Long –term Investment Decision

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What is capital budgeting?

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

Stages in Capital Budgeting

- Because a firm must continually evaluate possible investments, capital budgeting is an ongoing process.
- Five stages:
  - Stage 1: *Investment screening and selection*
  - Stage 2: *Capital budget proposal*
  - Stage 3: *Budgeting approval and authorization*
  - Stage 4: *Project tracking*
  - Stage 5: *Post-completion audit*

Financial Appraisal Tools

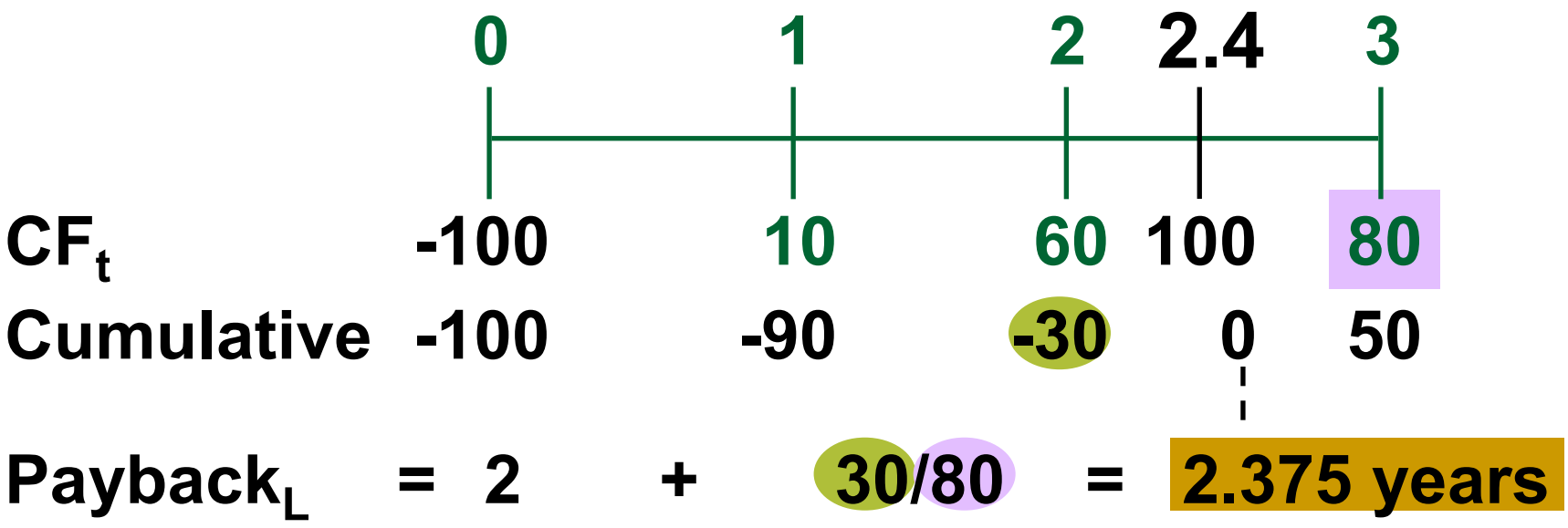
- Accounting rate of Return.
- Payback Method.
- Discounted Payback Method.
- NPV.
- IRR
  - Project IRR
  - Equity IRR
- Profitability Index.

What is the payback period?

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

or how long does it take to get the business's money back?

Payback for Project L
(Long: Most CFs in out years)



Project S (Short: CFs come quickly)

CF_t	-100	70	100	50	20
Cumulative	-100	-30	0	20	40

$Payback_S$ = 1 + 30/50 = 1.6 years

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.

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 yrs

Recover invest. + cap. costs in 2.7 yrs.

NPV and IRR

- Accounting rate of return method has limitations.
- The payback and discounted payback approaches also have limitations.
- The NPV (and IRR) method is free of such limitations.

