In total the loan stretches over seven
years, but the loan is repaid over the five last years. In this case he has a grace period of two years.

**Balloon**

A balloon is an amount to be repaid at the end of the loan period. If a loan of $10 million is to be repaid with 5 equal annual instalments of $1 million, at the end of the five years the remaining loan is $5 million. In this case the loan would have a balloon of $5 million.
Calculating Capital Costs

In November 1993 a ten year old Panmax dry bulk carrier of abt 64,000 dwt will cost $15 mill. Assume that we can borrow 60% of this amount or $9 mill. If the interest rate is fixed at 10% p.a. and the loan to be repaid over 5 years in equal instalments, the implication is that for each of the five years we would have the following Capital Costs:

Capital Costs (thousands of USD)

<table>
<thead>
<tr>
<th>Year</th>
<th>Loan at beginning of the year</th>
<th>Interests</th>
<th>Instalment</th>
<th>Loan at end of the year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9,000</td>
<td>900</td>
<td>1,800</td>
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</tr>
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<td>1,800</td>
</tr>
<tr>
<td>5</td>
<td>1,800</td>
<td>180</td>
<td>1,800</td>
<td>0</td>
</tr>
</tbody>
</table>

The Capital costs of this loan is the sum of the instalments and the interests:

All figures in thousands of USD

<table>
<thead>
<tr>
<th>Year</th>
<th>Interests + Instalments</th>
<th>Total Annual Capital Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>900 + 1,800</td>
<td>2,700</td>
</tr>
<tr>
<td>2</td>
<td>720 + 1,800</td>
<td>2,520</td>
</tr>
<tr>
<td>3</td>
<td>540 + 1,800</td>
<td>2,340</td>
</tr>
<tr>
<td>4</td>
<td>360 + 1,800</td>
<td>2,160</td>
</tr>
<tr>
<td>5</td>
<td>180 + 1,800</td>
<td>1,980</td>
</tr>
</tbody>
</table>

THE TREATMENT OF DEPRECIATION

Investment analysis is concerned only with the amounts and timing of cash flows. Depreciation enters into the analysis, but only insofar as it effects cash flow. That is depreciation is represented by the difference between the initial outlay and the end-of-life residual value, rather than by a series of annual depreciation charges.
For example, for an investment proposal calling for an outlay of $10 mill now and a residual value of $1 mill in 10 years' time, the timetable would show the following:

<table>
<thead>
<tr>
<th>Time</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>- $10 mill</td>
</tr>
<tr>
<td>10</td>
<td>+ $1 mill</td>
</tr>
<tr>
<td>Total</td>
<td>- $ 9 mill</td>
</tr>
</tbody>
</table>

Lifetime depreciation is $9 mill.

The accountant would spread this $9 mill over the 10 years for financial reporting. This is valid for that purpose, but it has no bearing on the capital expenditure decision. The cash outflow takes place now, not in annual instalments and the timetable must reflect this.

**THE TREATMENT OF INCOME TAXES**

Although depreciation does not represent a cash flow, income taxes do, and income taxes depend on the amounts of depreciation that are claimed on the company's annual income tax returns.

Thus if a shipping company is in a situation where taxes are relevant, the cash flows that have to be discounted are the after-Tax Cash Flows. The principles are the same for all three investment approaches.

As taxation rules differ from one country to another, we shall not discuss this issue further here. In most countries, however, profits from sales on vessels can be offset against new investments and taxes are rarely (at least in Norway) a relevant issue that have an impact on shipping investment analysis.

**Break Even on Capital Costs - Break Even Bareboat rate**

Since earnings of vessels are often expressed in USD/day, we can calculate the Break Even Capital costs pr day. This figure is an important measure that we need to look at in any investment analysis.
Calculating Capital Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital costs ('000) USD p.a.</th>
<th>Break even Rate USD/DAY (360 days p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,700</td>
<td>7,500</td>
</tr>
<tr>
<td>2</td>
<td>2,520</td>
<td>7,000</td>
</tr>
<tr>
<td>3</td>
<td>2,340</td>
<td>6,500</td>
</tr>
<tr>
<td>4</td>
<td>2,160</td>
<td>6,000</td>
</tr>
<tr>
<td>5</td>
<td>1,980</td>
<td>5,500</td>
</tr>
</tbody>
</table>

The Break Even Rate is what we need as a minimum to pay interests and instalments. This would correspond to the Break Even Bareboat hire.

**Break Even TC rate**

The Break Even TC rate is the minimum rate need to cover:

Capital Costs + Operating Costs

If we assume that the operating cost of the Panmax bulker is 4,000 USD/day and increases with 10 % p.a., we would find the B/E TC rate for each year as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Break even Bareboat Rate USD/DAY (360 days p.a.)</th>
<th>Operating Costs USD/DAY</th>
<th>Break even TC Rate USD/DAY (360 days p.a.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7,500</td>
<td>4,000</td>
<td>11,500</td>
</tr>
<tr>
<td>2</td>
<td>7,000</td>
<td>4,400</td>
<td>11,400</td>
</tr>
<tr>
<td>3</td>
<td>6,500</td>
<td>4,840</td>
<td>11,340</td>
</tr>
<tr>
<td>4</td>
<td>6,000</td>
<td>5,324</td>
<td>11,324</td>
</tr>
<tr>
<td>5</td>
<td>5,500</td>
<td>5,856</td>
<td>11,356</td>
</tr>
</tbody>
</table>

**TOTAL CAPITAL VS EQUITY CAPITAL**

There are two cash flow series that are of importance:

* THE TOTAL CAPITAL CASH FLOW SERIES
* THE EQUITY CAPITAL CASH FLOW SERIES

These two series are used to evaluate return on total capital versus the return on equity.

