

The Basics of Capital Budgeting

What is capital budgeting?

- Analysis of potential **additions to fixed assets.**
- **Long-term decisions; involve large expenditures.**
- Very **important** to firm's future.

Steps

- 1. Estimate CFs (inflows & outflows).**
- 2. Assess riskiness of CFs.**
- 3. Determine $k = \text{WACC}$ (adj.).**
- 4. Find NPV and/or IRR.**
- 5. Accept if $\text{NPV} > 0$ and/or $\text{IRR} > \text{WACC}$.**

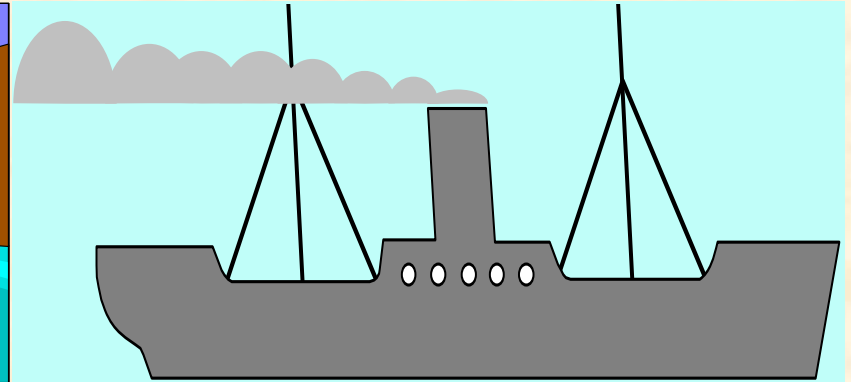
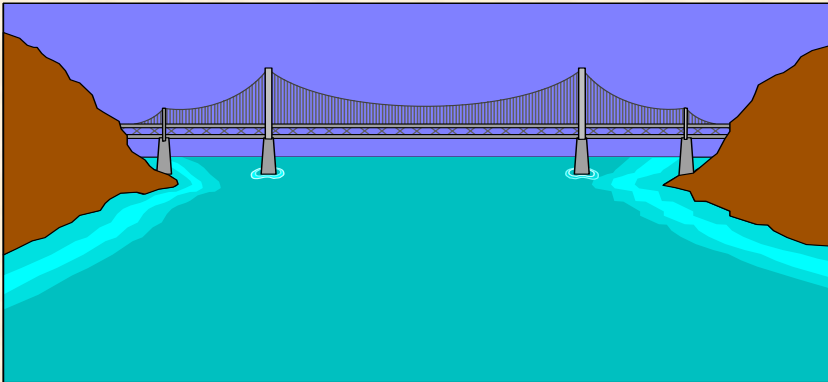
What is the difference between independent and mutually exclusive projects?

Projects are:

independent, if the cash flows of one are unaffected by the acceptance of the other.

mutually exclusive, if the cash flows of one can be adversely impacted by the acceptance of the other.

An Example of Mutually Exclusive Projects



BRIDGE vs. **BOAT** to get products across a river.

Normal Cash Flow Project

**Cost (negative CF) followed by a series of positive cash inflows.
One change of signs.**

Nonnormal Cash Flow Project

**Two or more changes of signs.
Most common: Cost (negative CF), then string of positive CFs, then cost to close project.
Nuclear power plant, strip mine.**