Steps

1. **Estimate CFs (inflows & outflows).**
2. **Assess riskiness of CFs.**
3. **Determine k = WACC for project.**
4. **Find NPV and/or IRR.**
5. **Accept if NPV > 0 and/or IRR > WACC.**

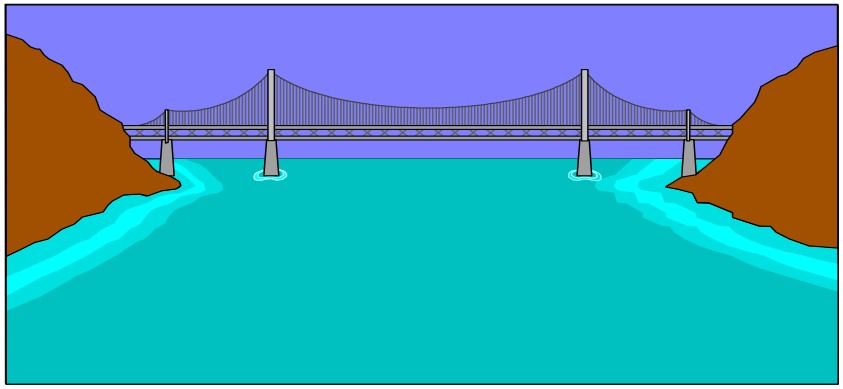
What is the difference between independent and mutually exclusive projects?

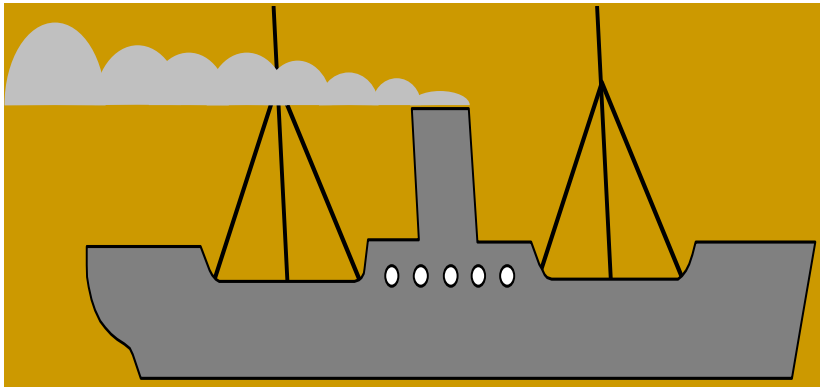
Projects are:

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.

NPV: Sum of the PVs of inflows and outflows.

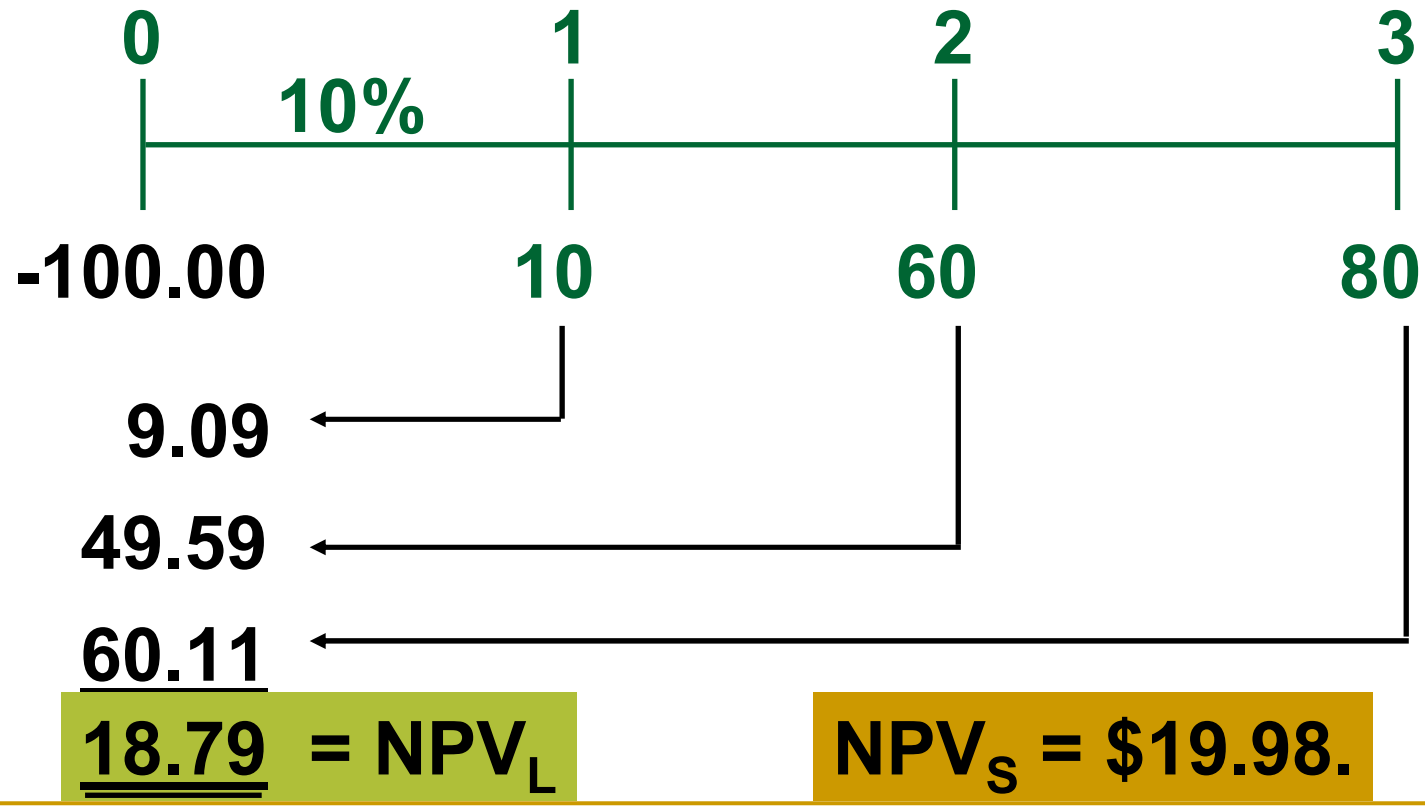
$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}.$$