The following lists shows which items are included in the different series:

<table>
<thead>
<tr>
<th>PAYMENT TYPE</th>
<th>TOTAL CAPITAL</th>
<th>EQUITY CAPITAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity Payments</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Loan Payments</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Instalments on loans</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Interests on loans</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Running Costs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>T/C Hire</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Residual Value</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
The Cash flow on "Total Capital" can be considered the cash flow in the case where the investment is 100 % Equity. There are no loans and consequently no Capital Costs in this case.

**Cash flow on "Equity Series"**

When borrowing money, we have additional Capital Costs, and the Cash flow Series we generate after Capital Costs are deducted from Operational Cash flow is what we refer to as Cash flow for the "Equity Series".

Cash flow on "Equity Series"
We notice that our cash outlay at the start of the investment is reduced by $9 mill to now $6 mill, but as a consequence, we have to pay capital costs for 5 years that if we add them, amount to $11.700 mill. So the effect of now paying mill today is that over time we have to pay a total of $11.7 mill.

The rational behind borrowing money is that we perceive future payments to be less worth than up front payments.

**NPV on Equity**

Because the Equity Cash flow is a different series of payments, this would give a different Net Present Value.

**IRR on Equity**

The same argument applies here, and the Internal Rate of Return on the Equity will be a different figure than the IRR on the total capital.

If a project gives an IRR of say 15 % on the Total Capital, and the finance costs (interests on the loan) is 10 %, the IRR of the Equity will be higher than the IRR on Total Capital.

**Modified Equity Series**

When we have discussed the calculation of IRR so far, we have assumed that the cash flow series are available to the firm at any time...
and that the cash flows can be reinvested continuously at a rate which is equal to the calculated internal rate of return.

This is not always the case, and often we rather want to look at an investment as a "closed" project.

We start out by investing a certain amount of equity in a project. Assume we open a separate bank account for this vessel and all transactions take place on this account. Let us further assume that we keep all surplus on the account. As the money is kept on the account, we earn interests. We earn positive interests if we have surplus and we earn negative interests if we have short term deficits. (If negative balance we assume that we have a line of credit with the bank) It is not until after we have sold the vessel that we take out the remaining balance in the bank. The remaining balance on our bank account we refer to as Terminal Value

In this case we can calculate our internal rate of return on the basis of the following formula:

\[
NPV = \frac{\text{Terminal value}}{\left(1 + \frac{p}{100}\right)^T} - \text{cost}
\]

Terminal value is what we have outstanding on our bank account after the vessel is sold and cost is our initial equity payment.

If we solve for \( p \) in this equation we get what we call the Modified Rate of Return. Or as it is called in some computer programs, the rate of return on the closed project.
In practice there are several computer models that can be used for assessing ship investment projects. We will in this note refer to a model developed by Norwegian Maritime Software, Oslo which is based on more than 15 years experience and extensively used by major shipping companies in Norway and abroad. Below is the structure of such model:
DIVESTMENTS

It may seem odd in a note on Shipping Investments to bring up the issue of Divestments, but we want to point out that the methods that we have described to analyse investments, are equally applicable to analyse whether to continue operations or sell out.

The principle approach is to:

1. Get an indication of the ship's market value Normally provided by brokers)

2. Project cash flows from continued operations for the remaining life time of the vessels.

3. Calculate the NPV of the projected cash flows.

4. If NPV from continued operations are lower than the Ship's market value, the vessels should be sold.

Decisions to sell vessels can often be difficult to take if market values have fallen far below book value. In such cases, the company has to face a loss in the income statement.

A rational attitude to this type of problem is of major importance in any shipping company. If the four steps indicated above leads to a conclusion to sell, a write-down loss should not change such decision.

The sunk cost fallacy

Despite general understanding of the incremental principle, capital expenditure decisions are sometimes influenced by the amounts spent (or lost) in the past.

For example let us assume that a company bought a newbuilding Panmax three years ago for $20 mill, and have recorded the following cash flows (tc-hire less running costs):

<table>
<thead>
<tr>
<th>Year 1</th>
<th>$ 1.0 mill</th>
<th>Book value: $ 18 mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2</td>
<td>$ 0.5 mill</td>
<td>Book value: $ 16 mill</td>
</tr>
<tr>
<td>Year 3</td>
<td>$ 0.5 mill</td>
<td>Book value: $ 14 mill</td>
</tr>
</tbody>
</table>

One mistake would be to conclude that the company must continue operating the vessel because it has not yet recovered the initial investment.
The relevant concept is *opportunity cost*: What is the present market value, and by how much will the residual value decline if the vessel is not sold today.

Assume that market value today is $6$ mill and the budget for the current year is:

- **T/C-hire:** $4,500$ pr day (350 days)
- **Running Costs:** $3,000$ pr day

**ANNUAL CASH FLOW:** $0.48$ MILL

In lack of a more specific scenario for the future outlook, let us assume that we can maintain this cash flow for the next 10 years (13 years lifetime). Zero residual value. Cost of capital is 10%.

Net Present Value of continued operations is thus:

$0.48$ mill x 6.14 (See annuity table)

$2.95$ mill.

If there is no more optimistic outlook for future earnings, a comparison against a market value of $6$ mill, indicates that *The vessel should be sold* (Despite a write down loss of $(14 - 6) = 8$ mill)