2.2.1 Investment Process and Appraisal Methods

Unit: Unit 1 – Treasury Strategy

Module: Module 2 – Risk and return

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Summary: A look at how firms should approach the investment process, including the generation of ideas and project evaluation. Several different financial appraisal techniques are described.

Keywords: evaluation, sensitivity analysis, hurdle rate, divisional level, growth project, asset replacement, discounted cash flow, net present value, internal rate of return, un-geared analysis, free cash flow to the firm, NOPLAT, tax shield, capital rationing, profitability index, payback, discounted payback, return on capital employed

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Learning outcomes:

1. To understand the process by which firms manage their investments and the importance of each stage, comprising:
   a) generation of ideas
   b) evaluation of ideas
   c) authorisation of projects
   d) implementation of projects
2. To understand the importance of sensitivity testing in evaluation.
3. To understand the difference between projects for growth and projects for asset replacement.
4. To understand that discounted cash flows are the bedrock of investment appraisal.
5. To understand the components of analysis, Free Cash Flows to the Firm, the un-geared analysis.
6. To understand the concept of Net Present Value.
7. To understand Internal Rate of Return (IRR) and its weaknesses.
8. To understand techniques around capital rationing.
9. To understand payback, discounted payback and Return on Capital Employed (ROCE).

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1 Introduction

The purpose of this reading is to start the approach to investment appraisal, the process that seeks to find a technique to assess potential projects that are proposed inside a firm. We will later go on to consider some of the practical difficulties inside modern firms but this reading will discuss the generation of investment ideas and the different techniques available to assess them and the basic discounted cash flow analysis.

The language of this reading and other academic and qualification approaches to this is always phrased within the context of investments and projects, i.e. ideas for some form of business expansion. However, the logic can apply to every business decision even if it involves no investment or is very small. It thus allows a technique for making any decision in a business. And don't forget that in any decision (on an investment, project or otherwise), doing nothing is always an alternative.

We have assumed that students are familiar with the concept of the time value of money but we will reprise these briefly in the reading.