Cost often is CF_0 and is negative.

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} - CF_0.$$

What's Project L's NPV?

Project L:



Rationale for the NPV Method

NPV = PV inflows - Cost

= Net gain in wealth.

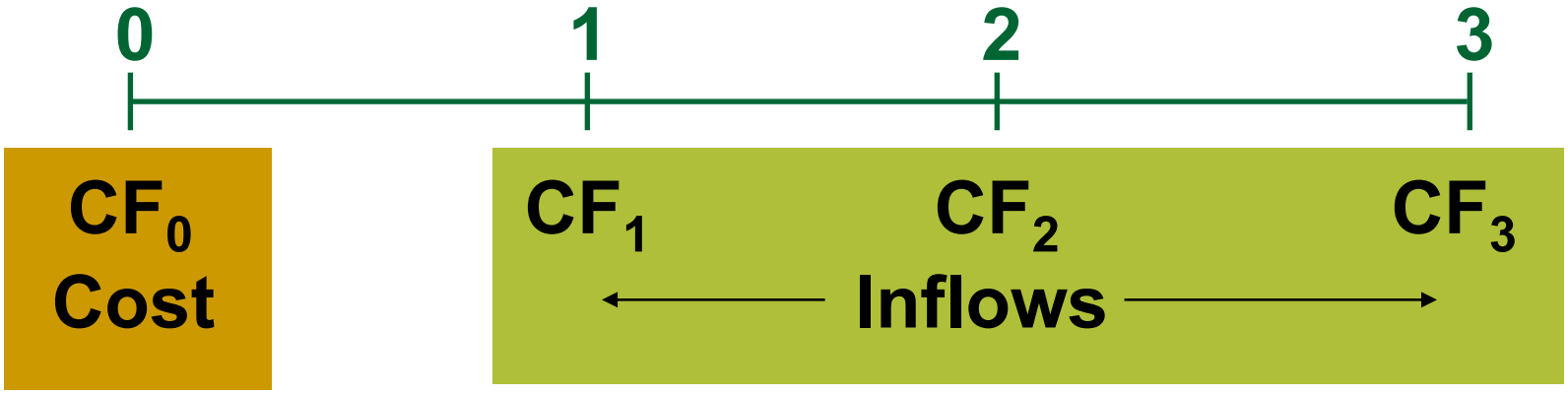
Accept project if NPV > 0.

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.

