CAPITAL BUDGETING

Cost of Capital

Evaluating Cash Flows

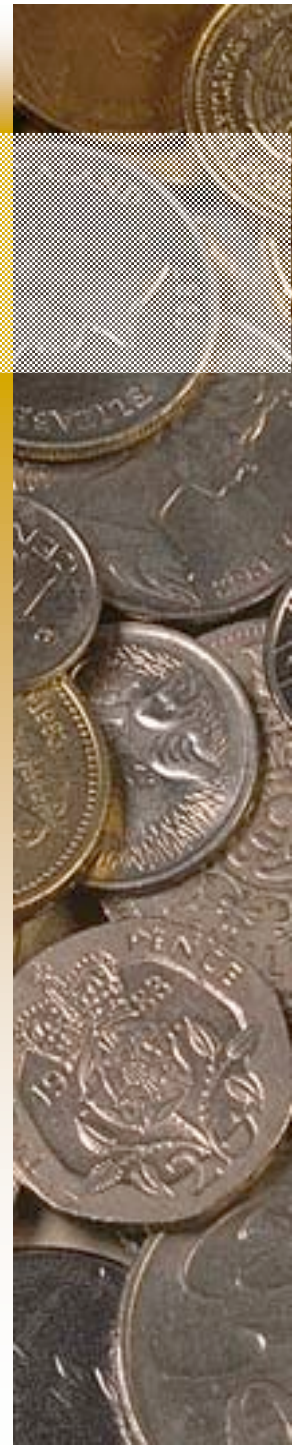
Payback, discounted payback

NPV

IRR, MIRR

The Cost of Capital

- Cost of Capital Components
  - Debt
  - Common Equity
- WACC



Should we focus on historical (embedded) costs or new (marginal) costs?

The cost of capital is used primarily to make decisions which involve raising and investing new capital. So, we should focus on marginal costs.

What types of long-term capital do organizations use?

- Long-term debt
- Equity

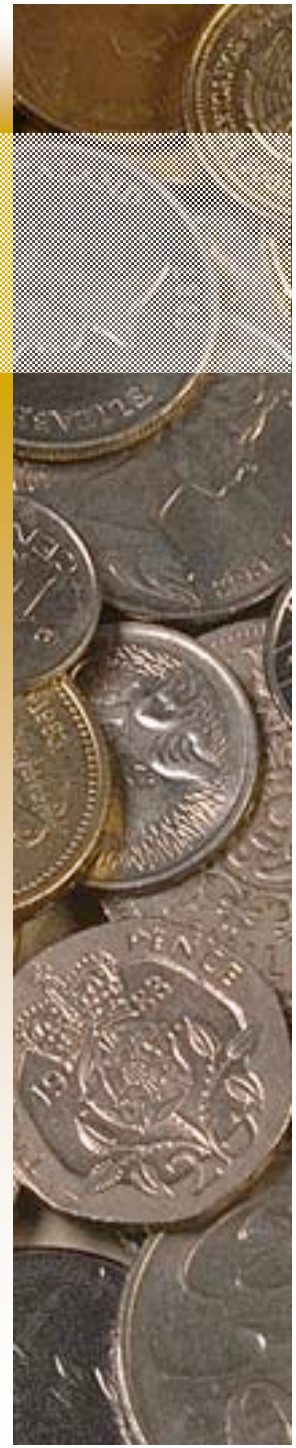
Weighted Average Cost of Capital is the weighted Average of the Marginal Costs of the Capital Components employed to acquire a long term asset (make a new real investment in things like Plant and Equipment, R&D, Human Capital, a new Product, a new Process, or a new Marketing Channel

Capital Components

Sources of funding that come from investors.

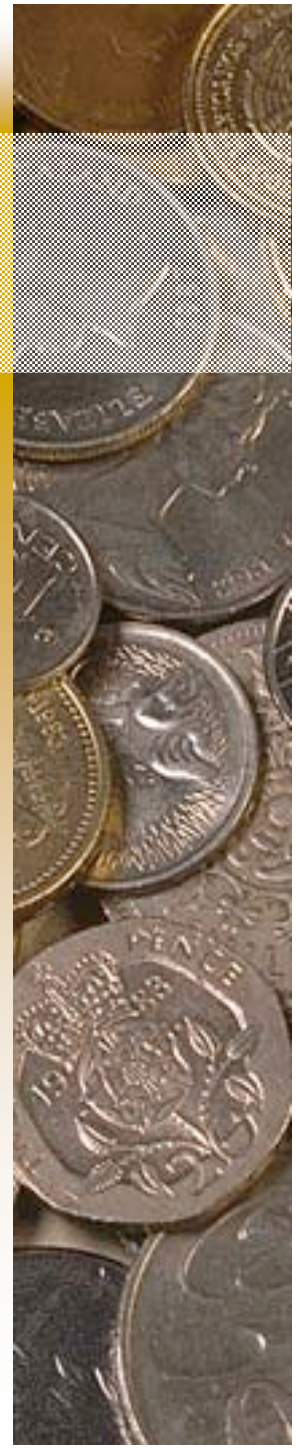
Accounts payable, accruals, and deferred taxes are not sources of funding that come from investors, so they are not included in the calculation of the cost of capital.

We adjust for these items when calculating the cash flows of a project, but not when calculating the cost of capital.



WACC Estimates for Some Large U. S. Corporations

Company	WACC	w_d
Intel (INTC)	16.0	2.0%
Dell Computer (DELL)	12.5	9.1%
BellSouth (BLS)	10.3	39.8%
Wal-Mart (WMT)	8.8	33.3%
Walt Disney (DIS)	8.7	35.5%
Coca-Cola (KO)	6.9	33.8%
H.J. Heinz (HNZ)	6.5	74.9%
Georgia-Pacific (GP)	5.9	69.9%



What factors influence a company's WACC?

- Market conditions, especially interest rates and tax rates.
- The organization's capital structure and dividend policy.
- The organization's investment policy. organizations with riskier projects generally have a higher WACC.

Should the company use the composite WACC as the hurdle rate for each of its divisions?