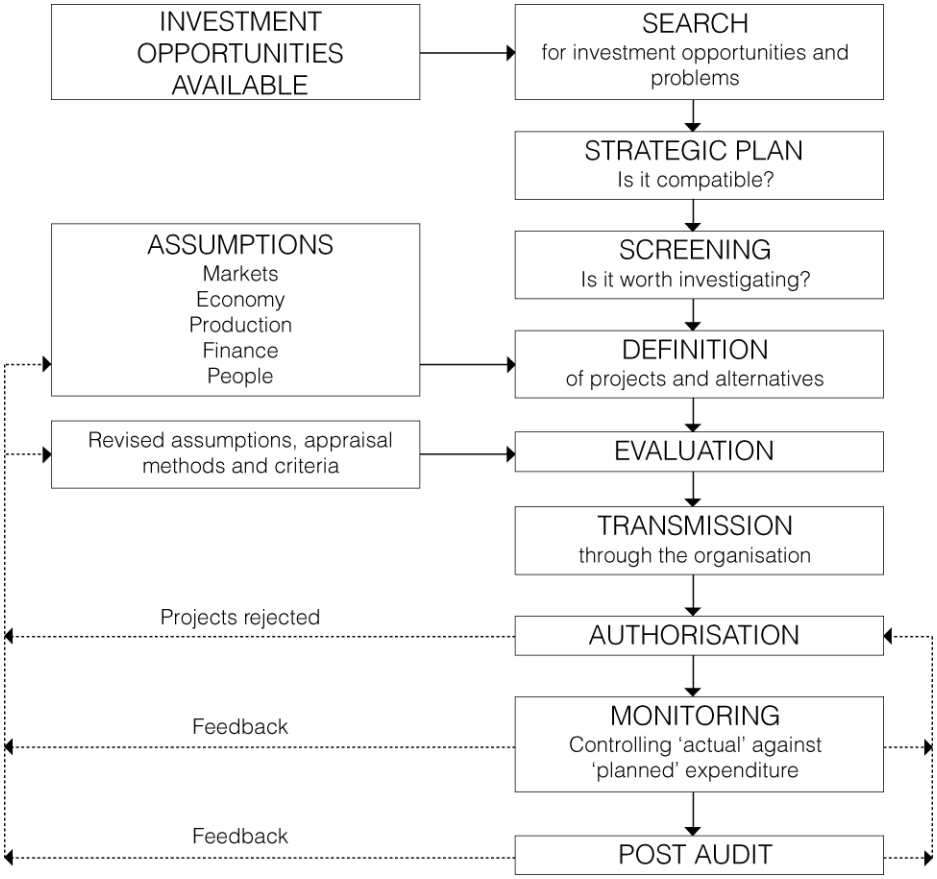
2 The capital investment process

The four main elements in the overall capital investment process of a project are:

- generation
- evaluation
- authorisation
- implementation

The following exhibit summarises the process.

Exhibit 1: The capital investment process



Source: R Pike and R Dobbins, Investment Decisions and Financial Strategy, Philip Allan, 1987

2.1 Project generation

Project generation refers to the process of searching for investment opportunities, which in many industries involves a wide range of employees or consultants. Most capital investment projects are originated by those involved in technology, production, marketing, strategy or at the point of delivery, rather than by financial management. Generally it is more important to generate a high flow of ideas for good projects than to refine the project evaluation techniques.

Although a company might only need one great project to succeed initially - think of Microsoft and the DOS system it acquired and developed for IBM compatible PCs – it is generally true that a successful firm needs a strong pipeline of good ideas so that it can pursue the best of these. Some companies, notably 3M, have allocated staff specific "blue sky" time in their schedules to come up with future ideas. Without this pipeline of investment projects, the best appraisal system in the World is doomed to failure.

The project generation process should involve two initial tests. First, is the project compatible with the company's overall risk appetite and risk policy, within its strategic plan and within the core skills which the firm uses to competitive advantage? If not, it should be abandoned at this stage[1]. Second, is it worth investigating once all the main assumptions of the project have been defined and questioned? In other words, there should be an initial screening process before any detailed financial analysis is carried out. Complex analysis takes time and effort,

[1] In the past some companies have set up internal "private equity" departments which can pursue non-core ideas.

and much of it would be wasted if this initial screening process was not in place to eliminate unsuitable projects.

Example 1: Investment ideas outside core skill area
Elite Autos GmbH is a successful car manufacturer and invests heavily in technological improvements to its cars. One of the improvements would be particularly useful in motor bikes and an investment opportunity has been identified which would involve the manufacture of motor bikes with this technology.

The idea is rejected because the production of motor bikes is outside a core skill area and would involve too many risks of production, marketing and brand etc.

2.2 Project evaluation

Whilst we need a good flow of projects to assess, this is no reason not to ensure that the financial evaluation is as good as it can be. However, we should never lose sight of the critical importance of project generation. Bear this in mind throughout this reading; at times you may think that we have overlooked this basic truth. Remember that in project analysis we are usually dealing with estimates of future cash flows. Rubbish in, rubbish out, not matter how much care and expertise we bring to the evaluation techniques. Marginal projects should always be assessed with care and it is important to remember that the evaluation process is not a black box, but just part of the overall process.

The project evaluation stage involves the full appraisal of the project, generally using various financial techniques. In this reading we will concentrate on some of these techniques, particularly those which rely on discounted cash flows. However, these techniques tell us nothing about the effect of the project on profits and, although cash flow based, rarely consider the availability of finance. Therefore, it is important that the capital appraisal process also picks up the annual impact on the P&L account, and identifies funding needs. The impact on key performance ratios should also be considered, e.g. Earnings per Share (EPS) and also covenanted ratios that appear in loan documentation and the effect on credit ratings.