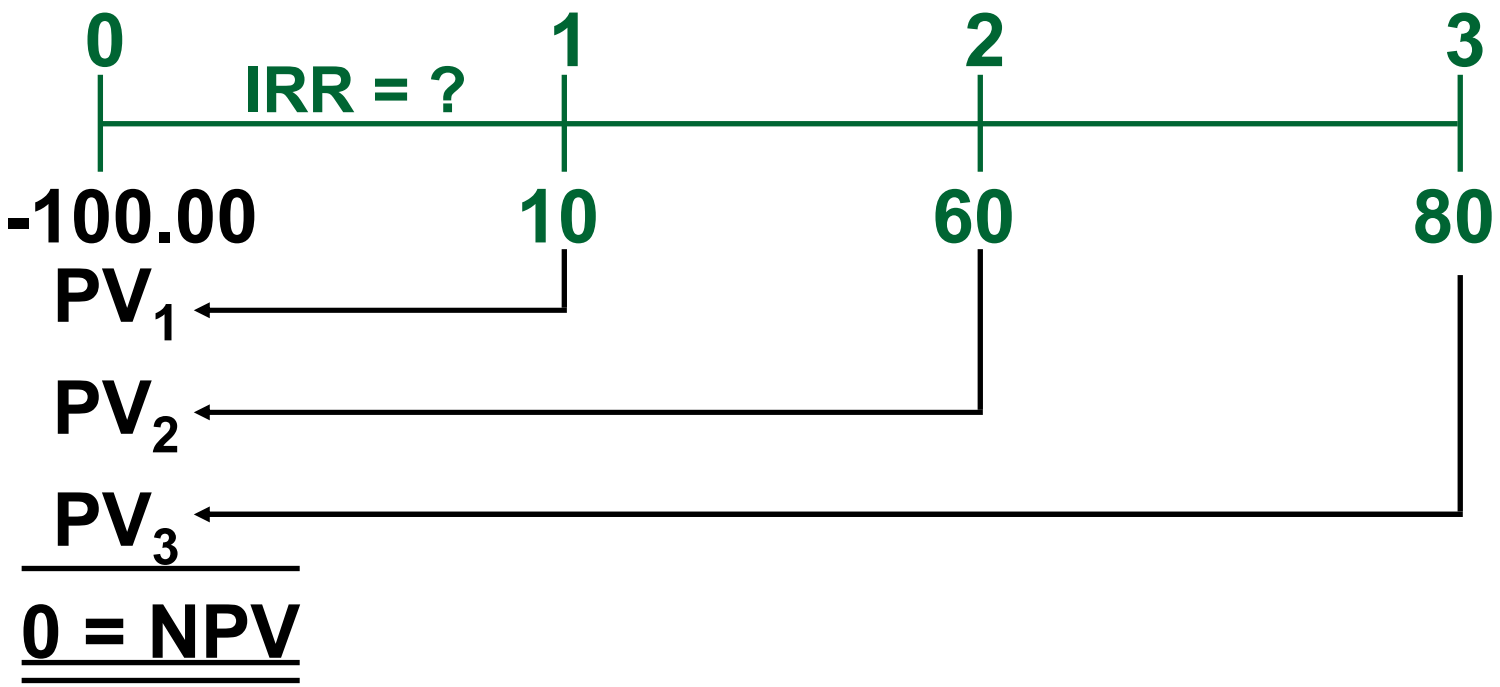
NPV: Enter k, solve for NPV.

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

IRR: Enter NPV = 0, solve for IRR.

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

What's Project L's IRR?



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

Find IRR if CFs are constant:

	N	I/YR	PV	PMT	FV
INPUTS	3		-100	40	0
OUTPUT		9.70%			

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.

<u>Example</u>: WACC = 10%, IRR = 15%. Profitable.

IRR Acceptance Criteria

- If IRR > k, accept project.
- If IRR < k, reject project.

