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TRADITIONAL APPRAISAL TECHNIQUES

Introduction

The payback and accounting rate of return (ARR) methods of evaluating capital investment proposals have historically been, and continue to be, very popular approaches, despite the best efforts of a number of writers to denigrate them. It is important to understand the disadvantages of these methods, but it is also useful to be aware of why practical business people still see a great deal of merit in observing the outcome of these calculations.

What appraisal techniques do businesses use?

A number of surveys enquiring into the appraisal methods used in practice have been conducted over the past 20 years. The results from surveys conducted by Pike and by the author jointly with Panos Hatzopoulos are displayed in Table 3.1. Some striking features emerge from these and other studies. Payback remains in wide use, despite the increasing application of discounted cash flow techniques. Internal rate of return is at least as popular as net present value. However, NPV is gaining rapid acceptance. Accounting rate of return continues to be the laggard, but is still used in over 50 percent of large firms. One observation that is emphasized in many studies is the tendency for decision-makers to use more than one method. In the 1997 study, 67 percent of firms use three or four of these techniques. These methods are regarded as being complementary rather than competitors.

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There is an indication in the literature that while some methods have superior theoretical justification, other, simpler, methods are used for purposes such as communicating project viability and gaining commitment throughout an organization. It is also suggested that those who sponsor and advance projects within organizations like to have the option of presenting their case in an alternative form which shows the proposal in the best light.

Another clear observation from the literature is that small and medium-sized firms use the sophisticated formal procedures less than their larger brethren.

Payback

The payback period for a capital investment is the length of time before the cumulated stream of forecasted cash flows equals the initial investment.

The decision rule is that if a project's payback period is less than or equal to a predetermined threshold figure it is acceptable. Consider the case of Tradfirm's three mutually exclusive proposed investments (*see* Table 3.2):

TABLE 3.1
Appraisal techniques used

	Proportion of companies using technique							
	Pike surveys[a]				Arnold and Hatzopoulos survey[b]			
	1975	1980	1986	1992	1997			
	%	%	%	%	Small %	Medium %	Large %	Total %
Payback	73	81	92	94	71	75	66	70
Accounting rate of return	51	49	56	50	62	50	55	56
Internal rate of return	44	57	75	81	76	83	84	81
Net present value	32	39	68	74	62	79	97	80

Capital budget (per year) for companies in Arnold and Hatzopoulos study approx.

Small: £1–50m. Medium: £1–100m. Large: £100m+

Notes

(a) Pike's studies focus on 100 large UK firms.

(b) In the Arnold and Hatzopoulos study (2000), 300 finance directors of UK companies taken from *The Times* 1000 (London: Times Books), ranked according to capital employed (excluding investment trusts), were asked dozens of questions about project appraisal techniques, sources of finance and performance measurement. The first 100 (large size) of the sample are the top 100; another 100 are in the rankings at 250–400 (medium size); the final 100 are ranked 820–1,000 (small size). The capital employed ranges between £1.3bn and £24bn for the large firms, £207m and £400m for the medium-sized firms, and £40m and £60m for the small companies. Ninety-six usable replies were received: 38 large, 24 medium and 34 small.

Sources: R.H. Pike (1988) 'An empirical study of the adoption of sophisticated capital budgeting practices and decision making effectiveness', *Accounting and Business Research*, 18 (72), Autumn, pp. 341–51. R.H.Pike (1996) 'A longitudinal survey of capital budgeting practices', *Journal of Business Finance and Accounting*, 23(1), pp.79–92. Arnold and Hatzopoulos (2000) 'The theory practice gap in capital budgeting: evidence from the United Kingdom' *Journal of Business Finance and Accounting*, 27(5) and (6), June/July, pp. 603–26.

TABLE 3.2
Tradfirm

	Cash flows (£m)						
Points in time (yearly intervals)	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Project A	–10	6	2	1	1	2	2
Project B	–10	1	1	2	6	2	2
Project C	–10	3	2	2	2	15	10

Note: Production ceases after six years, and all cash flows occur on anniversary dates.

There is a boardroom battle in Tradfirm, with older members preferring the payback rule. They set four years as the decision benchmark. For both A and B the £10m initial outflow is recouped after four years. In the case of C it takes five years for the cash inflows to cumulate to £10m. Thus payback for the three projects is as follows:

Project A:	4 years
Project B:	4 years
Project C:	5 years

If the payback rule is rigidly applied, the older members of the board will reject the third project, and they are left with a degree of indecisiveness over whether to accept A or B. The younger members prefer the NPV rule and are thus able to offer a clear decision.