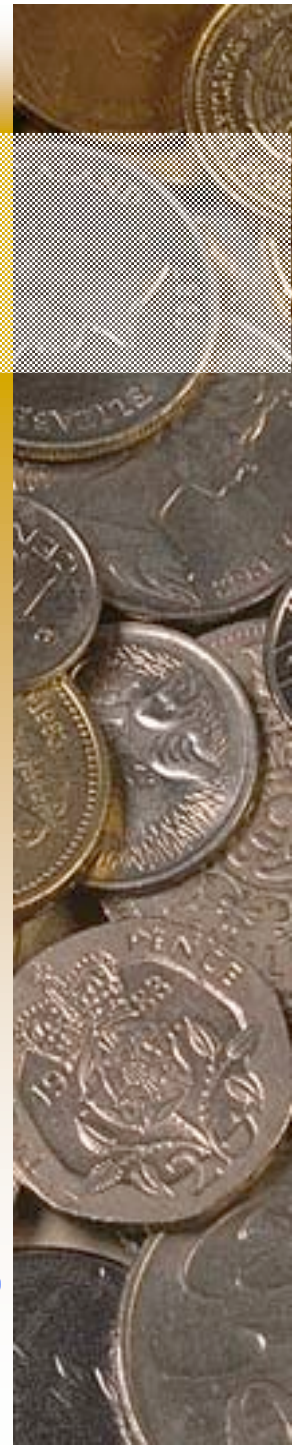
- **NO! The composite WACC reflects the risk of an average project undertaken by the organization.**
- **Different divisions may have different risks. The division's WACC should be adjusted to reflect the division's risk and capital structure.**

Four Mistakes to Avoid

1. When estimating the cost of debt, don't use the coupon rate on existing debt. **Use the current interest rate on new debt.**
2. When estimating the risk premium for the CAPM approach, don't subtract the ***current*** long-term T-bond rate from the ***historical*** average return on common stocks.

(More ...)

For example, if the historical r_M has been about 12.2% and inflation drives the current r_{RF} up to 10%, the current market risk premium is not 12.2% - 10% = 2.2%!



(More ...)

3. Don’t use book weights to estimate the weights for the capital structure.

Use the target capital structure to determine the weights.

If you don’t know the target weights, then use the current market value of equity, and never the book value of equity.

If you don’t know the market value of debt, then the book value of debt often is a reasonable approximation, especially for short-term debt.

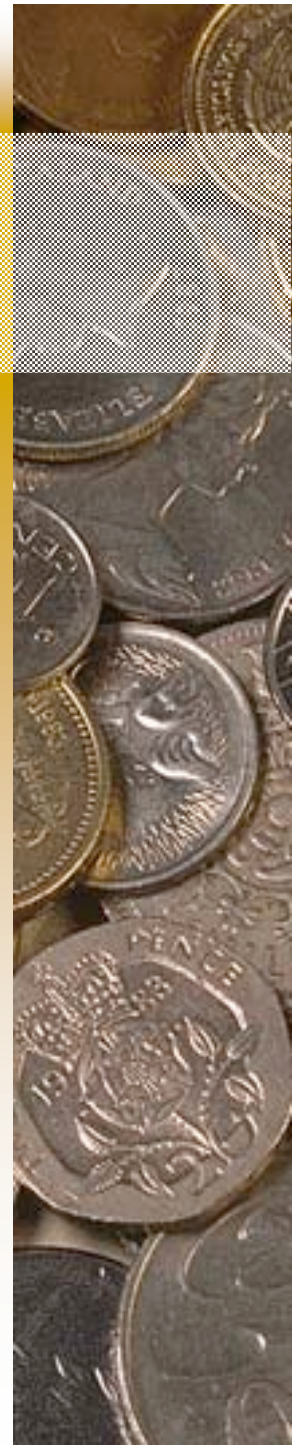
(More...)

4. Always remember that capital components are sources of funding *that come from investors*.

Accounts payable, accruals, and deferred taxes are not sources of funding that come from investors, so they are not included in the calculation of the WACC.

Evaluating Cash Flows

- Overview and "vocabulary"
- Methods
  - Payback, discounted payback
  - NPV
  - IRR, MIRR
- Economic life



What is capital budgeting?

- Analysis of potential projects.
- Long-term decisions; involve large expenditures.
- Very important to organization's future.

Steps in Capital Budgeting

- Estimate cash flows (inflows & outflows).
- Assess risk of cash flows.
- Determine r = WACC for project.
- Evaluate cash flows.

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 would be adversely affected by the acceptance of the other.

What is the payback period?

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

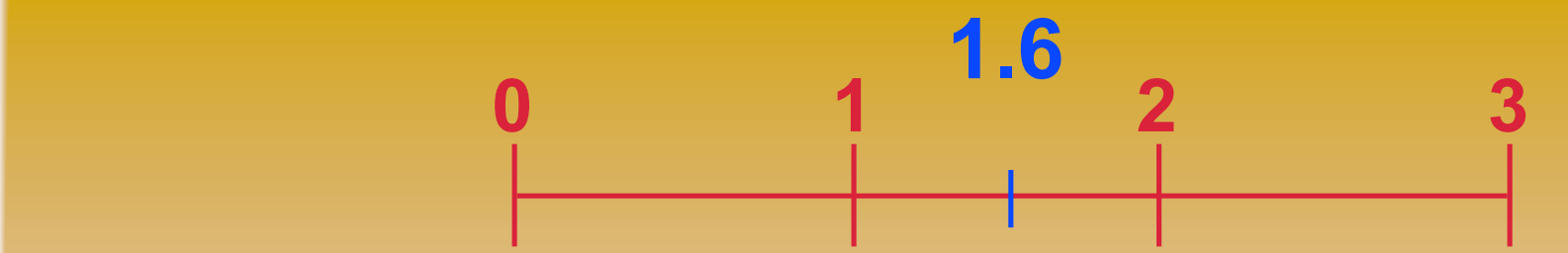
or how long does it take to get the entity's money back?