Inflow (+) or Outflow (-) in Year

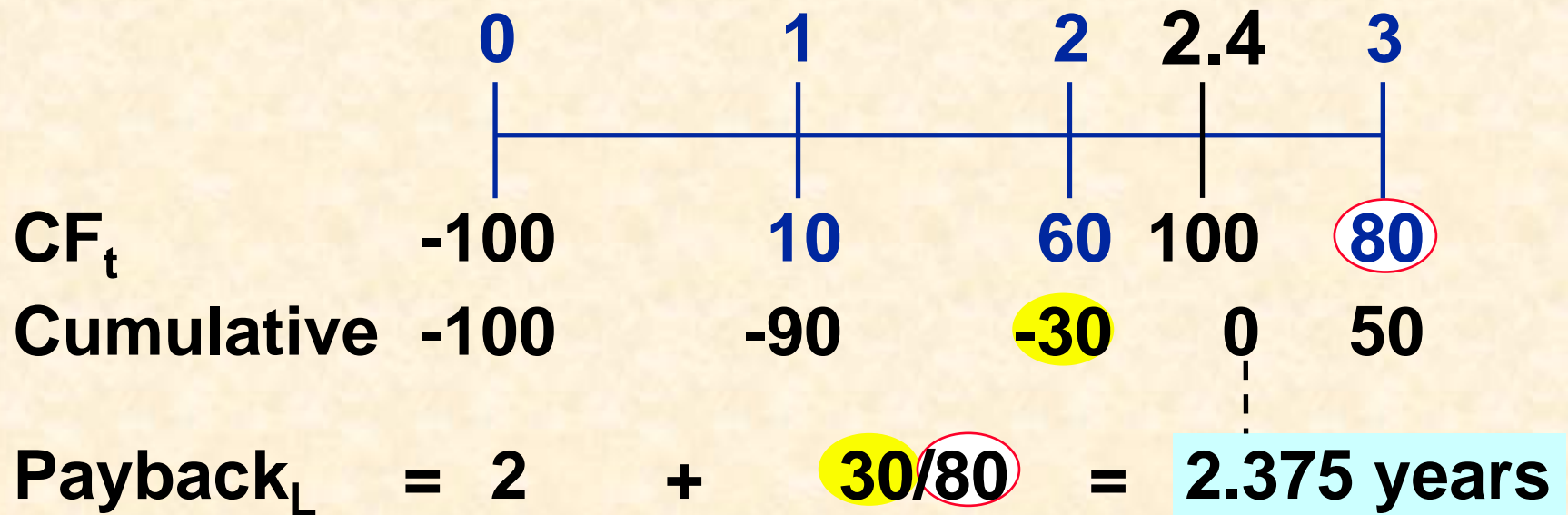
<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>N</u>	<u>NN</u>
-	+	+	+	+	+	N	NN
-	+	+	+	+	+		NN
-	-	-	+	+	+	N	
+	+	+	-	-	-	N	
-	+	+	-	+	-		NN

What is the payback period?

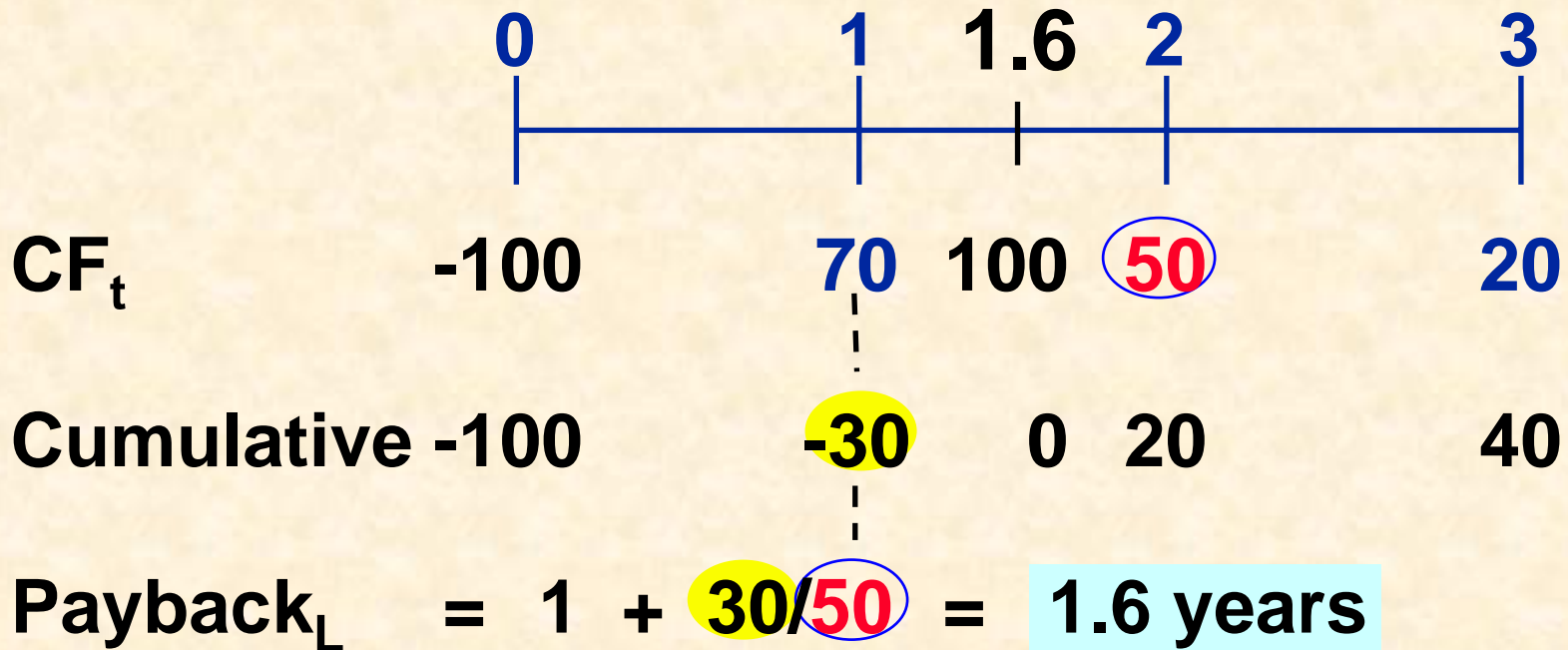
The number of years required to recover a project's cost,

