

Derivatives

(d) Timing Option

Q.46) Alternative 1 : Start the Project today

Cal. of NPV:

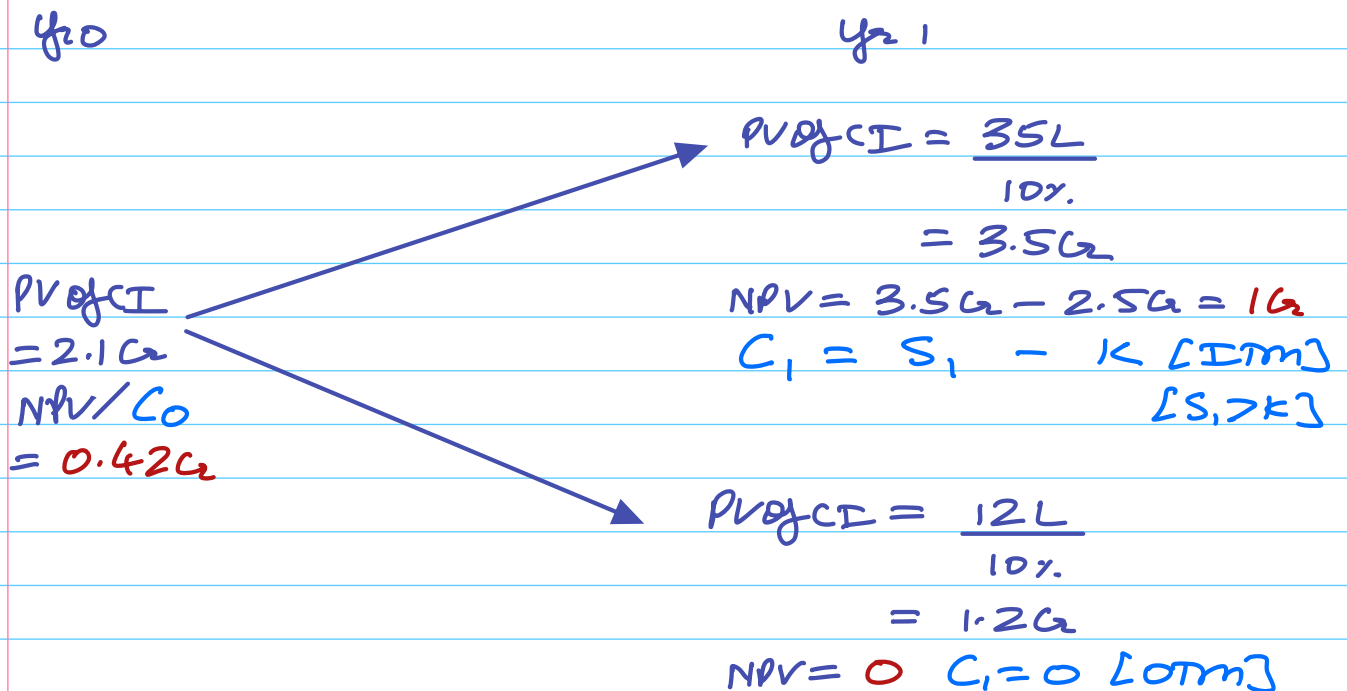
Yr	Particulars	CF	DF @ 10%	Calculation	PV
0	II	(2.5L)	1		(2.5L)
1-∞	Savings in El. Cost.	0.21L		$\frac{0.21L}{10\%}$	2.1L

NPV @ 10%

(0.4L)

∴ NPV @ 10% is $\ominus$, we should reject this Alternative.

Alternative 2 : Start after 1 year :



$S < K$

$$\text{Step 1: } S_u \text{ i.e. PV of CI} = \frac{35L}{10\%} \\ = 3.5L$$

$$S_d \text{ i.e. PV of CI} = \frac{12L}{10\%} \\ = 1.2L$$

Step 2: Calculation of NPV after 1 year

$$\text{If } S_u = 3.5L, \\ NPV = 3.5L - 2.5L = 1L$$

If $S_d = 1.2L$, We will not go for Project $\therefore$
NPV will turn out $\ominus \rightarrow 1.2L - 2.5L$.

$$NPV = 0$$

Alternate understanding of this Timing Option:

It is a Call option i.e. a Right to Buy the Project @ $2.5L$ [K].

$$\text{If } S_1 > K \text{ i.e. } S_1 = 3.5L, \text{ Call is Exercised.} \\ \text{Value of Call on Due Date [C]} \quad [Irrm] \\ = S_1 - K \\ = 3.5L - 2.5L \\ = 1L$$

$$\text{If } S_1 < K \text{ i.e. } S_1 = 1.2L, \text{ Call is Lapsed.} \\ \text{Value of Call on Due Date [C]} \quad [Irrm] \\ = 0$$

Step 3: Calculation of p_u & p_d

Cal. of Rats :

$$\begin{aligned}\text{Rate [up]} &= \frac{3.56 - 2.16}{2.16} \times 100 \\ &= 66.67\%\end{aligned}$$

$$\begin{aligned}\text{Rate [down]} &= \frac{1.26 - 2.16}{2.16} \times 100 \\ &= (42.86\%)\end{aligned}$$

$$\begin{aligned}66.67 \times p_u + (42.86) \times p_d &= 8 \\ 66.67 p_u - 42.86 [1 - p_u] &= 8 \\ 66.67 p_u - 42.86 + 42.86 p_u &= 8 \\ 109.53 p_u &= 50.86 \\ \therefore p_u &= 0.464 \\ \& \quad p_d &= 1 - 0.464 \\ &= 0.536\end{aligned}$$

Step 4: Calculation of :

PV of NPV today / Calculation Call Value today
[C_0]

$$\begin{aligned}\text{NPV today} / C_0 &= \frac{16 \times 0.464 + 0 \times 0.536}{1.10} \\ &= 0.426\end{aligned}$$

Conclusion: We should wait for a year to start the project since the NPV of this decision is $(+)$.