2.3 Project authorisation and implementation

Project authorisation or rejection will then take place, taking all of the above factors into consideration. With large and complex projects, the evaluation and authorisation stages may be repeated several times as projects are progressively screened and filtered at several approval levels, each one involving more detailed analysis and greater commitment than the previous one.

Final approval does not mean the end of the process, since the project implementation involves monitoring actual against planned expenditure and taking any corrective action that may be necessary. Finally, it is important to carry out a post audit check that will feed back into the capital investment process for future projects. This should cover the out-turn on the key financial metrics but should also identify the main factors responsible for any discrepancies, e.g. higher construction costs, delays in construction, lower sales, higher operating cost, information which can be used in improve future decision making.

3 Investment appraisal – management issues

Capital investment appraisal is not carried out in a vacuum. Real people put forward the proposals. Real people collect the data and forecast the cash flows. Real people carry out the analysis. All these people (and of course it may be the same person undertaking the whole appraisal process) have their own reasons for wanting the project to succeed (or to fail) which may well influence the data towards their own bias. Projects need sponsors to move them forward but this can lead to disadvantages when someone gets over-identified with a project. This means that it is important that a dispassionate view is taken of cash flow forecasts and project appraisals. Read 2.2.1b for further information on cognitive bias, which has implications way beyond this narrow topic.

It is almost certainly sensible to test the results for sensitivity to possible changes in key factors. It may be better to get sponsors to provide all the assumptions and for a central project analysis department to undertake the full project appraisal. Many of us will have seen instances where the data is constructed to ensure the project is viable; once a hurdle rate of return is known most projects appear to meet that target - such is the managerial process. Another approach is to provide a framework of key assumptions such as macro-economic scenarios, commodity prices, capital expenditure and operating expense guidelines, etc. A modern approach to all forecasting is to create ranges of outcomes and modern risk management software (e.g. spreadsheet add-ins) can easily compute these ranges of outcomes.

The issue of tax also causes practical difficulties. Tax is a real cost and cannot be ignored in project evaluation. However, many managers are not familiar with tax or any aspect of the profit & loss account below their divisional operating profit line. It can make sense to only require project originators to look at costs down to this level. This usually makes more sense than centralising the entire process as the expertise for these revenues and expenses is at divisional level.

This separation of financing (and taxation) from investment decisions is typical for most firms since operating managers are usually unaware of the firm's financing policies or, for that matter, its tax status. In other words, most operating decisions are decentralised and most financing decisions are centralised.

3.1 Projects for growth

The evidence is that those involved in cost reduction projects or sales expansion projects are often too optimistic in their forecasts – some project evaluators will add back around 10% to any cost reduction projects and take 40% off any sales expansion projects as a matter of course. Of course project sponsors probably know this as well and so there should be an honest and transparent process, linked to the empirical evidence from previous projects' post-audits. Of course what is happening here is simple sensitivity analysis which is an important part of the overall process.

Example 2: Sales forecasts
The senior management of Ready as Ever Inc, a quarry and aggregates owner, has received a proposal from operating management to build a 'block plant' making concrete block for use in construction. They forecast a volume in one area of 500,000 units per annum, leading to a healthy profit. However, no mention is made of market share or competitive issues and how they would remove turnover from competitors. In the appraisal the volume assumed is cut by 40% to 300,000 units.

3.2 Projects for asset replacement

There are also some projects where it is very difficult to establish what the cash flows are and/or where the project has to be undertaken for legal or regulatory reasons. It is easy to identify costs, but not so easy to identify incremental inflows. In academic terms you may be able to suggest a solution, but in commercial terms, it makes more sense to manage the project against a cost budget, milestones, etc. That is, skip straight to the implementation stage.

Example 3: Essential investment
Fly by Night Ltd uses a Soothsayer ERP (Enterprise Resource Planning) system to manage inventory, ordering and purchasing, production control, invoicing and despatch. The writers of Soothsayer have brought out a new version and will cease support of the old version in 6 months. Fly by Night has no choice but to invest in the new software, or risk shutdown of all manufacture on a failure of the software. The new version does bring improvements in functionality, however, which will be useful.