or how long does it take to get our money back?

Payback for Project L (Long: Large CFs in later years)



Project S (Short: CFs come quickly)



Strengths of Payback

1. Provides an indication of a project's **risk** and **liquidity**.
2. **Easy to calculate** and understand.

Weaknesses of Payback

1. Ignores the **TVM**.
2. **Ignores CFs** occurring after the payback period.

Discounted Payback: Uses discounted rather than raw CFs.

	0	1	2	3
		10%		
CF_t	-100	10	60	80
$PVCF_t$	-100	9.09	49.59	60.11
Cumulative	-100	-90.91	-41.32	18.79
Discounted payback	= 2	+ 41.32 / 60.11	= 2.7 years	

A red arrow points from the 2.7 years result to the timeline between year 2 and year 3.

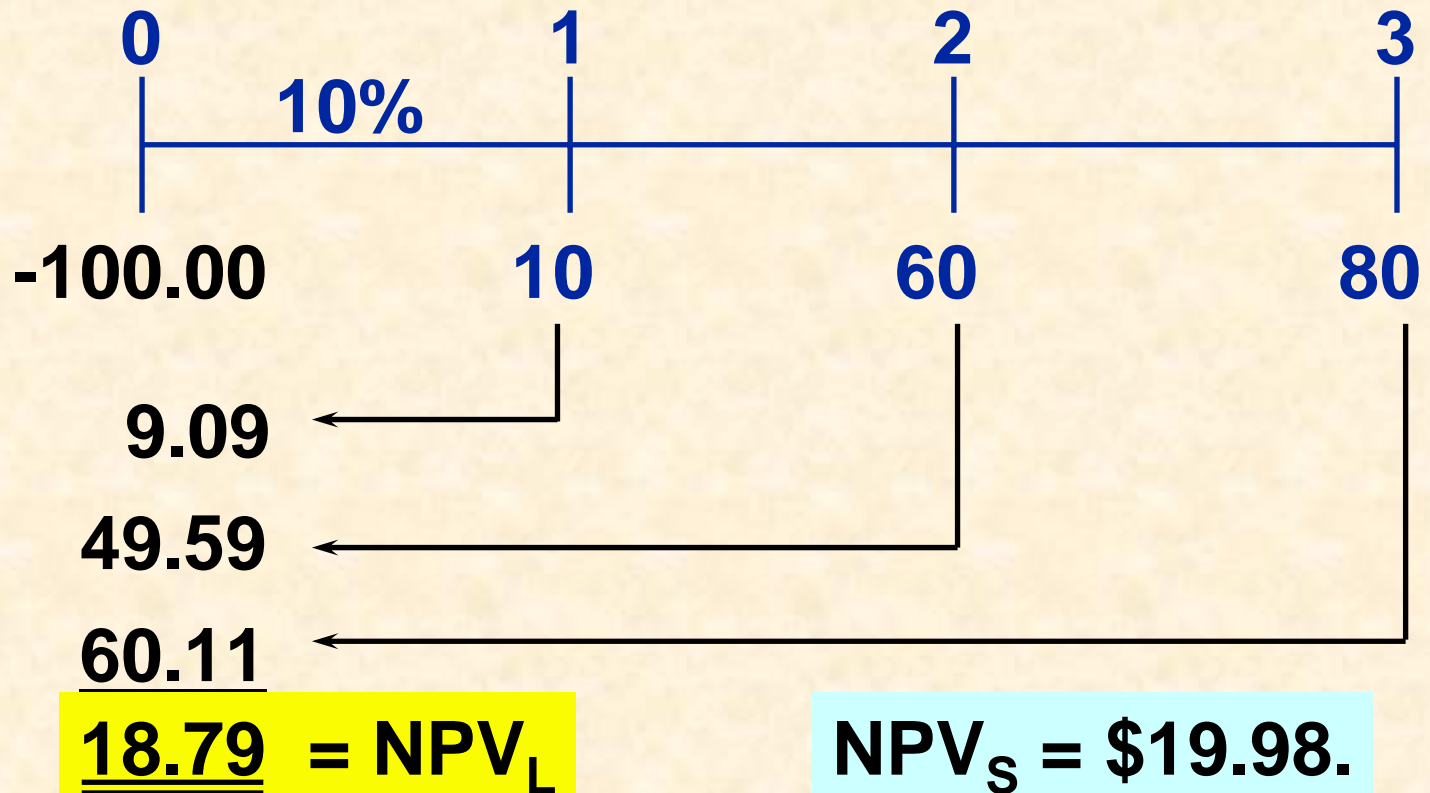
Recover invest. + cap. costs in 2.7 years.