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

CF_t	-100	10	60	100	80
Cumulative	-100	-90	-30	0	50

$Payback_L$ = 2 + 30/80 = 2.375 years

Franchise 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:

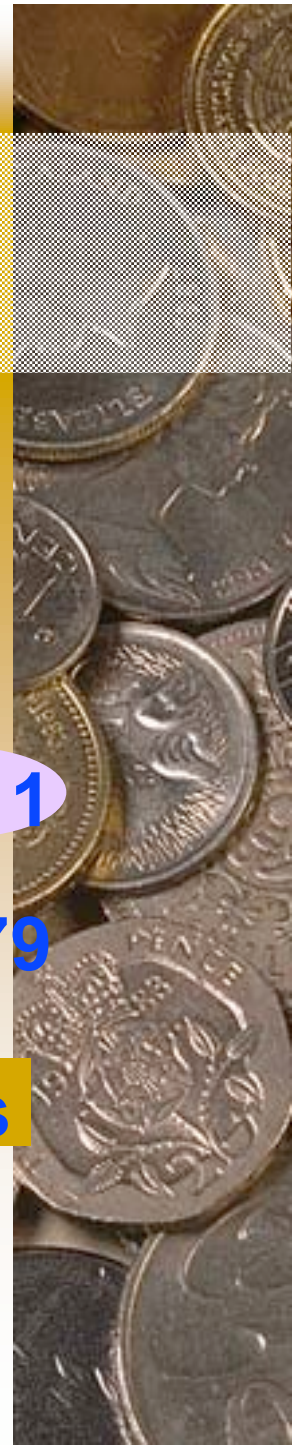
1. Ignores the Time Value of Money.
2. Ignores CFs occurring after the payback period.

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.

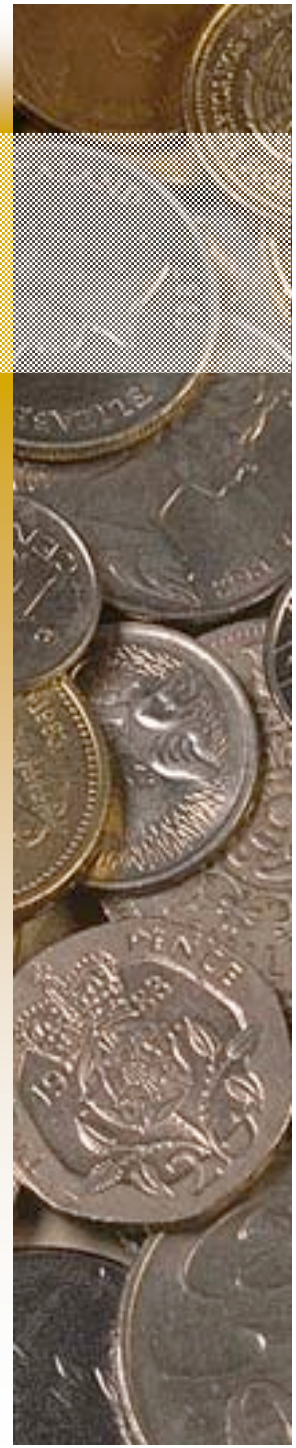


NPV: Sum of the PVs of inflows and outflows.

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

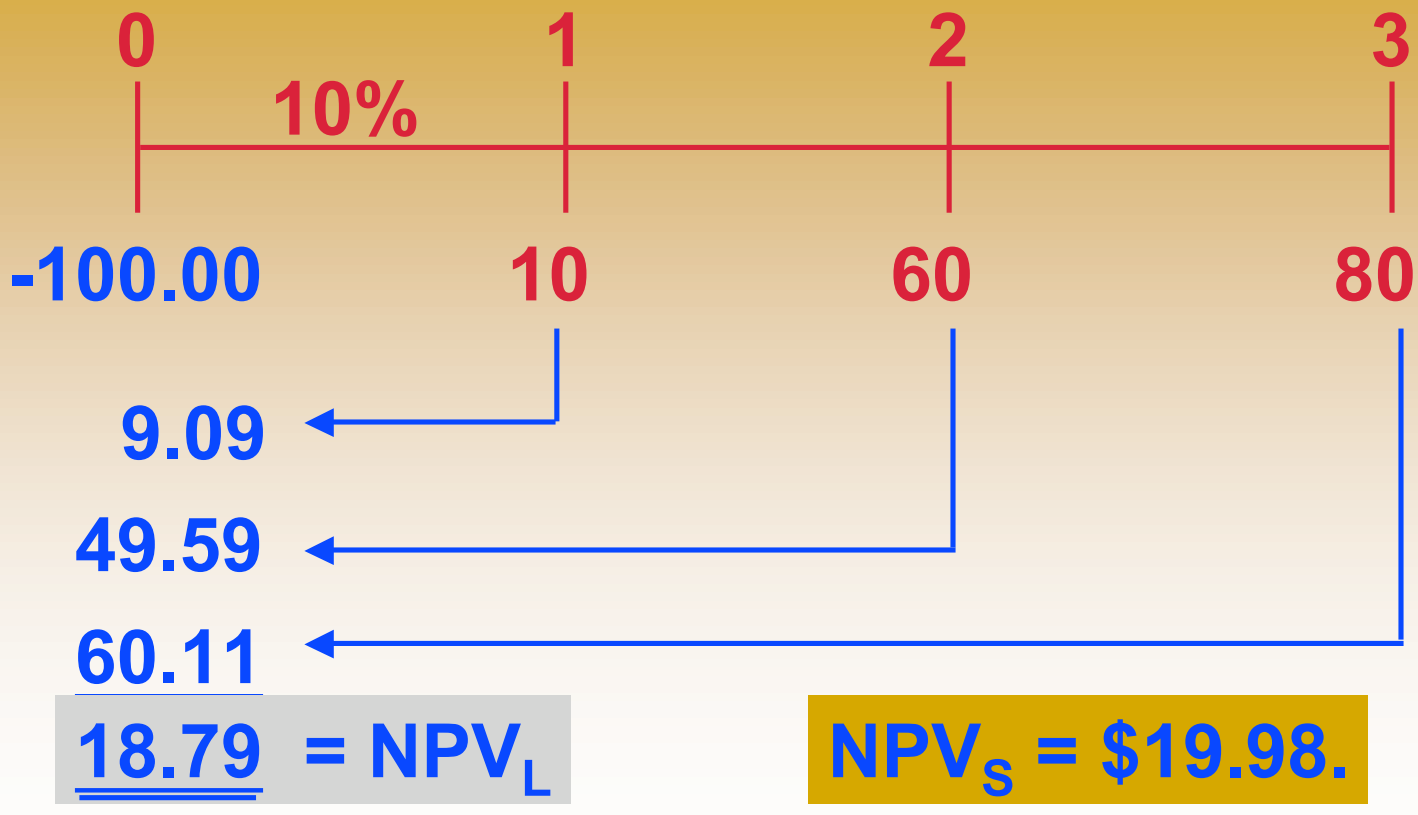
Cost often is CF_0 and is negative.