Above all, the non-financial reasons for the project must be well articulated and given appropriate weighting in the decision process. What is needed is an incisive summary of the key value drivers and major risk factors. These should add credibility to the financial metrics; if the internal rate of return (IRR) is 30%, why is it so good? If there is no apparent reason the numbers are probably wrong. Discounted Cash Flow (DCF) methods can be very unreliable in the wrong hands as well as powerful in the right ones.

4 Discounted cash flow (DCF) methods

Discounted cash flow methods are all based on the concept of the time value of money, whereby a €1 today is worth more than a €1 tomorrow, next year or in twenty years time.

Example 4: Discounted cash flow
AGF has been given a choice of when to be paid for its services.

It can choose to receive USD 95 today or USD 100 in one year's time. If it received the USD 95 now it could invest those at 4% per annum.

USD 95 invested at 4% will result in receiving USD98.8, so all things being equal, it would choose the USD 100 in a year's time. It has done a DCF calculation.

The break even is calculated as follows:

$P \times (1 + r)^{-t}$, where P is the principal, r is the interest rate and t is the time.

$100 \times (1.04)^{-1}$, which is 96.15

So if it received more than USD 96.15, it would be worth accepting the lesser amount today.

We have shown the classic calculation, but a useful alternative to understand is the 'continuously compounded' version which is:

$P \times e^{-rt}$, where e=2.71828 (actually a mathematical constant which appears frequently in many growth patterns), r is the interest rate and t is the time.

Example 5: Discounted cash flow
AGF also makes the DCF calculation as follows:

$100 \times e^{-0.04 \times 1}$, which is 96.08

This version can be manipulated more easily in complicated financial calculations but does assume that interest is received continuously over the period.

Cash flows are included in the analysis as and when they occur. This is different to the accruals basis used in financial statements where cash flows are allocated to different time periods, so there is no element of discretion and less scope to fudge the figures.

There are two main methods of using DCF, namely NPV (Net Present Value) and IRR (Internal Rate of Return). As we shall see, the NPV technique is more flexible and is generally regarded as the superior technique.

5 Un-geared analysis

Un-geared analysis is the bread-and-butter of project evaluation. Most of you will already be familiar with simple DCF techniques, often working with cash flows before taking tax into consideration. Hurdle and discount rates in such analysis are often rounded figures such as 10% or 15%.

Un-geared analysis builds on this simple approach, but there is a little more logic in which cash flows are analysed and the choice of an appropriate hurdle or discount rate. In fact, the cash flows and the hurdle/discount rate are inextricably linked.

5.1 Free cash flows to the firm (FCFF)

From our earlier work we know that the company's cost of capital is measured by its WACC. Therefore, if the company is to deliver acceptable returns to its investors, the projects it invests in should deliver a return at least equal to the WACC.

The cash generated by projects is then used to repay lenders – loan capital plus interest – with the balance accruing to shareholders as dividends or retained earnings. The cash flows

we are therefore interested in valuing are those before the costs of financing are taken into account. Crucially, whilst the tax shield effect on interest must be excluded from these cash flows, the tax on operating profits must be included; after all, tax is a real cost borne by the company. These cash flows are often referred to as the **Free Cash Flows to the Firm (FCFF)**.

We refer to this approach as **un-geared analysis**. Note that this does not mean that the company is not geared, simply that the cash flows under consideration are before the effects of gearing. We recognise that this terminology is confusing, but it is in common use and it is important that you understand its meaning.

There are two approaches when building the cash flow model:

- Consider the project in isolation, taking into account only incremental[2] cash flows, including tax on the project's profits. The tax rate used should be the rate applicable to profits, most probably the effective rate from the accounts.
- Work back from the profit and loss projections for the project or acquisition adjusting for non cash items.