NPV: Sum of the PVs of inflows and outflows.

$$\text{NPV} = \sum_{t=0}^n \frac{\text{CF}_t}{(1+k)^t} \cdot$$

What is Project L's NPV?

Project L:



Rationale for the NPV Method

$$\begin{aligned}\text{NPV} &= \text{PV inflows} - \text{Cost} \\ &= \text{Net gain in wealth.}\end{aligned}$$

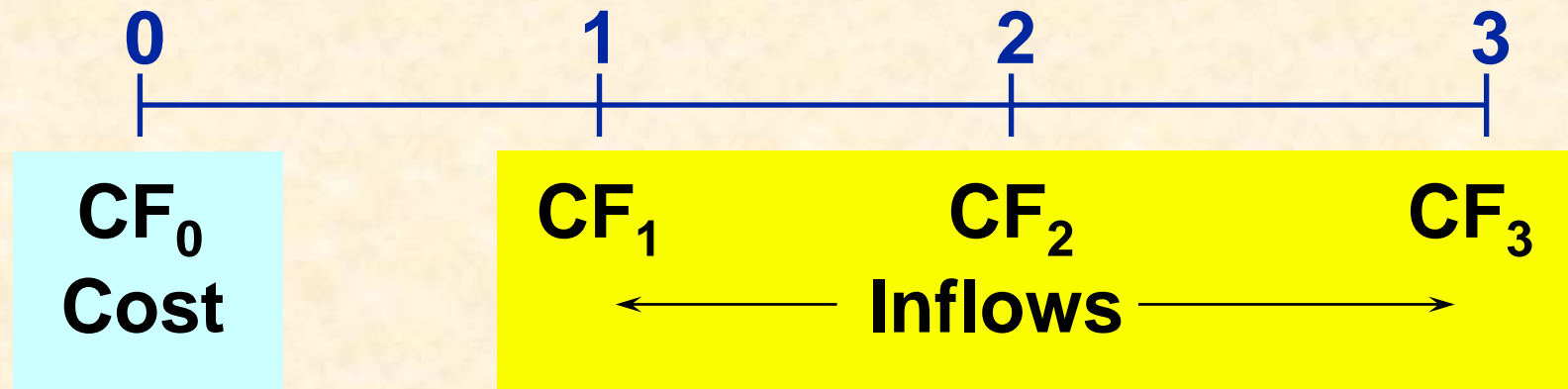
Accept project if $\text{NPV} > 0$.