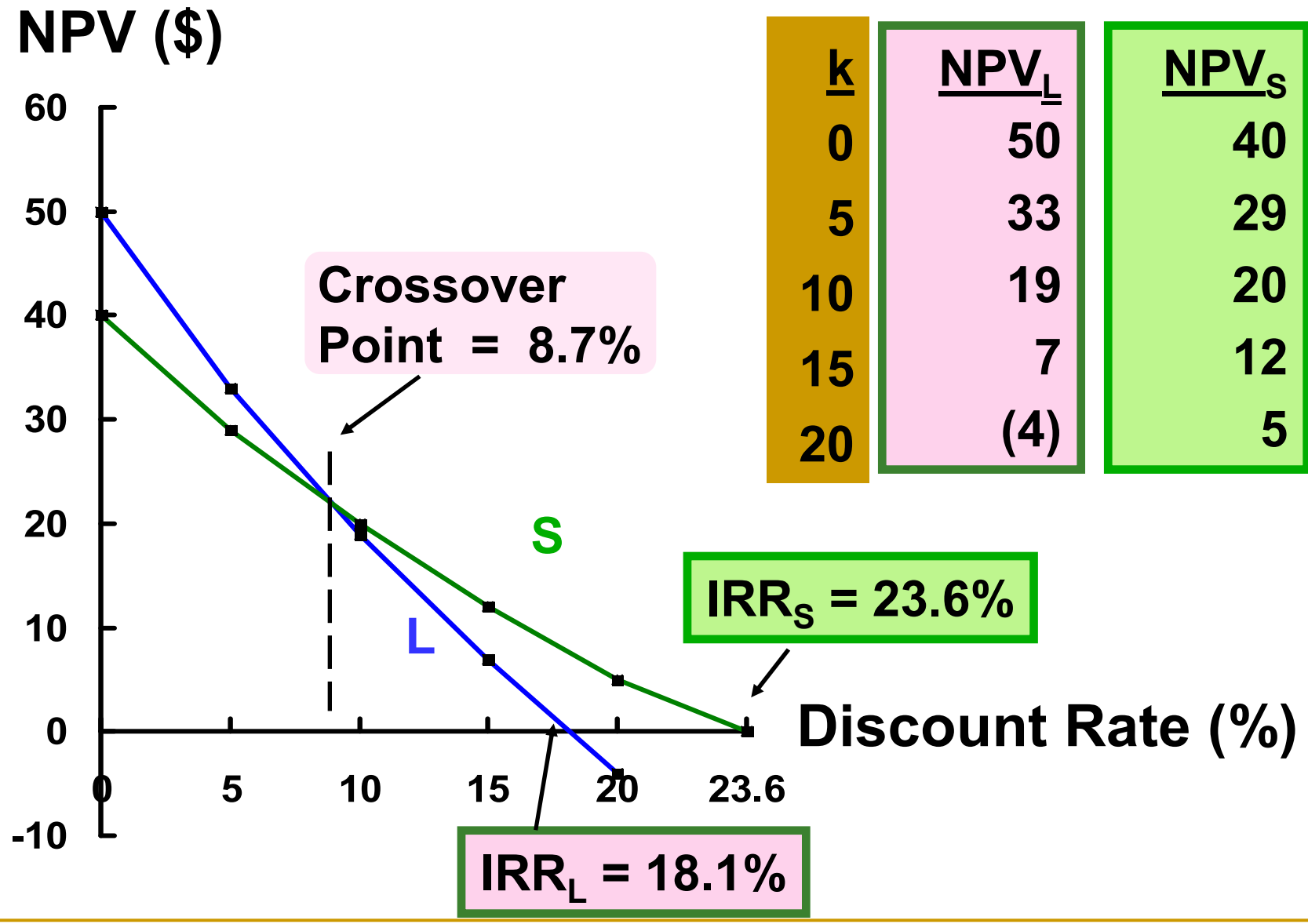
Decisions on Projects S and L per IRR

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