For MCT we tend to concentrate on the second approach. Here we start with NOPLAT which stands for Net Operating Profits less Adjusted Tax. Adjusted tax is the tax on operating profits[3] as opposed to the tax figure appearing in the profit & loss account. That is, it is the tax figure in the accounts with the Tax Shield added back as this is part of the cost of financing.

We then adjust these cash flows for any depreciation replacing this with the actual cash capital expenditure.

We also need to adjust for cash consumed in additional working capital and for other non-cash items such as amortisation & provision movements.

5.2 Timing of cash flows

In DCF analysis cash flows are allocated to time buckets, typically the time of the investment is assumed to occur at Time 0. Cash flows during the first year are assumed to occur at Year 1, i.e. at the end of the year, and so on.

[2] Traditionally sunk cash flows are not included. However managers need to be aware of the options they are closing off if they accept a marginal project which is only viable because of sunk costs. There is a danger when a major cost component is ignored that it might be uneconomic to expand a project accepted on this basis. Arguably it is better practice to only invest in projects that cover all costs (and take a super-return on the sunk cost) as these are replicable as the business expands.

[3] It is usual to apply the tax rate directly to operating profit and this is the practice we use in the MCT syllabus. This seems to be a reasonable approach, especially for practitioners who operate in jurisdictions where tax relief on capital assets is allowed on the basis of depreciation (which is usually specified by the tax authorities). However, it is less intuitive where there is a capital allowance system such as in the UK. Some practitioners prefer to calculate tax after adding back depreciation and deducting capital expenditure which might give a better estimate for the tax charge, but only if the tax system allows 100% for all expenditure in year 1. Ideally you would use estimates of the actual tax charge. Spreadsheet models can accommodate such complexity, but it is beyond the scope of this course.

Clearly, this is a gross simplification. Some practitioners assume that the cash flows arise evenly over the year and adjust the discount factor accordingly.

Example 6: Discounted cash flow

TMD analyses cash flows on a project into yearly time buckets. It has a year two cash flow of €500 and it uses a discount rate of 5%.

The classic way to approach the calculation of the present value of this cash flow is as follows:

Normally, we would say

$$PV = \frac{€500}{(1+5\%)^2} = €453.5$$

However, if we assume that the cash flows arise evenly over the year, we could say:

$$PV = \frac{€500}{(1+5\%)^{1.5}} = €464.7$$

Note that you should not be making adjustments such as this simply to ensure that a project is viable.

In some projects the timing of cash flows can make a significant difference. This is particularly true of large construction projects where the investment does not occur at time 0. In these circumstances it can make more sense to model cash flows on a monthly basis. If construction payments are made to contractors subject to an agreed schedule, it can even make sense to model payments by reference to actual dates. Such complexities are easily accommodated by spreadsheets.

5.3 Reliability of cash flows

We have already highlighted the problem of bias in cash flows, but there is also the genuine problem of forecasting future cash flows.

Many cash flows can be forecast, at least initially, with some certainty. Plant investment and overhead costs fall into this category. The main danger here is that some costs are overlooked. Even if your inflation assumptions going forward are incorrect, they are likely to vary in line with revenues and discount rates, so this is not a major concern.

Sales forecasts and margin forecasts are more problematic, particularly if we are assessing a new product or a new market. Some academics suggest using a stochastic approach[4] assigning probabilities to different outcomes. However, one has to question what this is likely to achieve. If we start with the sales figure in the forecast, it is reasonable to assume that this

[4] This approach could be used by a centralised capital budgeting team. They could measure actual outcomes against forecasts for previous projects for the same business team and build an appropriate probability distribution. This however is probably an example of over refining the evaluation process, although many managers are doing this intuitively by cutting back forecasts by an arbitrary number. The other danger is that the business managers are adjusting their own forecasts based on their own experience (indeed we would hope this was the case) and so we would be double counting. Best not to second guess.

is the most likely outcome. If the manager responsible for the project is asked to assign probabilities to other outcomes, there is a strong chance that he will assign equal probabilities to a 10% shortfall and a 10% over-performance and so forth. Without really thinking about it, the manager has assumed a normal distribution which will have an expected outcome equal to his original forecast! We will also have some meaningless variance data.