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

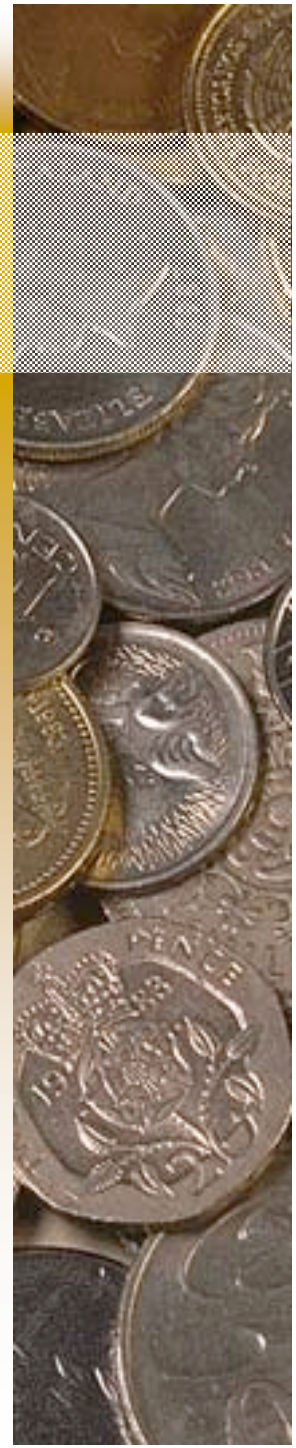


What's Franchise L's NPV?

Project L:



$NPV_S = \$19.98.$

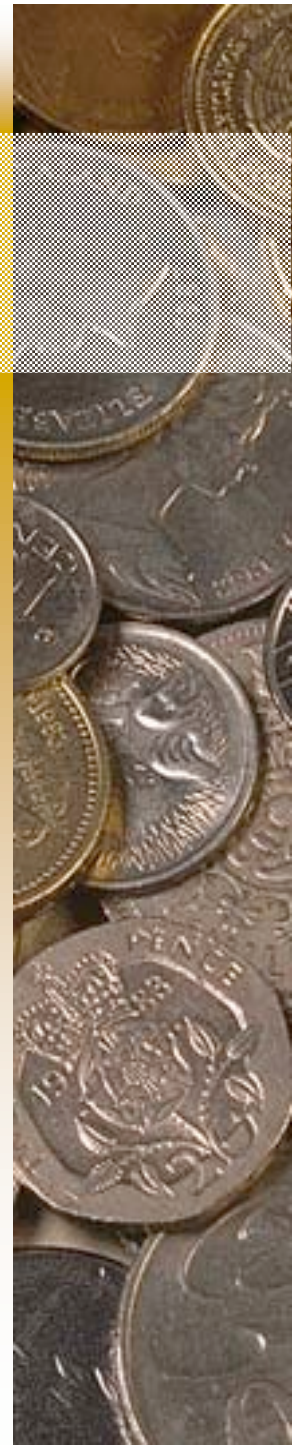


Rationale for the NPV Method

NPV = PV inflows - Cost
= Net gain in wealth.

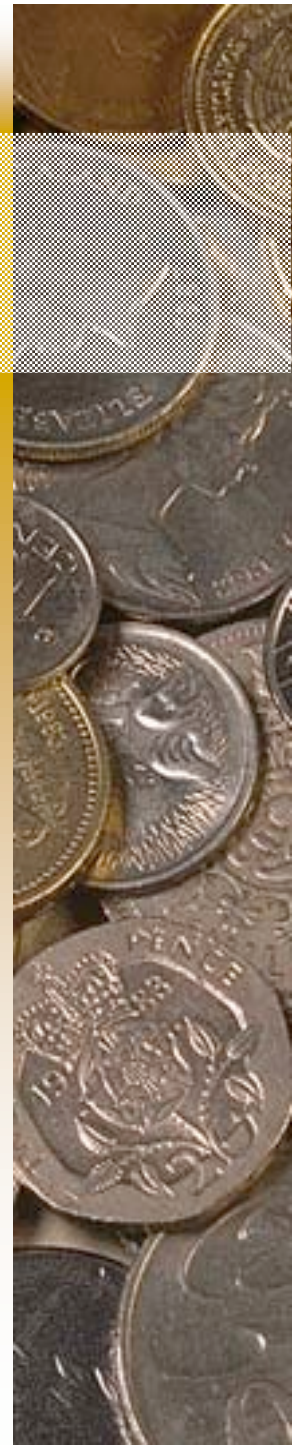
Accept project if NPV > 0.