ICAI Solution

Q.46) Alternative 1 : Start the Project today

Cal. of NPV:

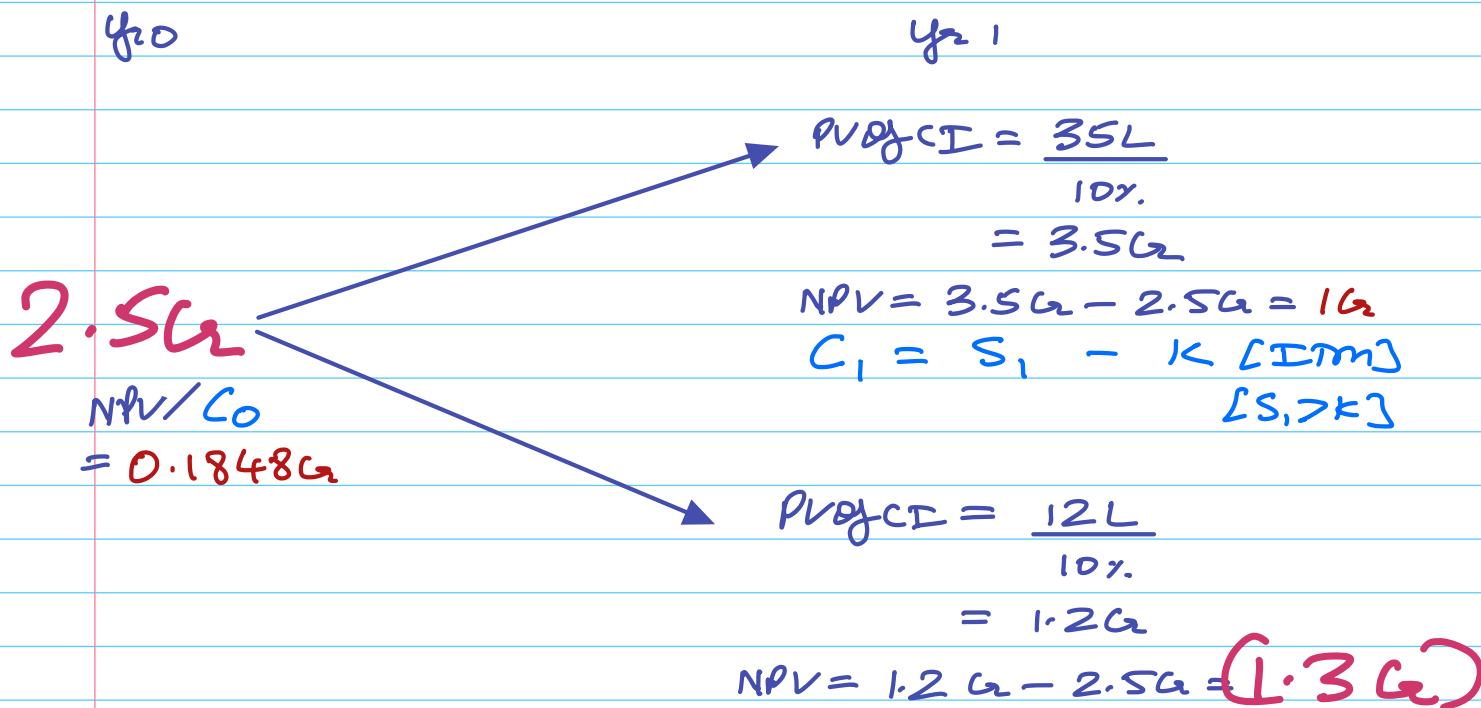
Yr	Particulars	CF	DF @ 10%	Calculation	PV
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1-∞	Savings in El. Cost.	0.21L		$\frac{0.21L}{10\%}$	2.1L

NPV @ 10%

(0.4L)

∴ NPV @ 10% is $\ominus$, we should reject this Alternative.

Alternative 2 : Start after 1 year :



Step 3: Calculation of pu & pd

Cal. of Rates :

$$\begin{aligned}\text{Rate [up]} &= \frac{3.56 - 2.56}{2.56} \times 100 \\ &= 40\%\end{aligned}$$

$$\begin{aligned}\text{Rate [down]} &= \frac{1.26 - 2.56}{2.56} \times 100 \\ &= (52\%)\end{aligned}$$

$$\begin{aligned}40 \times pu + (52) \times pd &= 8 \\ 40 pu - 52 [1 - pu] &= 8 \\ 40 pu - 52 + 52 pu &= 8 \\ 92 pu &= 60 \\ \therefore pu &= 0.652 \\ \& \quad pd &= 1 - 0.652 \\ &= 0.348\end{aligned}$$

Step 4: Calculation of :

PV of NPV today / Calculation Cash Value today
[C₀]

$$\begin{aligned}\text{NPV today} / C_0 &= \frac{16 \times 0.652 + (1.36) \times 0.348}{1.08} \\ &= 0.18486 \\ &\text{i.e. } 18.48\%\end{aligned}$$

Conclusion: We should wait for a year to start the project since the NPV of this decision is (+).