A better approach may be to ask the manager to provide a worst case, his expected case and an upside case (although arguably this is less important). Most managers can relate to this approach. They will also consider the impact on other inputs such as marketing spend which may have to be increased in the downside case.

Armed with this information, decision makers will be able to make better decisions. For example, two identical projects in NPV terms may have very different downside (or upside) cases.

5.4 Incremental cash flows

Sunk costs (for example R&D or marketing costs if incurred before the investment decision is taken) should not be included. Allocated costs (or non-incremental costs) such as head office charges should not be included, because they would still be incurred whether or not the project were carried out. All overheads have to be covered in the end but allocating a portion of overheads to new projects could kill the project and make the company worse off than it would have been with the project. Using financial numbers for project evaluation and decision making is a different science from producing management or statutory accounts or evaluating them. Valuable resources within the company that the project will use should be included in the cash flows at their opportunity cost.

6 Net present value (NPV)

For the NPV method an appropriate discount rate (hurdle rate or cost of capital) is required. All projected cash flows are discounted at the hurdle rate then summed to give the NPV. In simple terms the NPV is the value that is expected to be added to the business by the project expressed in terms of today's value.

The financial decision rule is simple; accept all positive-NPV projects, reject those with negative NPVs.

Example 7: Net present value

LJI proposes an investment with the following characteristics:

Investment, time 0	500
Post tax return, year 1	120
Post tax return, year 2	140
Post tax return, year 3	100
Post tax return, year 4	150
Post tax return, year 5	160

It assumes a WACC of 8%. The NPV is calculated as follows:

Year	Cash flow	Discount	CF x D
0	(500)	1.0000	(500)
1	120	0.9259	111
2	140	0.8573	120
3	100	0.7938	79
4	150	0.7350	110
5	160	0.6806	109
		TOTAL	30

LJI accepts the project.

7 Internal rate of return (IRR)

The Internal Rate of Return method does not require a discount rate prior to the calculation, but sensible interpretation[5] does require a target or hurdle rate. The IRR method calculates the discount rate which gives an NPV of zero for the set of cash flows (the IRR for the project).

Example 8: Internal rate or return
LJI proposes an investment with the following cash flow characteristics:

Investment, time 0	500
Post tax return, year 1	120
Post tax return, year 2	140
Post tax return, year 3	100
Post tax return, year 4	150
Post tax return, year 5	160

By setting the discount rate to 10.13%, the discounted cash flows total zero as follows:

Year	Cash flow	Discount	CF x D
0	(500)	1.0000	(500)
1	120	0.9080	109
2	140	0.8245	115
3	100	0.7487	75
4	150	0.6798	102
5	160	0.6173	99
		TOTAL	0

[5] Those who argue that one advantage of IRR compared to NPV is that you do not need to know the discount rate are delusional. You can only make sensible IRR decisions if you know the hurdle rate you are trying to exceed.

10.13% is the Internal Rate of Return.

The natural appeal of a metric which summarises the project in terms of a percentage return is often cited as a key strength of IRR, particularly to non-financial managers. If the firm wants a return of 10% and the project delivers 20%, it is easy to understand that the project is viable. However, there are two technical problems which financial managers should not overlook.

7.1 Problems with IRR and ideas for solutions

First, it is only possible to calculate a unique value for the IRR if the project being evaluated is characterised by a series of investment outflows followed by a series of investment inflows. Fortunately, this is the norm.

For example, there are two values for IRR if there is a single net intermediate cash outflow in one period occurring after one or more periods with a cash inflow. If there are multiple changes of net cash inflows and outflows, there are no solutions.