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

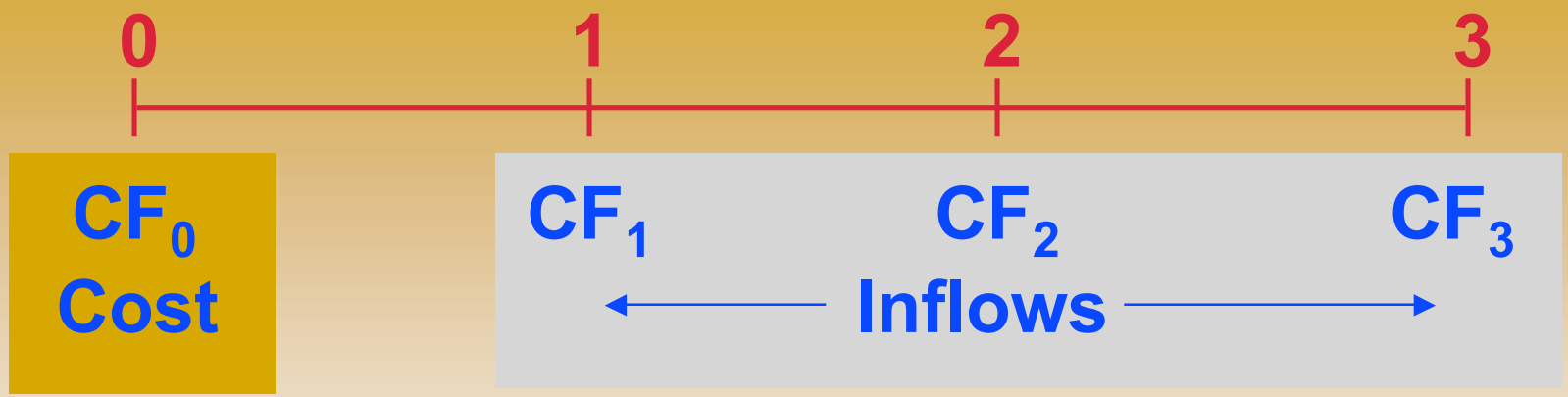


Using NPV method, which franchise(s) should be accepted?

- If Franchise 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



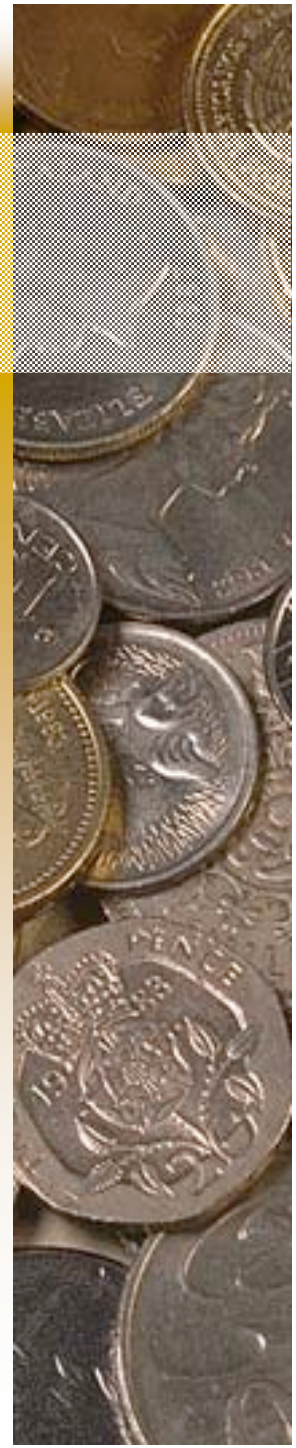
IRR is the discount rate that forces PV inflows = cost. This is the same as forcing NPV = 0.

NPV: Given r, solve for NPV.

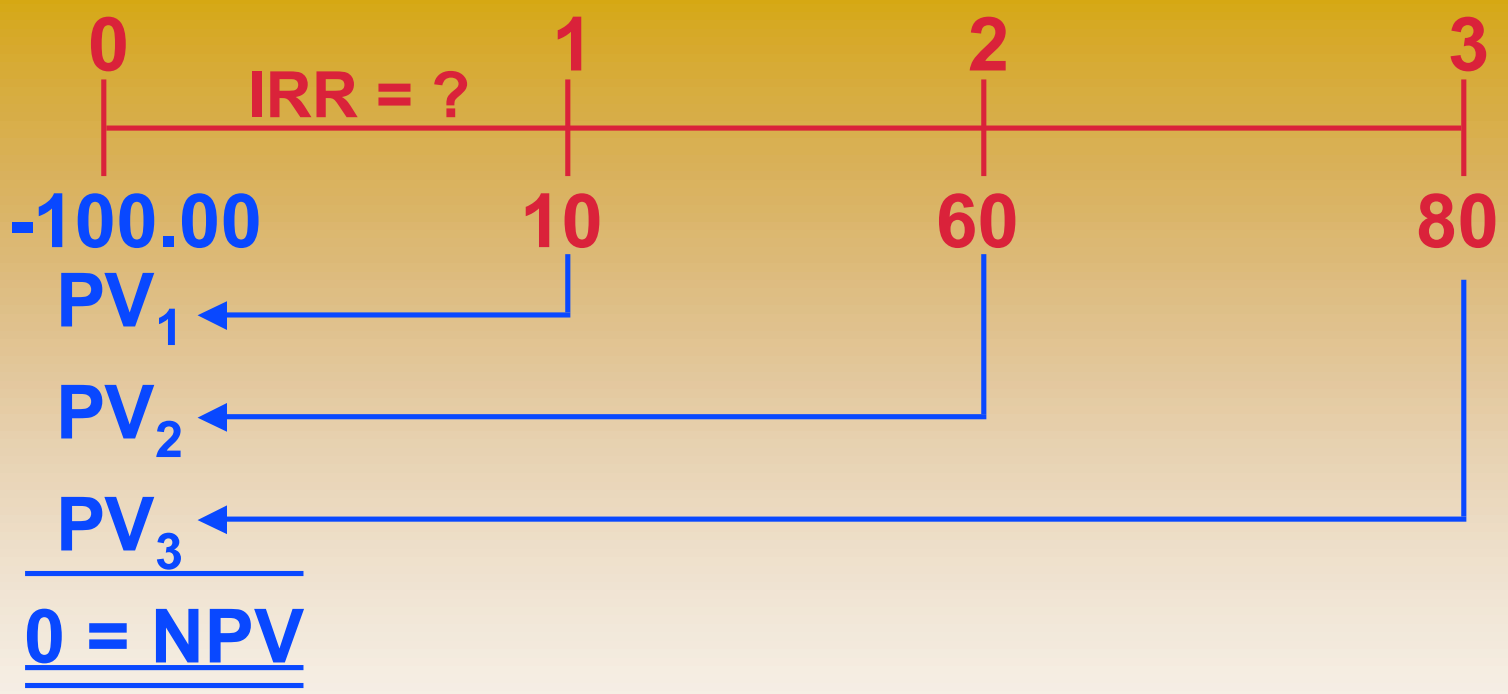
$$\sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} = NPV.$$

IRR: Given NPV = 0, solve for IRR.

