IRR (Internal rate of return) and Capital Budgeting Decisions

→ IRR is the discount rate such that $NPV = 0$

⟹ NPV rule → Accept a project if $NPV > 0$

→ IRR rule → accept a project if $IRR > r$. (discount rate)

eg. Assume $C_0 = -100$ \$, $C_1 = 110$, Calculate IRR

⟶ $NPV = -100 + \dfrac{110}{1+r}$

$0 = -100 + \dfrac{110}{1+IRR}$ ⟹ $IRR = 10\%$.
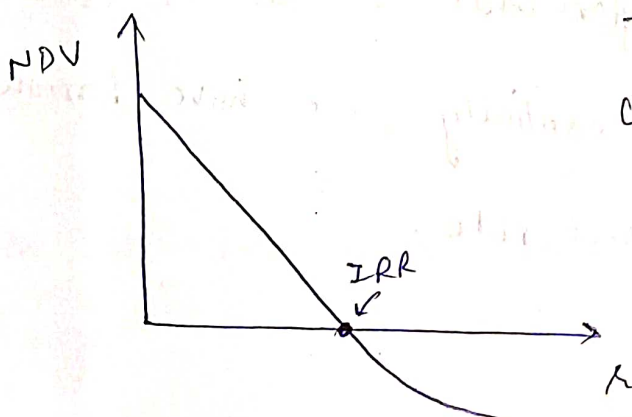
→ If given $r = 8\%$.

→ IRR rule says accept.

⟶ $NPV = -100 + \dfrac{110}{1+0.08} = 1.85 > 0$,

↳ NPV rule also says accept.

⟹ NPV v/s IRR.

In this case where the curve looks like this, NPV rule and IRR

when will NPV and IRR rule not agree.
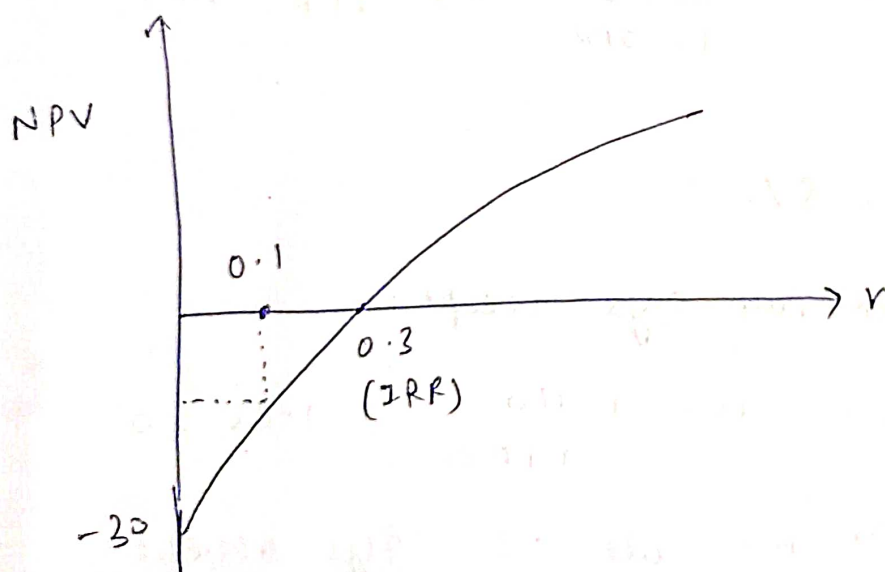
eg. $C_0 = 100\$$ $C_1 = -130\$$, $r = 10\%$.

$$NPV = 100 - \frac{130}{1+r}$$

$IRR = 30\%$.

At $r = 10\%$. $NPV < 0$, thus reject
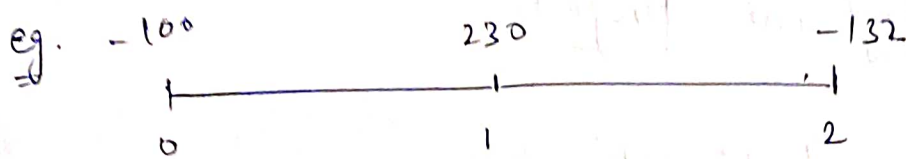
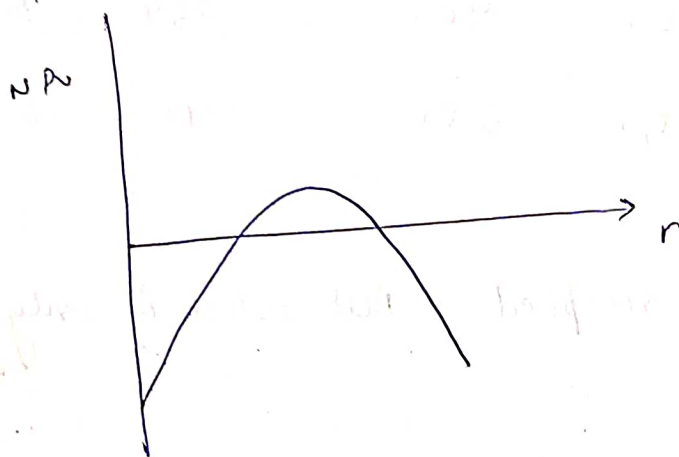$IRR > r$, thus accept.