Tradfirm: Net Present Values (£m)

$$\text{Project A} \quad -10 + \frac{6}{1.1} + \frac{2}{(1.1)^2} + \frac{1}{(1.1)^3} + \frac{1}{(1.1)^4} + \frac{2}{(1.1)^5} + \frac{2}{(1.1)^6} = £0.913\text{m}$$

$$\text{Project B} \quad -10 + \frac{1}{1.1} + \frac{1}{(1.1)^2} + \frac{2}{(1.1)^3} + \frac{6}{(1.1)^4} + \frac{2}{(1.1)^5} + \frac{2}{(1.1)^6} = -£0.293\text{m}$$

$$\text{Project C} \quad -10 + \frac{3}{1.1} + \frac{2}{(1.1)^2} + \frac{2}{(1.1)^3} + \frac{2}{(1.1)^4} + \frac{15}{(1.1)^5} + \frac{10}{(1.1)^6} = £12.208\text{m}$$

Note: The discount rate is 10 percent.

Project A has a positive NPV and is shareholder wealth-enhancing. Project B has a negative NPV; the firm would be better served by investing the £10m in the alternative that offers a 10 percent return. Project C has the largest positive NPV so it creates most shareholder wealth.

Drawbacks of payback

- It makes no allowance for the time value of money. It ignores the need to compare future cash flows with the initial investment after they have been discounted to their present values.
- Receipts beyond the payback period are ignored. This problem is particularly obvious in the case of Project C.
- The arbitrary selection of the cut-off point. There is no theoretical basis for setting the appropriate time period and so guesswork, whim and manipulation take over.

Discounted payback

With discounted payback the future cash flows are discounted prior to calculating the payback period. This is an improvement on the simple payback method in that it takes into account the time value of money. In Table 3.3 the *discounted* cash inflows are added together to calculate payback. In the case of Project B the discounted cash inflows never reach the level of the cash outflow.

This modification tackles the first drawback of the simple payback method but it is still necessary to make an arbitrary decision about the cut-off date and it ignores cash flows beyond that date.

TABLE 3.3
Discounted payback: Tradfirm plc (£m)

Points in time (yearly intervals)	0	1	2	3	4	5	6	Discounted payback
Project A								
Undiscounted cash flow	–10	6	2	1	1	2	2	
Discounted cash flow	–10	5.45	1.65	0.75	0.68	1.24	1.13	Year 6
Project B								
Undiscounted cash flow	–10	1	1	2	6	2	2	Outflow –10m
Discounted cash flow	–10	0.909	0.826	1.5	4.1	1.24	1.13	Inflow +£9.7m
Project C								
Undiscounted cash flow	–10	3	2	2	2	15	10	
Discounted cash flow	–10	2.72	1.65	1.5	1.37	9.3	5.64	Year 5

Note: The discount rate is 10 percent

Reasons for the continuing popularity of payback

Payback remains a widely used project appraisal method despite its drawbacks. This requires some explanation.

- The first fact to note is that payback is rarely used as the primary investment technique, but rather as a secondary method which supplements the more sophisticated methods. Although it appears irrational to employ payback when the issue is examined in isolation, we may begin to see the logic behind its use if we take into account the organizational context and the complementary nature of alternative techniques. For example, payback may be used at

an early stage to filter out projects that have clearly unacceptable risk and return characteristics. Identifying those projects at a preliminary stage avoids the need for more detailed evaluation through a discounted cash flow method, thus increasing the efficiency of the appraisal process. This early sifting has to be carefully implemented to avoid premature rejection.

- Payback also has one extraordinarily endearing quality to busy managers: it is simple and easy to use. Executives often admit that the payback rule, used indiscriminately, does not always give the best decisions, but it is the simplest way to communicate an idea of project profitability. NPV is difficult to understand, so it is useful to have an alternative measure which all managers can follow. In the workplace a project's success often relies on the gaining of widespread employee commitment. Discussion, negotiation and communication of ideas often need to be carried out in a simple form so that non-quantitative managers can make their contribution and, eventually, give their commitment. Communication in terms of the sophisticated models may lead to alienation and exclusion and, ultimately, project failure.

Payback is simple and easy to use.

- Another argument advanced by practitioners is that projects that return their outlay quickly reduce the exposure of the firm to risk. In the world beyond the simplifications needed in academic exercises there is a great deal of uncertainty about future cash flows. Managers often distrust forecasts for more distant years. Payback has an implicit assumption that the risk of cash flows is directly related to the time distance from project implementation date. By focusing on near-term returns this approach uses only those data in which management have greatest faith. Take the case of the internet service provider (ISP) industry. Here, competitive forces and technology are changing so rapidly that it is difficult to forecast for eight months ahead, let alone for eight years, so managers may choose to ignore cash flow projections beyond a certain number of years. Those who advocate NPV counter this approach by saying that risk is accounted for in a better way in the NPV model than is done by simply excluding data. Adjusting for risk in NPV calculations is considered in Chapter 5.
- A further advantage of payback, as perceived by many managers, is its use in situations of capital shortage. If funds are limited, there is an advantage in receiving a return on projects earlier rather than later, as this permits investment in other profitable opportunities. But, as we have seen with Project 3, relying solely on payback because of the speedy return of capital can result in the sacrifice of massive cash flows just after the cut off.