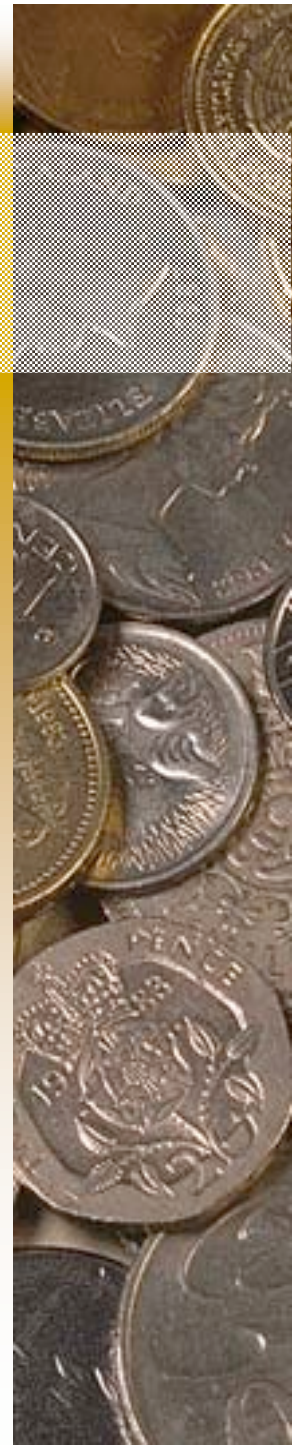
$$\sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} = 0.$$



What's Franchise L's IRR?



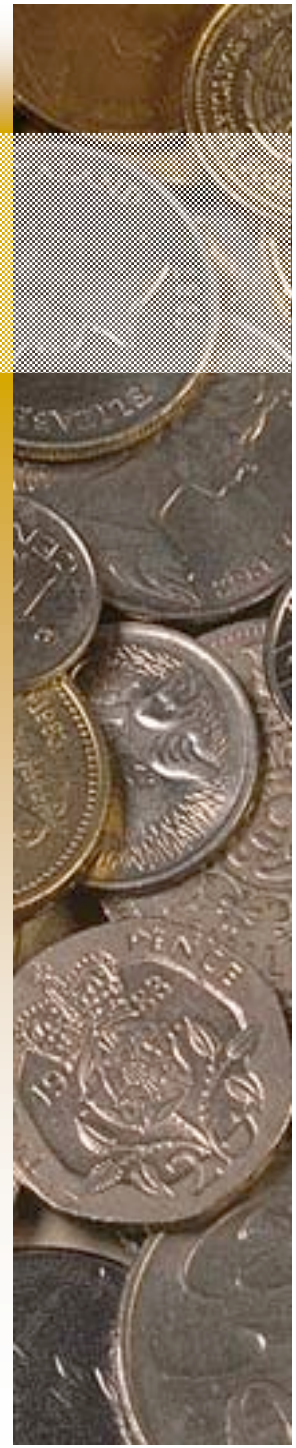
IRR_L = 18.13%. IRR_S = 23.56%.



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.