Choose between mutually exclusive projects on basis of higher NPV. Adds most value.

Using NPV method, which project(s) should be accepted?

- If Projects S and L are mutually exclusive, accept S because $NPV_S > NPV_L$.
- If S & L are independent, accept both; $NPV > 0$.

Internal Rate of Return: IRR



IRR is the discount rate that forces PV inflows = cost. This is the same as forcing NPV = 0.

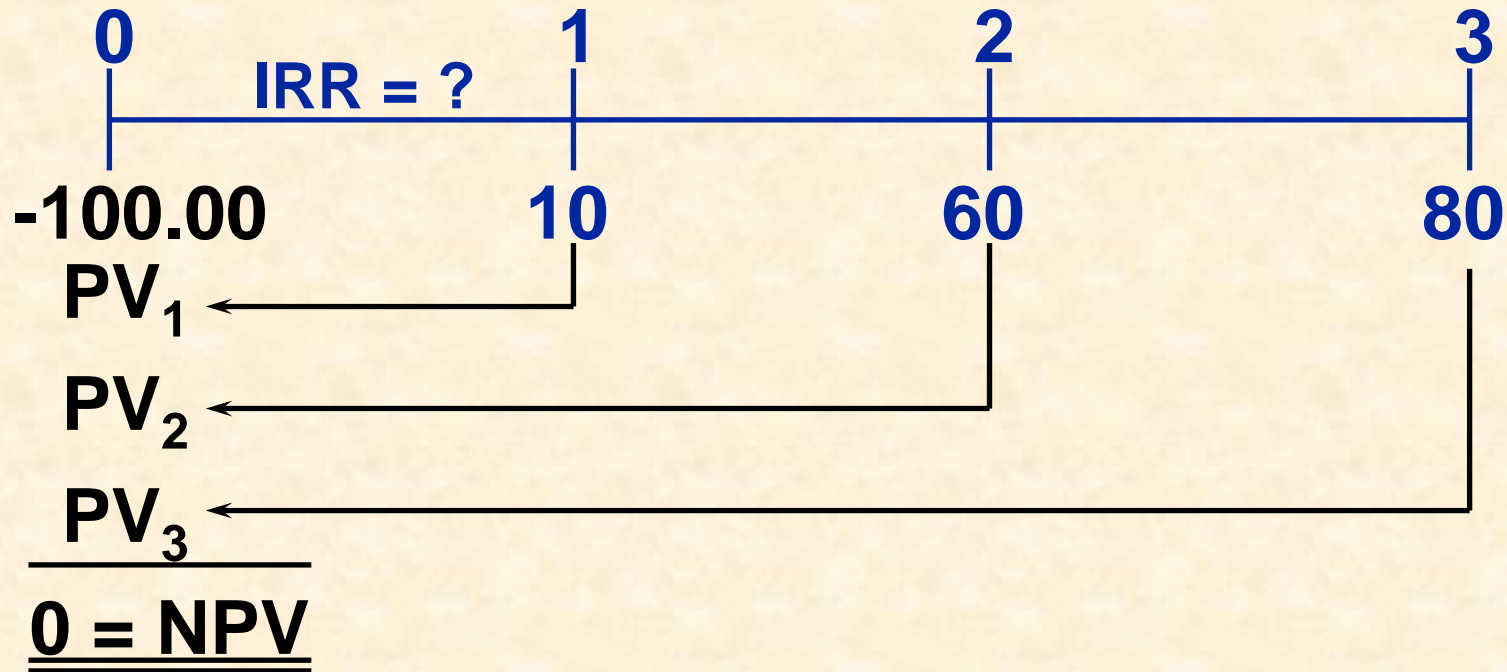
NPV: Enter k , solve for NPV.

$$\sum_{t=0}^n \frac{CF_t}{(1+k)^t} = \text{NPV.}$$

IRR: Enter NPV = 0, solve for IRR.

$$\sum_{t=0}^n \frac{CF_t}{(1+\text{IRR})^t} = 0.$$

What's Project L's IRR?



Enter CFs in CFLO, then press IRR:

$IRR_L = 18.13\%$. $IRR_S = 23.56\%$.