IRR and NPV rules disagree here.

In this project, we initially get 100 $ and then pay 130 $ afterwards. This is called a financing project. Essentially, we have borrowed 100 $ at 30% interest rate.

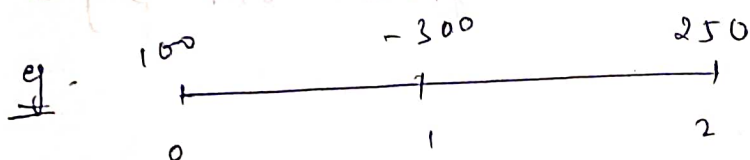For financing project, we want a low rate of borrowing interest. IRR rule does not work here.

eg.

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    -100              230                -132            (Mix b/w
    ├─────────────────┼──────────────────┤               financing &
    0                 1                  2                  investing)
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$$NPV = -100 + \frac{230}{1+\lambda} - \frac{132}{(1+\lambda)^2}$$

Can't use IRR rule here.

eg.

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      100            -300              250
    ├────────────────┼─────────────────┤
    0                1                 2
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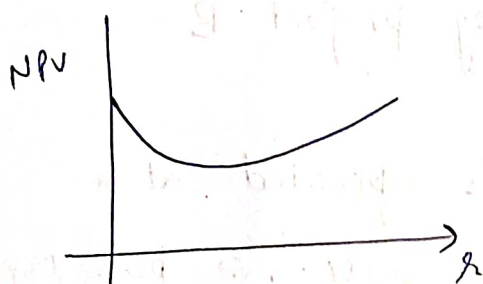
$$NPV = 100 - \frac{300}{1+\lambda} + \frac{250}{(1+\lambda)^2}$$

NPV always > 0.

No IRR, so can't apply IRR rule.

⟹ In all IRR rule does not give correct answer always.

IRR and NPV rule agree when the projects are investing projects.

→ Comparing different projects

     ↳ IRR is problematic here.

$n = 10\%$

eg.

Project	C_0	C_1	NPV	IRR
A	−100	400	264	300%
B	−250	650	341	160%

Both projects can be accepted. But what if only one can be chosen?

Do we pick greater NPV or greater IRR project?

Ans is NPV.

Project B should be chosen because value of company is increased more by project B.

$IRR_A > IRR_B$ ⎤ B is operated at a
$NPV_B > NPV_A$ ⎦ larger scale., so percentage return maybe less but total value to company is increasing.

eg.

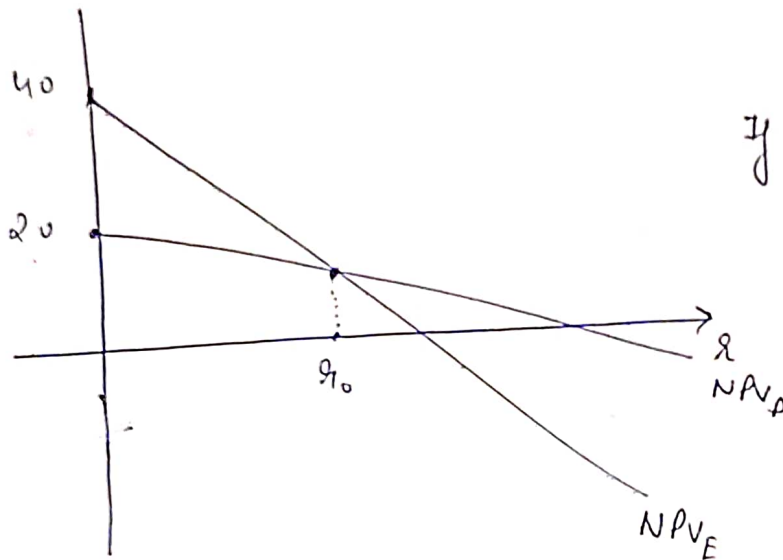| Projects	C_0	C_1	C_2	C_3
D	-100	100	10	10
E	-100	10	10	120

which project is better.? Depends on r.

$IRR_D > IRR_E$

If $r < r_0$

$NPV_E > NPV_D$

Thus, project E is better.

$r > r_0$

$NPV_D > NPV_E$

Thus choose D.