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



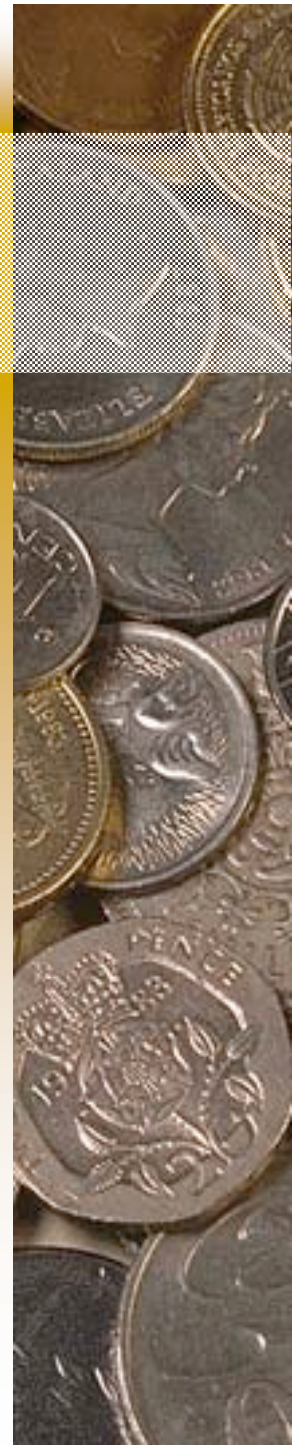
Decisions on Projects S and L per IRR

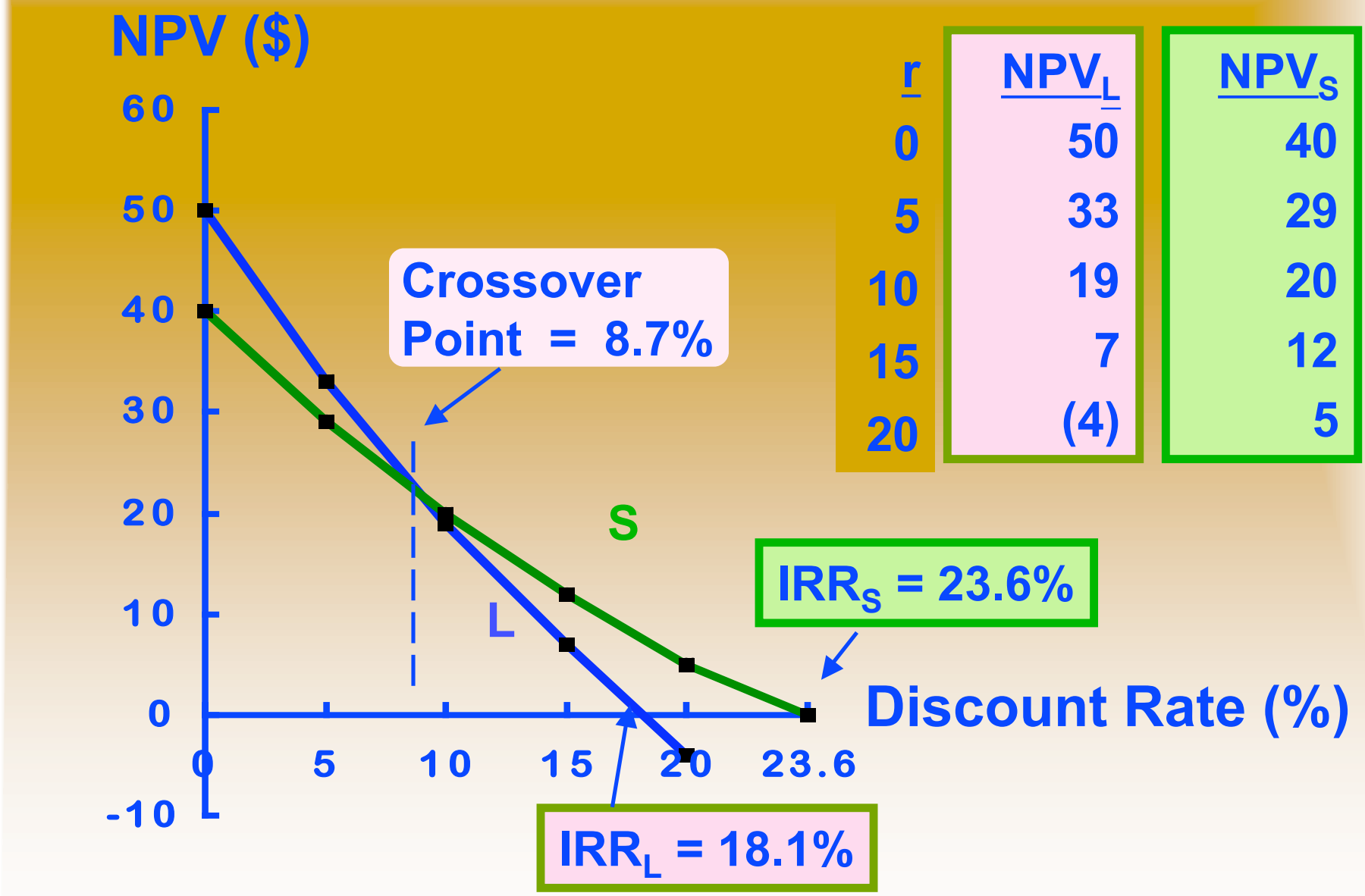
- If S and L are independent, accept both. IRRs > r = 10%.
- If S and L are mutually exclusive, accept S because $IRR_S > IRR_L$.

Construct NPV Profiles

Find NPV_L andNPV_S at different discount rates:

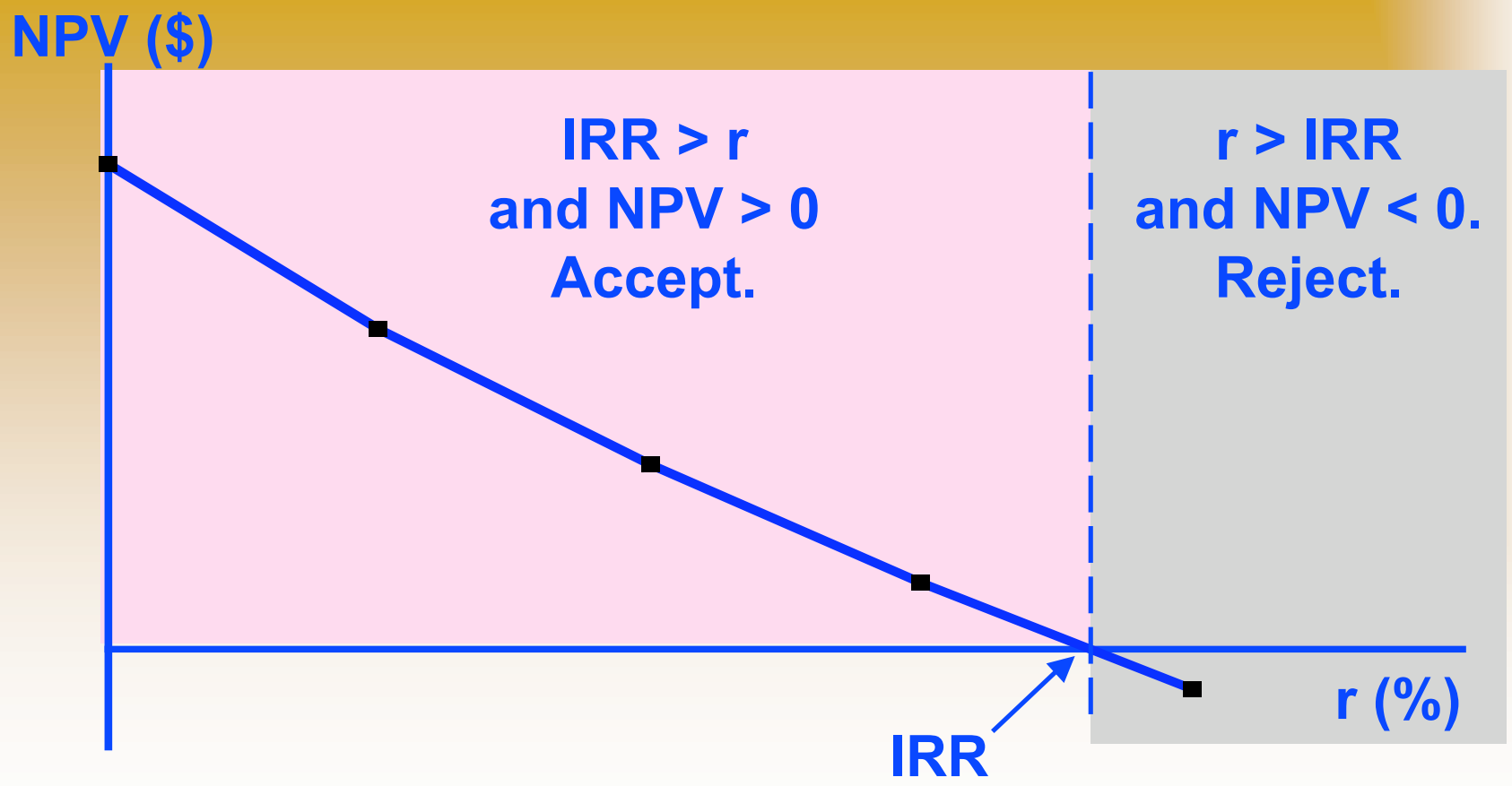
r	NPV_L	NPV_S
0	50	40
5	33	29
10	19	20
15	7	12
20	(4)	5



