

The Institute of Chartered Accountants of Sri Lanka

Executive Diploma in Accounting, Business and Strategy

Quantitative Methods for Business Studies

Handout 06: Investment Appraisal

Importance of Investment appraisal

Most businesses spend money on new fixed assets in the form of capital expenditure. Capital investments involve expenditure on fixed assets that provides returns. Investment Appraisal is the use of scientific decision-making tools to analyse whether a proposed future investment should go ahead.

There are various reasons why capital expenditure might be desirable and these can be categorized into the following types

- **Maintenance**
This is spending on new assets to replace worn-out assets or obsolesces. This could also be spending on existing fixed assets to improve safety and security features.
- **Profitability**
This is spending on new assets to improve profitability of existing business, to achieve cost savings, quality improvement and improved productivity.
- **Expansion**
This is spending to expand the business, to make new products, open new outlets, and invest in research and development.

Investment appraisal techniques

There are 5 techniques that involve a comparison of the cost of investment project with the expected return in the future.

- **Payback**
The time taken to recover the initial cost of the investment.
- **Average Rate of Return (ARR)**
The profits earned on investment expressed as a % of the cost of initial investment.
- **Net Present Value (NPV)**
The total returns from an investment in today's terms.
- **Internal Rate of Return (IRR)**
A discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero
- **The discounted Payback**
Number of years taken to break even from undertaking the initial expenditure, by discounting future cash flows and recognizing the time value of money.

From the above methods, the payback method and the ARR do not consider the time value of money.

Payback Method.

Payback measures the time taken to payback the initial cost of the investment. This includes calculating the year and month in which it will be paid back. This method is commonly used by businesses due to its simplicity. However, rarely used on its own.

Exercises:

1. A project has the following cash flows

Year Cash flow Rs000

1	(1900)
2	500
3	300
4	500
5	600
6	300
7	200

Find the payback period of the initial investment.

2. A company plans to buy a new machine costing Rs.5, 000,000 which is expected to bring in new revenues of Rs 1,000,000 in the following year and then Rs150, 000 for each of the next four years.

There will be maintenance costs of

- Year 3: Rs.200,000
- Year 4: Rs.300,000
- Year 5: Rs.500,000

How long will it take to repay the initial investment?

Advantages of payback

- Simplicity – as a concept it is easily understood and easily calculated
- Payback favours project with quick returns- rapid paybacks lead to rapid returns
- Cash flows- it uses cash flows rather than profits
- Payback minimises risk- the shorter the payback period the less there is that can go wrong.)
- Rapid payback maximises liquidity
- Payback improves investment conditions
- Rapid payback leads to rapid company growth

Disadvantages of Payback

- It ignores project returns- cash flows arising after the payback period are totally ignored.
- Payback ignores profitability and concentrates on cash flows and liquidity.
- Time value of money is ignored because cash flows are categorized as pre-payback or post payback
- Payback takes into account of the effects on business profits and periodic performance of the project as evidenced in the financial statement

Accounting Rate of Return (ARR)

Accounting rate of return (also known as average rate of return) is the ratio of estimated accounting profit of a project to the average investment made in the project.

Formula

Accounting Rate of Return is calculated using the following formula:

$$\text{ARR} = \frac{\text{Average Accounting Profit}}{\text{Average Investment}}$$

Average accounting profit is the arithmetic mean of accounting income expected to be earned during each year of the project's life time. Average investment may be calculated as the sum of the beginning and ending book value of the project divided by 2. Another variation of ARR formula uses initial investment instead of average investment. A project is accepted only if its ARR is equal to or greater than the required accounting rate of return. In case of mutually exclusive projects, accept the one with highest ARR.

Exercises

1. An initial investment of Rs.130, 000 is expected to generate annual cash inflow of Rs32, 000 for 6 years. Depreciation is allowed on the straight line basis. It is estimated that the project will generate scrap value of Rs10, 500 at end of the 6th year. Calculate its accounting rate of return assuming that there are no other expenses on the project.
2. Compare the following two mutually exclusive projects on the basis of ARR. Cash flows and salvage values are in thousands of dollars. Use the straight line depreciation method.

Project A:

Year	0	1	2	3
Cash Outflow	-220			
Cash Inflow		91	130	105
Salvage Value				10

Project B:

Year	0	1	2	3
Cash Outflow	-198			
Cash Inflow		87	110	84
Salvage Value				18

Which project would you consider for investment?

Advantages of ARR

- Like payback period, this method of investment appraisal is easy to calculate.
- It recognizes the profitability factor of investment.

Disadvantages of ARR

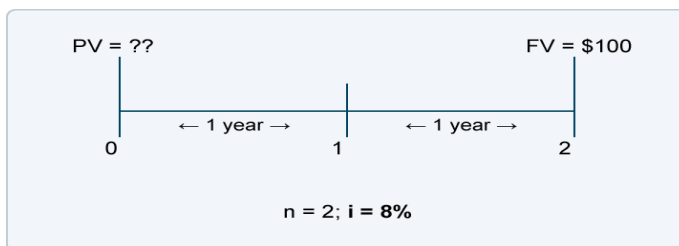
- It ignores time value of money. Suppose, if we use ARR to compare two projects having equal initial investments. The project which has higher annual income in the latter years of its useful life may rank higher than the one having higher annual income in the beginning years, even if the present value of the income generated by the latter project is higher.
- It can be calculated in different ways. Thus there is problem of consistency.
- It uses accounting income rather than cash flow information. Thus it is not suitable for projects which having high maintenance costs because their viability also depends upon timely cash inflows.