This section is not meant to promote the use of payback. It remains a theoretically inferior method to the discounted cash flow approaches. Payback has a number of valuable attributes, but the primary method of project appraisal in most organizations should take into account all of the relevant cash flows and then discount them.

Accounting rate of return

The accounting rate of return (ARR) method may be known to readers by other names such as the return on capital employed (ROCE) or return on investment (ROI). The ARR is a ratio of the accounting profit to the investment in the project, expressed as a percentage.

The *decision rule* is that if the ARR is greater than, or equal to, a hurdle rate then accept the project.

This ratio can be calculated in a number of ways, but the most popular approach is to take profit after deduction of depreciation. For the investment figure we regard any increases in working capital as adding to the investment required. Three alternative versions of ARR are calculated for Timewarp plc which give markedly different results (*see* Worked Example 3.1). These are just three of all the possible ways of calculating ARR – there are many more. The fact that there are many ways of calculating a measure of project valuation and performance should be ringing alarm bells – 'choose your result by choosing your method of calculation' is not a sound basis for decision-making.

Worked example 3.1
TIMEWARP PLC

Timewarp is to invest £30,000 in machinery for a project which has a life of three years. The machinery will have a zero scrap value and will be depreciated on a straight-line basis.

Accounting rate of return, version 1 (annual basis)

$$\text{ARR} = \frac{\text{Profit for the year}}{\text{Asset book at start of year}} \times 100$$

Time (year)	1	2	3
	£	£	£
Profit before depreciation	15,000	15,000	15,000
Less depreciation	10,000	10,000	10,000
Profit after depreciation	5,000	5,000	5,000
Value of asset (book value)			
Start of year	30,000	20,000	10,000
End of year	20,000	10,000	0

Accounting rate of return $\frac{5{,}000}{30{,}000} = 16.67\%$ $\frac{5{,}000}{20{,}000} = 25\%$ $\frac{5{,}000}{10{,}000} = 50\%$

On average the ARR is: $1/3 \times (16.67 + 25 + 50)\% = 30.55\%$.

Note the illusion of an annual rise in profitability despite the profits remaining constant.

Accounting rate of return, version 2 (total investment basis)

$$\text{ARR} = \frac{\text{Average annual profit}}{\text{Initial capital invested}} \times 100$$

$$\text{ARR} = \frac{(5{,}000 + 5{,}000 + 5{,}000)/3}{30{,}000} \times 100 = 16.67\%$$

Accounting rate of return, version 3 (average investment basis)

$$\text{ARR} = \frac{\text{Average annual profit}}{\text{Initial capital invested}} \times 100$$

$$\text{Average capital invested: } \frac{30{,}000}{2} = 15{,}000$$

(at time 0 the machinery has a value of £30,000, three years later it has a value of zero. If we assume constant devaluation then the average value of the machinery is £15,000)

$$\text{ARR} = \frac{(5{,}000 + 5{,}000 + 5{,}000)/3}{15{,}000} \times 100 = 33.33\%$$

Drawbacks of accounting rate of return

- The number of alternative ARR calculations can be continued beyond the three possibilities described in Worked Example 3.1. Each alternative would be a legitimate variant and would find favor with some managers and accountants. The almost wide-open field for selecting profit and asset definitions is a major weakness of ARR. This flexibility may tempt decision-makers to abuse the technique to suit their purposes.
- The inflow and outflow of cash should be the focus of investment analysis appraisals. Profit figures are very poor substitutes for cash flow because they frequently fail to show when cash is received and when it flows out. For example, a £10m machine purchase this year is a cash outflow of £10m, but may result in a depreciation entry for the profit and loss account of only £1m. The £9m difference is merely one of hundreds of accounting entries that make profit figures inappropriate for project evaluation. Another area of concern is working capital. For example, a project requiring an increase in inventory (e.g. raw material) will see an outflow of cash for this purpose, but the accountant's profit calculations for the project do not change just because one

current asset, i.e. cash, has been used up, because it has been replaced by an equal amount of another asset, i.e. inventory, such as raw materials. There is no effect on profit but there could be a large effect on cash flow. Shareholders wealth depends on when cash goes in and when it comes out. The same issue exists for cash used to increase the level of trade debtors or the release of cash by using supplier cash to finance the business (by increasing trade credit).