Example 9: Two IRR solutions

The following set of cash flows are identical on a nominal basis but have been discounted at 2 different rates, one at 100% and one at 200%. These two rates are both solutions for IRR.

Year	Cash flow	Discount	CF x D
0	(1,000)	1.0000	(1,000)
1	6,000	0.3333	2,000
2	(11,000)	0.1111	(1,222)
3	6,000	0.0370	222
		TOTAL	0

Year	Cash flow	Discount	CF x D
0	(1,000)	1.000	(1,000)
1	6,000	0.500	3,000
2	(11,000)	0.250	(2,750)
3	6,000	0.125	750
		TOTAL	0

It is quite easy to find cash flow sets that have no IRR solution.

However this problem is relatively easy to circumvent – the intermediate outflows can be discounted back to time 0[6], so that once again we have investment outflows followed by inflows. Although this complicates the calculation, this adjustment preserves the intuitive attractiveness of IRR.

The second technical issue is the re-investment problem. IRR assumes that any intermediate cash flows generated by the project are reinvested at the IRR. This is a potential problem if

[6] The WACC is usually used for this purpose in ungeared analysis.

the IRR is very high, particularly if it is significantly higher than the company's average project which is the most likely use of the cash flows being generated. The NPV method assumes that intermediate cash flows are reinvested at the chosen discount rate, a significant advantage over IRR as this is a much more realistic scenario. One suggested solution to this problem is the Modified IRR or MIRR which assumes that intermediate cash flows are reinvested at the hurdle rate. This results in a terminal value at the end of the project and the MIRR is the IRR of this terminal value. MIRR is available in Excel.

Nevertheless IRR is still widely used. Not only is it well understood by non-financial managers but, in the right hands, it is also useful in establishing just how good a project is by comparison to normal returns in the industry. However, this should prompt questions about why the project is better or worse than average and ideally should always be used in conjunction with NPV. Read 2.2.1b, an article by Mckinsey, for more issues with IRR.

Interestingly, IRR is also widely used by private equity houses, particularly when reporting fund performance to their investors. Beware inflated IRR claims.

8 Capital rationing and the profitability index (PI)

This is sometimes used in conjunction with NPV particularly where there is a limitation on investment capital.

In theory the size and cost of the project should not matter. If we assume the existence of perfect capital markets, then firms will always be able to raise funds for all projects that have positive NPVs. Companies should be able to raise appropriate amounts of equity and debt to fund all viable projects.

However, the reality is different. In many ways the real limiting resource is management time. Management can only effectively manage so many projects. They may impose their own limits to facilitate orderly capital budgeting, planning and financing or these limits may be imposed on them by their lenders.

PI enables the firm to identify those projects which return the highest NPV for the smallest investment outlay. The firm can then rank its projects and invest in those which maximise total NPV while complying with its investment capital limit.

Unfortunately, there are several definitions, some considering the investment outlay in the current period and others considering the total investment outlay. Clearly with the first of these, it is easier to ensure compliance with the capital limit, but it ignores future periods which might require additional outlay and which might also be subject to capital rationing. The second approach takes future investment into account, but obscures how much investment is required in a particular period which was, after all the initial point of the exercise, although this approach might be more useful where a company is always seeking to minimise its investment expenditure.

Single Period

$$PI = \frac{\text{Project NPV}}{\text{Initial Investment}}$$

Multi Period

$$PI = \frac{\text{Project NPV}}{\text{PV(Investment Cash Flows}}$$

or

$$PI = \frac{\text{PV(Cash Inflows)}}{\text{PV(Investment Cash Flows)}}$$

Example 10: PI Calculations

ANG has a project with a single initial investment cost of £300m and a NPV of £50m. The present value of cash inflows must be £350m.

$$PI = \frac{\text{Project NPV}}{\text{PV}(\text{Investment Cash Flows})} = \frac{50}{300} = 0.17$$

$$PI = \frac{\text{Project}(\text{Cash Inflows})}{\text{PV}(\text{Investment Cash Flows})} = \frac{350}{500} = 1.17$$

As you can see the difference between the two formulae is that the second returns a value for PI which is higher by 1 as the numerator excludes the PV of the investment cash flows – the value of the denominator.

