BS2551 Money Banking and Finance

Capital Budgeting

Capital budgeting techniques are decision rules used by managers when undertaking investment decisions. The best techniques should satisfy the following criteria:

I) All cash flows should be considered.

II) The cash flows should be discounted at the opportunity cost of capital.

III) From a number of mutually exclusive projects select the one that maximises shareholders' wealth.

IV) Managers should be able to consider each project independently of the other.

- *We assume that all projects have the same level of risk, since all cash flows are known with certainty.*

- There are four widely used capital budgeting techniques:

A) Payback Period (PP)

It is the time period taken to recover the initial cash outlay of a project.

If mutually exclusive projects: Choose the project with the shortest PP.

Problems: It violates properties I, II by not considering cash flows that arrive after the PP and by failing to discount cash flows within the PP.

Year	Project A (CF)	Project B (CF)
0	-100	-100
1	20	40
2	80	40
3	-200	20
Payback Period	2 years	3 years

Project A is preferred because it has a shorter payback period. This method fails to consider the negative cash flow of project A in year 3.

b) **Accounting Rate of Return (ARR)**

It is the average after-tax profit divided by the initial outlay of the project.

If mutually exclusive projects: Choose the one with the highest ARR.

Problems: It uses accounting profits instead of economic profits (cash flows) and does not consider the time value of money. Hence violating assumptions I and II.

Year	Project A (AP)	Project B (AP)
0	-100	-100
1	20	40
2	80	40
3	-200	40
ARR	-67%	7%

e.g

$$ARR_A = \frac{\left(-100+20+80-200\right)/3}{100} * 100 = -67\%$$

Choose project C, where ARR=7%.

c) Net Present Value (NPV)

It is computed by subtracting the initial cash outlay $\left(I_0\right)$ from the present value of the cash flows $\left(CF\right)$ discounted at the opportunity cost of capital.

$$NPV = \sum_{t=1}^{N} \frac{CF_t}{\left(1+k\right)^t} - I_0$$

where K is the opportunity cost of capital and N is the time period of the project (years).

If mutually exclusive projects choose the one with the highest NPV.

If independent projects choose the projects with NPV>0.

Problems: NPV shortcomings stem from the assumptions of certainty in future cash flows and pre-commitment. Pre-commitment implies that

managers cannot defer investment into a project or extend the life of a project.

Year	A (CF)	B (CF)	C (CF)
0	-1000	-1000	-1000
1	100	0	100
2	900	0	200
3	100	300	300
4	100	700	400
5	400	1300	1250

Assuming the cost of capital is 10% (K=0.1)

$$NPV_A = -1000 + \frac{100}{(1+0.1)} + \frac{900}{(1+0.1)^2} + \frac{100}{(1+0.1)^3} + \frac{100}{(1+0.1)^4} + \frac{400}{(1+0.1)^5}$$

= -406.83<0 (reject the project).

$$NPV_B = -1000 + \frac{0}{(1+0.1)} + \frac{0}{(1+0.1)^2} + \frac{300}{(1+0.1)^3} + \frac{700}{(1+0.1)^4} + \frac{1300}{(1+0.1)^5}$$

= 510.7>0.

$$NPV_C = -1000 + \frac{100}{(1+0.1)} + \frac{200}{(1+0.1)^2} + \frac{300}{(1+0.1)^3} + \frac{400}{(1+0.1)^4} + \frac{1250}{(1+0.1)^5}$$

$= 530.85 > 0.$

Project A is rejected, if mutually exclusive choose project C because has maximum NPV.

d) Internal Rate of Return (IRR)

It is the rate, which equates the present value of cash outflows and inflows and sets NPV equal to zero. Thus, it is the rate of return on invested capital that the project is returning to the firm.

Mathematical we obtain the numerical solution of IRR when we set NPV=0.

$$NPV = \sum_{t=1}^{N} \frac{CF_t}{\left(1+IRR\right)^t} - I_0 = 0$$

If mutually exclusive projects choose the project with the highest IRR.

If Independent projects choose the project with IRR>k, where k is the opportunity cost of capital.

Year	A (CF)	B (CF)
0	-100	-350
1	225	400
2	0	100

K=10%

$$\frac{225}{(1+IRR_A)}=100 \Leftrightarrow 1+IRR_A=2.25$$

$$IRR_A=1.25=125\%.$$

$$\frac{400}{1+IRR_B}+\frac{100}{(1+IRR_B)^2}-350=0$$

$$400\left(1+IRR_B\right)+100=350(1+IRR_B)^2$$

set $x=1+IRR_B$:

$$350x^2-400x-100=0 \Leftrightarrow \frac{-(-400)\pm\sqrt{(-400)^2-4(350)(-100)}}{2(350)}$$

X=1.35 or –0.21. Therefore, IRR of project B is either 0.35 (35%) or –1.21 (-121%).

Therefore $IRR_B=35\%$ (the negative IRR has no economic meaning.

If independent projects both will be accepted since $IRR_A>K,\ IRR_B>K$

If mutually exclusive choose project A since: $IRR_A>IRR_B>K$

Problems:

- IRR assumes that the opportunity cost of capital (k) is constant throughout the lifetime of the project.

- Multiple rates of return.

Year	CF
0	-1600
1	10000
2	10000

K=30%

$$\frac{10000}{1+IRR}+\frac{10000}{(1+IRR)^2}-1600=0$$

IRR of the project is either 0.25 (25%) or 40 (400%).

Thus if IRR is 25% we reject the project, if its 400% we accept the project. Therefore, the IRR offers conflicting evidence.

Conclusion

- The PP and ARR techniques have many shortcomings and can therefore not be used for investment decisions by managers.

- The NPV and IRR techniques can be used because they compute the effect on shareholder wealth if a project is undertaken. Due to the problems of the IRR over the NPV method, NPV is the most reliable capital budgeting technique.