Rationale for the IRR Method

If $IRR > WACC$, then the project's rate of return is greater than its cost--some return is left over to boost stockholders' returns.

Example: $WACC = 10\%$, $IRR = 15\%$.
Profitable.

IRR Acceptance Criteria

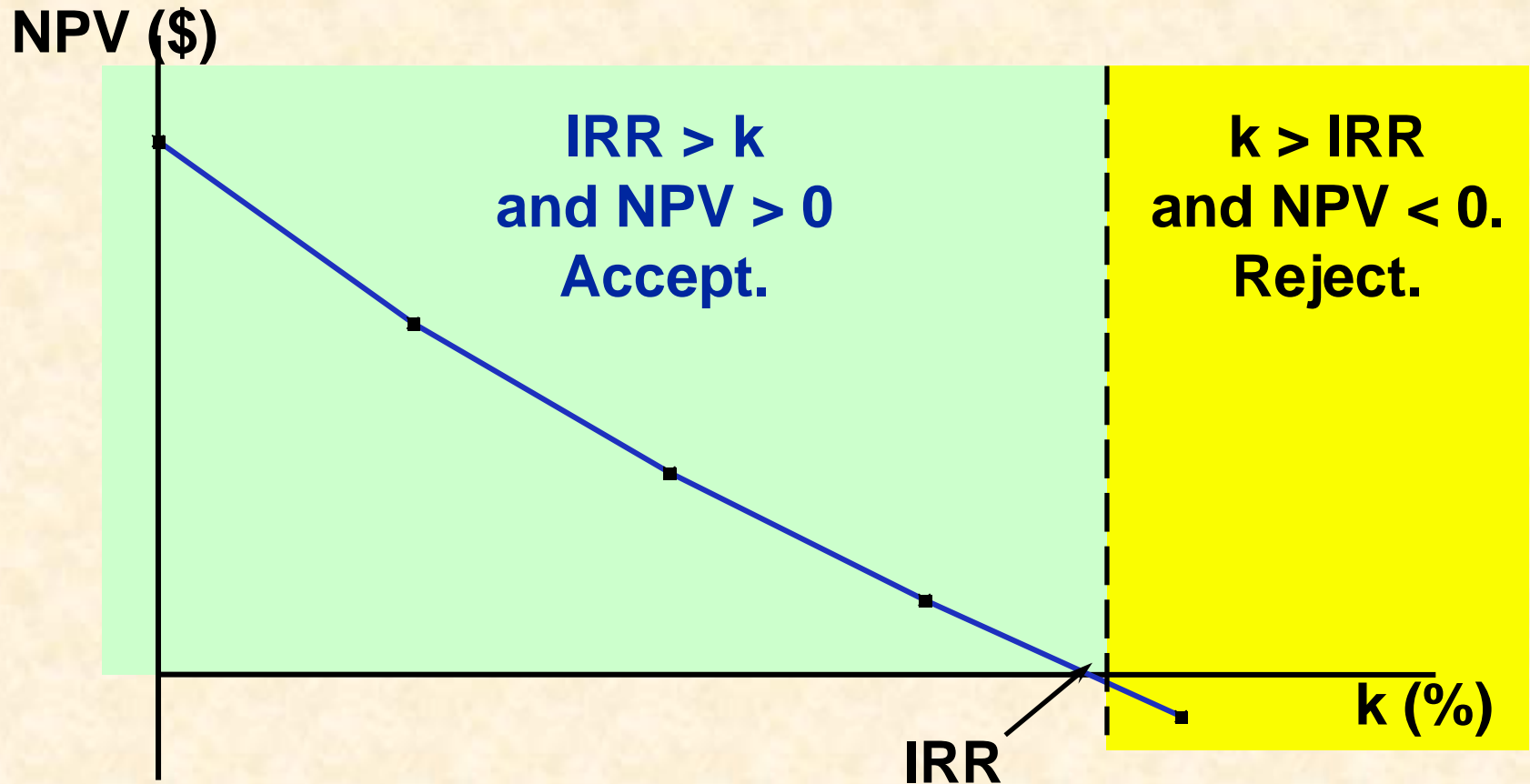
■ If $IRR > k$, **accept** project.