Construct NPV Profiles

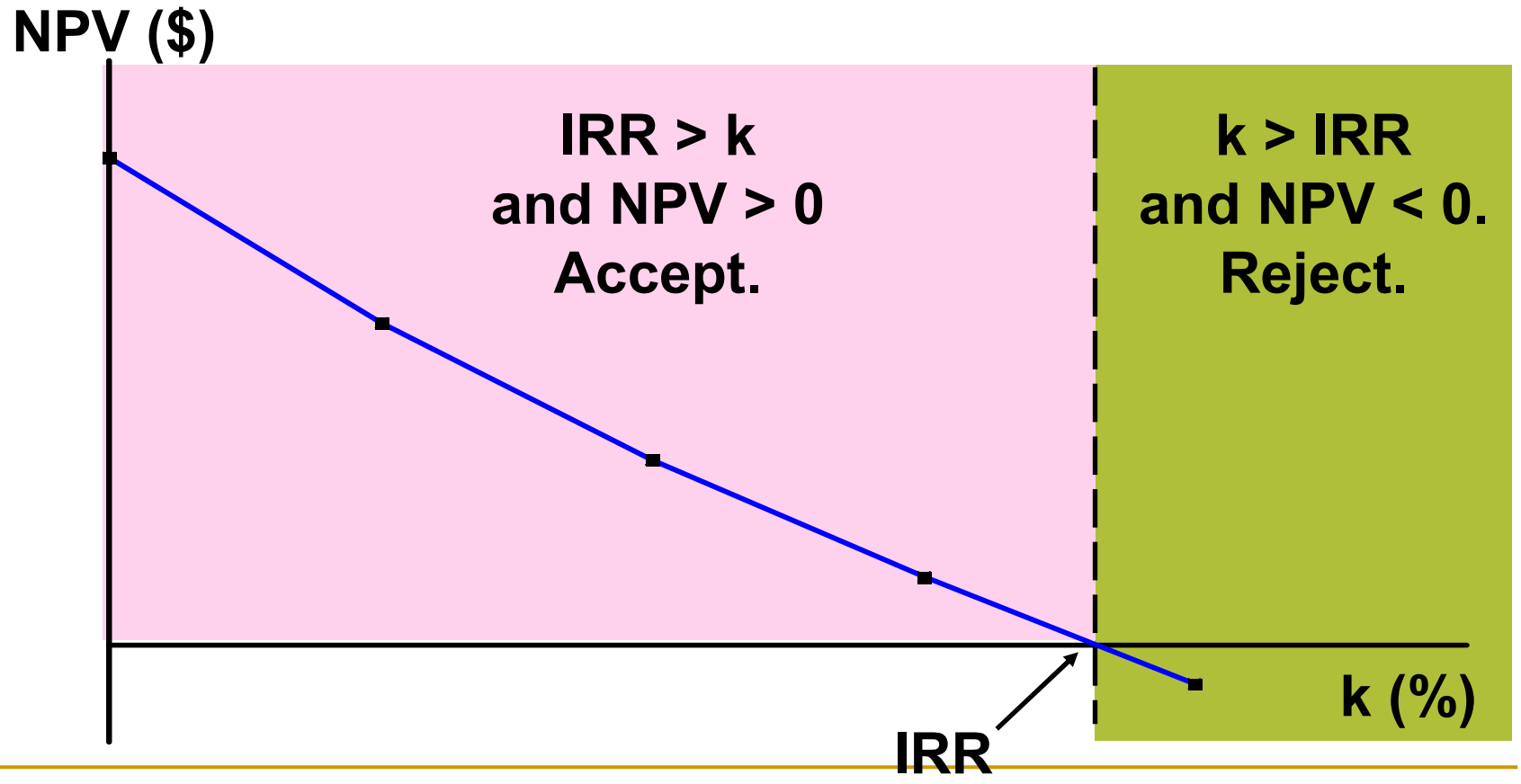
Enter CFs in CFLO and find NPV_L and NPV_S at different discount rates:

k	NPV_L	NPV_S
0	50	40
5	33	29
10	19	20
15	7	12
20	(4)	5

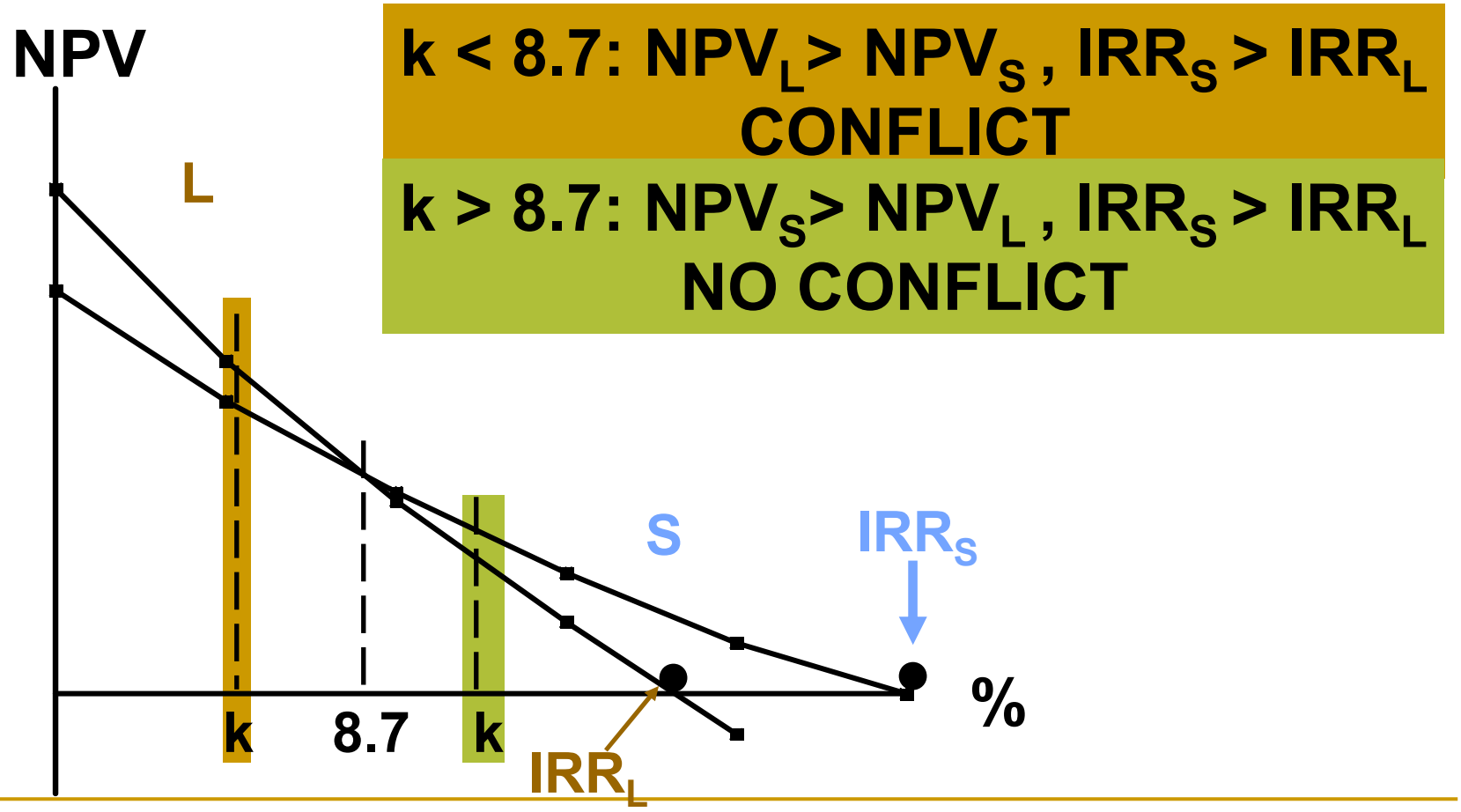


k	NPV$_L$	NPV$_S$
0	50	40
5	33	29
10	19	20
15	7	12
20	(4)	5

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

To Find the Crossover Rate

1. **Find cash flow differences between the projects.**
2. **Calculate IRR on cash flow differential. Crossover rate = 8.68%, rounded to 8.7%.**
3. **Can subtract S from L or vice versa, but better to have first CF negative.**
4. **If profiles don't cross, one project dominates the other.**

Two Reasons NPV Profiles Cross

1. **Size (scale) differences.** **Smaller project frees up funds at t = 0 for investment. The higher the opportunity cost, the more valuable these funds, so high k favours small projects.**
2. **Timing differences.** **Project with faster payback provides more CF in early years for reinvestment. If k is high, early CF especially is good, $NPV_S > NPV_L$.**

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.

Multiple IRR

- There is another situation in which the IRR approach may not be usable-when projects with nonnormal cash flows are involved.
- Projects with nonnormal cash flows would provide multiple IRRs.

Inflow (+) or Outflow (-) in Year

0	1	2	3	4	5	N	NN
-	+	+	+	+	+	N	
-	+	+	+	+	-		NN
-	-	-	+	+	+	N	
+	+	+	-	-	-	N	
-	+	+	-	+	-		NN