- The most important criticism of accounting rate of return is that it fails to take account of the time value of money. There is no allowance for the fact that cash received in Year 1 is more valuable than an identical sum received in Year 3.
- There is a high degree of arbitrariness in defining the cut-off or hurdle rate. There is no sound logical reason for selecting 10, 15 or 20 percent as the acceptable ARR. It is a case of picking a number from the air. However, NPV has a firm logical base to the discount rate used by the company for a project. It is the opportunity cost of the suppliers of capital. We examine its calculation in Chapter 10.
- Accounting rate of return can lead to some perverse decisions. For example, suppose that Timewarp use the second version, the total investment ARR, with a hurdle rate of 15 percent, and the appraisal team discover that the machinery will in fact generate an additional profit of £1,000 in a fourth year. Common sense suggests that if all other factors remain constant this new situation is better than the old one, and yet the ARR declines to below the threshold level (15 percent) because the profits are averaged over four years rather than three and the project is therefore rejected.

The original situation is:

$$\text{ARR} = \frac{(5{,}000 + 5{,}000 + 5{,}000)/3}{30{,}000} \times 100 = 16.67\% \qquad \textbf{Accepted}$$

The new situation is:

$$\text{ARR} = \frac{(5{,}000 + 5{,}000 + 5{,}000 + 1{,}000)/4}{30{,}000} \times 100 = 13.33\% \qquad \textbf{Rejected}$$

An alternative way of viewing this problem is to think of two projects that are identical except that one offers the additional £1,000. If only one project can be accepted which will the managers go for? If they are motivated by ARR (e.g. by bonuses related to ARR achieved) they may be inclined to accept the project that offers the highest ARR even if this means sacrificing £1,000 of shareholders' money.

Reasons for the continued use of accounting rate of returns

Table 3.1 shows that over one-half of large firms calculate ARR when appraising projects, so the conclusion must be that in the practical world of business, some merit is seen in this technique. One possible explanation is that managers are

familiar with this ancient and extensively used profitability measure. The financial press regularly report accounting rates of return. Divisional performance is often judged on a profit-to-assets employed ratio. Indeed, the entire firm is often analyzed and management evaluated on this ratio. Because performance is measured in this way, managers have a natural bias towards using it in appraising future projects. Conflicting signals are sometimes sent to managers controlling a division. They are expected to use a discounted cash flow approach for investment decisions, but find that their performance is being monitored on a profit-to-investment ratio basis. This dichotomy may produce a resistance to proposed projects that produce low returns in the early years and thus report a low ARR to head office. This may result in excellent long-term opportunities being missed.

Internal rate of return: reasons for continued popularity

Table 3.1 shows that firms use IRR as much as the theoretically superior NPV. Given the problems associated with IRR described in Chapter 2, this may seem strange. It is all the more perplexing if one considers that IRR is often more difficult to calculate manually than NPV (although, with modern computer programs, the computational difficulties virtually disappear). Some possible explanations follow.

- ***Psychological*** Managers are familiar with expressing financial data in the form of a percentage. It is intuitively easier to grasp what is meant by an IRR of 15 percent than, say, an NPV of £2,000.
- ***IRR can be calculated without knowledge of the required rate of return*** Making a decision using the IRR involves two separate stages. Stage 1 involves gathering data and then computing the IRR. Stage 2 involves comparing this with the cut-off rate. By contrast, it is not possible to calculate NPV without knowing the required rate of return. The proposal has to be analyzed in one stage only. In a large company it is possible for senior managers to request that profit centers and divisions appraise projects on the basis of their IRRs, while refusing to communicate in advance the rate of return required. This has at least two potential advantages. First, the required rate may change over time and it becomes a simple matter of changing the cut-off comparison rate at head office once the IRR computations are received from lower down the organization. With NPV, each project's cash flows would need to be calculated again at the new discount rate. Secondly, managers are only human and there is a tendency to bias information passed upwards so as to achieve their personal goals. For instance, it has been known for ambitious managers to be excessively optimistic concerning the prospects for projects that would lead to an expansion

of their domain. If they are provided with a cut-off rate prior to evaluating projects you can be sure that all projects they sponsor will have cash flows 'forecasted' to produce a return greater than the target. If the head office team choose not to communicate a cut-off rate, this leaves them free to adjust the required return to allow for factors such as over-optimisim. They may also adjust the minimum rate of return for perceived risk associated with particular projects or divisions.

- ***Ranking*** Some managers are not familiar with the drawbacks of IRR and believe that ranking projects to select between them is most accurately and most easily carried out using the percentage-based IRR method. This was, in Chapter 2, shown not to be the case.

Conclusion

We can see why most firms use three or four measures when evaluating the return on a project. Payback, ARR and IRR provide alternative perspectives, and are useful for communicating project viability to a wide range of team members. However, the preferred method for the final decision must be NPV in a rationally managed, shareholder wealth-oriented company.