■ If $IRR < k$, **reject** project.

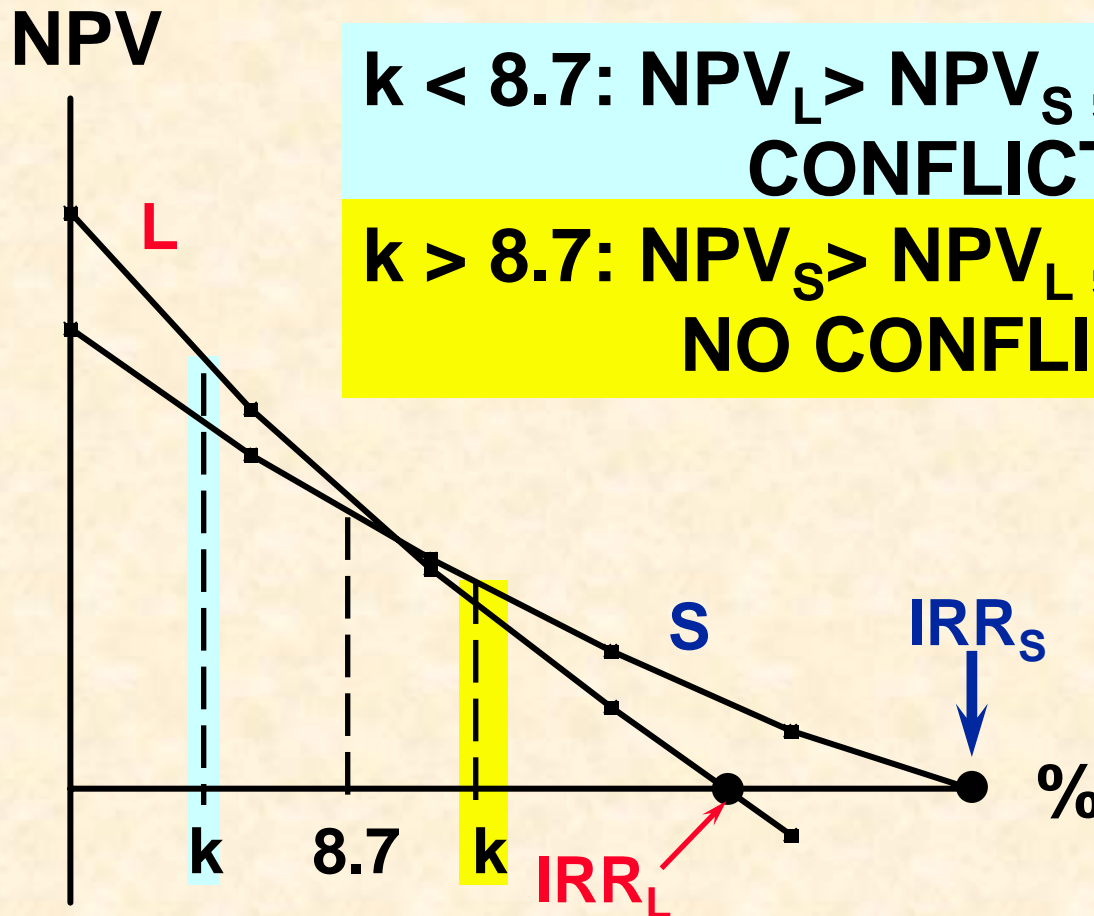
Decisions on Projects S and L per IRR

- If S and L are independent, accept both. $IRR_s > k = 10\%$.
- If S and L are mutually exclusive, accept S because $IRR_s > IRR_L$.

NPV and IRR always lead to the same accept/reject decision for independent projects:



Mutually Exclusive Projects



$k < 8.7$: $NPV_L > NPV_S$, $IRR_S > IRR_L$
CONFLICT

$k > 8.7$: $NPV_S > NPV_L$, $IRR_S > IRR_L$
NO CONFLICT

Reinvestment Rate Assumptions

- NPV assumes reinvest at k (opportunity cost of capital).
- IRR assumes reinvest at IRR.
- Reinvest at opportunity cost, k , is more realistic, so **NPV method is best.** NPV should be used to choose between mutually exclusive projects.