However, both enable the firm to rank projects so that they can identify those projects which maximise NPV for the minimum capital outlay.

Example 11: Profitability Index

GTH GmbH has only €5 million to spend at time zero, and has the following projects available, none of which are mutually exclusive. Which should it choose?

Project	Capital Cost (initial investment) €000	GPV €000	PI	Ranking by PI
A	3,000	3,550	1.18	4th
B	2,000	2,490	1.25	1st
C	2,500	2,860	1.14	5th
D	1,500	1,855	1.24	2nd
E	1,500	1,850	1.23	3rd

(GPV = 'Gross present value' = Present value of all cash flows except the initial investment)

The best use of the €5m is to accept projects B, D and E giving a total NPV of €1,195,000 (€490,000 + €355,000 + €350,000 = €1,195,000). This is €155,000 more than if we rank on the basis of the highest NPV.

9 Other advantages of NPV analysis v IRR

Another significant advantage of NPV over IRR is that different discount rates can be used for different periods. This is not possible with IRR which calculates a unique rate of return for the entire project.

10 Payback and discounted payback

Payback is a very simple technique which establishes the number of years until all outlays have been recouped on an un-discounted basis.

Example 12: Payback
We reprise the investment proposed by LJI with the following characteristics:

Investment, time 0	500
Post tax return, year 1	120
Post tax return, year 2	140
Post tax return, year 3	100
Post tax return, year 4	150
Post tax return, year 5	160

Payback in this case is around 3.95 years.

Although a very blunt instrument, this simple measure captures a key aspect of risk. The longer the project life, the greater the risk of errors in the forecast project cash flows. Many companies have payback criteria and there is a strong case for including payback data in the investment appraisal process.

We would not advocate its use in isolation although it is commonly used in Japan where inflation has traditionally been low and therefore the effects of discounting are less apparent. However, it does overcome a major weakness in both NPV and IRR analysis. Analysis using NPV or IRR could return very positive data, yet all the returns may be back-ended. Using payback highlights this long-tail problem.

A further refinement is to use discounted payback. Discounted payback establishes the number of years until all outlays have been recouped on a discounted basis, i.e. it calculates the year in which a project turns NPV positive. This is arguably a very useful measure.

Example 13: Discounted payback
The LJI investment has the following characteristics:

Investment, time 0	500

Post tax return, year 1	120
Post tax return, year 2	140
Post tax return, year 3	100
Post tax return, year 4	150
Post tax return, year 5	160

It assumes a WACC of 8%. The NPV is calculated as follows:

Year	Cash flow	Discount	CF x D
0	(500)	1.0000	(500)
1	120	0.9259	111
2	140	0.8573	120
3	100	0.7938	79
4	150	0.7350	110
5	160	0.6806	109
		TOTAL	30

Discounted payback is around 4.75 years.

11 Return on capital employed (ROCE)

ROCE is commonly used within companies to assess performance, albeit usually on an aggregate basis, rather than on a project-by-project basis. Unlike discounted cashflow methods, the required data is usually produced by the accounting system and management is very familiar with the level of return they are expected to deliver.

However, although a good capital appraisal process might include ROCE data for the project on a periodic basis, it is not a reliable method for assessing projects when set alongside NPV and IRR.

In particular, ROCE takes no account of the time value of money and is affected by accounting estimates, particularly depreciation policies. Additionally, ROCE is very difficult to use when the capital invested in a project is low, e.g. where the plant is leased. Returns in such cases can look spectacular.

Read 'Assessing Accounting Return Approaches' on page 191 from Applied Corporate Finance, by Aswath Damodaran, 4th edition, which goes into this in more detail.