The time value of money

The time value of money is a basic financial concept that holds that money in the present is worth more than the same sum of money to be received in the future. This is true because money that you have right now can be invested and earn a return, thus creating a larger amount of money in the future.

Example

Let's assume we are to receive \$100 at the end of two years. How do we calculate the present value of the amount, assuming the interest rate is 8% per year compounded annually?



$$\begin{aligned} PV &= FV \times [1 \div (1 + i)^n] \\ PV &= \$100 \times [1 \div (1 + 0.08)^2] \\ PV &= \$100 \times [1 \div (1.08)^2] \\ PV &= \$100 \times [1 \div 1.1664] \\ PV &= \$100 \times [0.8573388] \leftarrow PV \text{ factor} \\ \mathbf{PV} &= \mathbf{\$85.73} \end{aligned}$$

$$PV = FV (1 + i)^{-n} \quad (\text{or}) \quad PV = FV \times [1 \div (1 + i)^n]$$

The factor by which the future cash flows are multiplied to compute their present values is called the PV factor or the discount factor. The present value of the future cash flows is called the discounted cash flows.

The investment appraisal techniques such as NPV, IRR and Discounted pay back use the discounted cash flows to evaluate investments.

Net Present Value (NPV)

NPV is the value obtained by discounting all cash outflows and inflows at the cost of capital. It's the sum of the present value (PV) of all the cash inflows from a project minus the PV of all cash outflows. The sum of the present value of all the cash flows from the project is the "Net" present value amount. The NPV is the sum of the present value (PV) of all the cash inflows from project minus the PV of all cash outflows.

Exercises.

1. Rug Limited is considering a capital investment in new equipment. The estimated cash flows are as follows

Year	cash flow Rs
0	(240,000)
1	80,000
2	120,000
3	70,000
4	40,000
5	20,000

The company's cost of capital is 9%. Calculate the NPV of the Project to assess whether it should be undertaken.

2. Two projects A and B are under consideration. Either A or B but not both may be accepted. The relevant discount rate is 10%. You are required to recommend A or B by Discounting each cash flow separately and calculating the NPVs for both projects

The cash flow is as follows

Time	Project A Rs.000s	Project B Rs 000s
0	(1500)	(2500)
1	500	500
2	600	800
3	700	1100
4	500	1100
5	Nil	500

Advantages of NPV

- Give importance to the time value of money
- Cash flows during the complete life time of project considered
- Helps maximising firm's value

Disadvantages of NPV

- Difficult to use
- Cannot give accurate decision if amounts of investments of two mutually exclusive projects differ
- May not give correct decision for projects with unequal lifetimes

Internal rate of return (IRR)

IRR is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero. Internal rate of return is used to evaluate the attractiveness of a project or investment. If the IRR of a new project exceeds a company's required rate of return, that project is desirable. If IRR falls below the required rate of return, the project should be rejected.

Exercise

Two projects have the following cash flows in Rs 000s:

Year	Project A	Project B
0	(1000)	(1000)
1	500	100
2	400	300
3	300	400
4	100	600

The NPV of both projects were calculated based on two levels of cost of capital as follows

Year	Dis. Factor @ 10%	Dis Factor @ 16%	Project A DCF @ 10%	Project A DCF @ 16%	Project B DCF @ 10%	Project B DCF @ 10%
0	1.000	1.000	-1000.00	-1000.00	-1000.00	-1000.00
1	0.909	0.862	454.55	431.03	90.91	86.21
2	0.826	0.743	330.58	297.27	247.93	222.95
3	0.751	0.641	225.39	192.20	300.53	256.26
4	0.683	0.552	68.30	55.23	409.81	331.37
		NPV	78.81	(24.27)	49.17	(103.21)

Find the IRR for both projects

Based on the selection criteria given below, which project will you accept?

When cost of capital > IRR, NPV < 0 → Reject

When cost of capital < IRR, NPV > 0 → Accept

Advantages of IRR

- Internal Rate of Return takes into account the total cash inflow and outflows.
- It gives much importance to the objective of maximizing shareholder's wealth

Disadvantages of IRR

- It involves tedious calculations.

Discounted Payback

The Payback Period analysis does not take into account the time value of money. To correct for this deficiency, the Discounted Payback Period method was created. This method discounts the future cash flows back to their present value so the investment and the stream of cash flows can be compared at the same time period.

Exercises.

1. A project involves an initial investment of Rs2, 324,000 is expected to generate Rs600, 000 per year for 6 years. Calculate the discounted payback period of the investment if the discount rate is 11%.
2. Calculate the Discounted cash flow and the NPV for the two projects given below. If only one out of the two can be chosen, which one should be chosen? Assume the cost of capital is 10%.

Timing	Project A	Project B
	NCF	NCF
Now	-100	-100
Year 1	60	20
Year 2	60	20
Year 3	40	40
Year 4	20	60
Year 5	20	60
Total	100	100

Advantages of discounted payback

Discounted payback period is more reliable than simple payback period since it accounts for time value of money. It is interesting to note that if a project has negative net present value it won't pay back the initial investment.

Disadvantage of discounted payback

It ignores the cash inflows from project after the payback period.