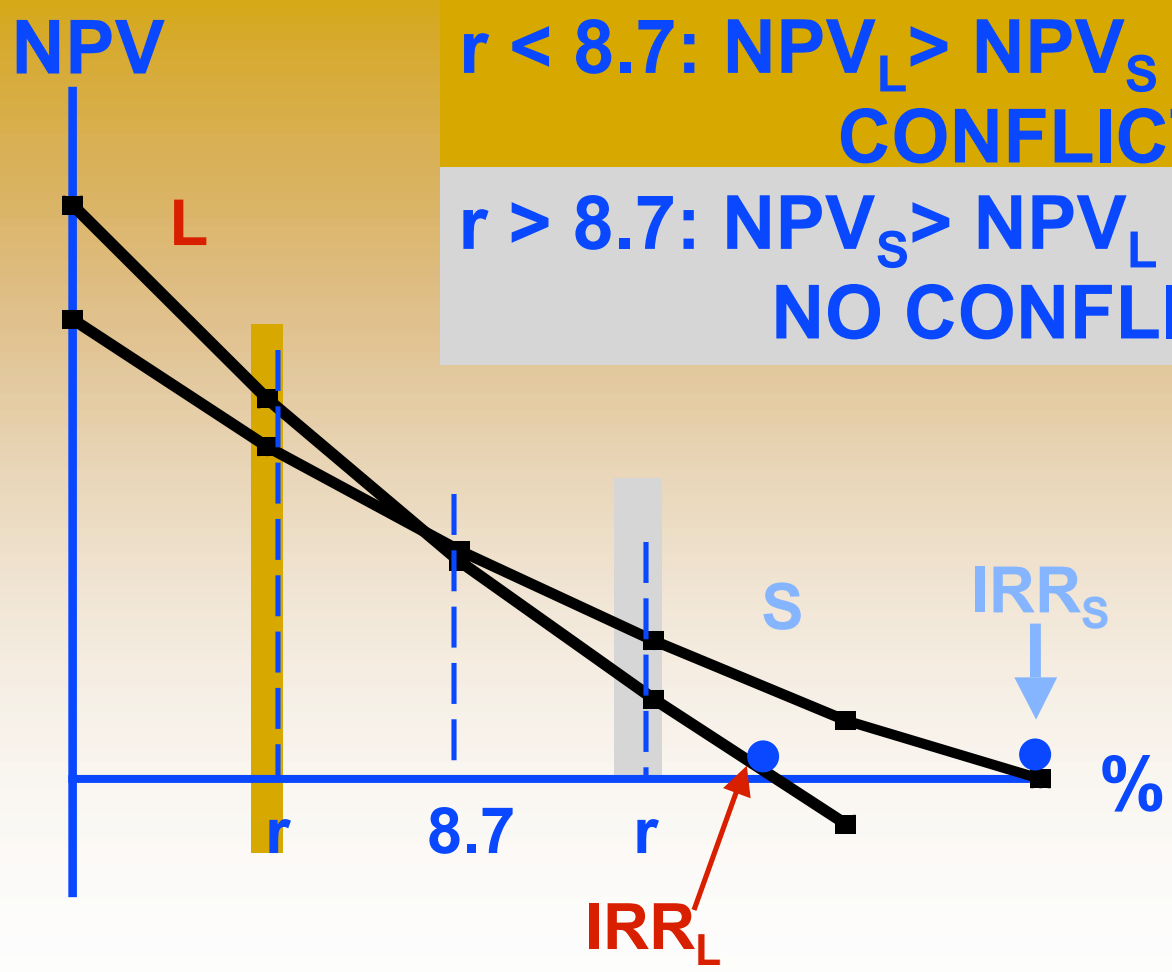


r	NPV$_L$	NPV$_S$
0	50	40
5	33	29
10	19	20
15	7	12
20	(4)	5

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



Mutually Exclusive Projects

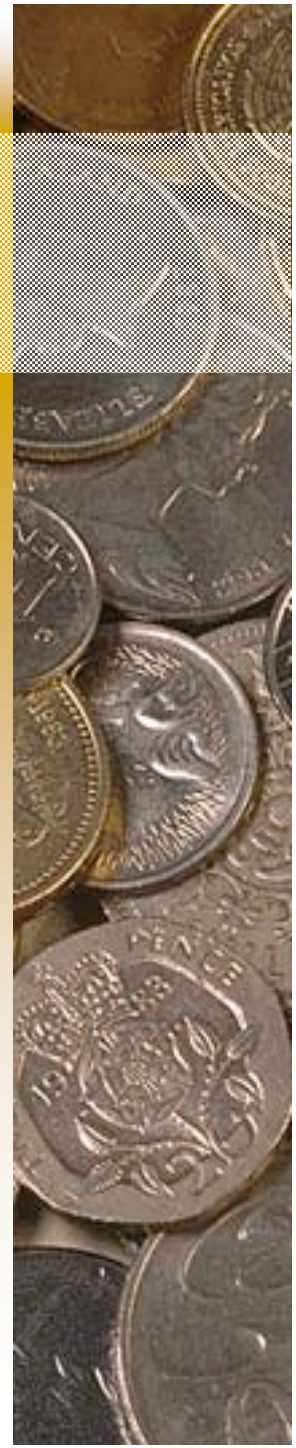


r < 8.7: $NPV_L > NPV_S$, $IRR_S > IRR_L$
CONFLICT

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

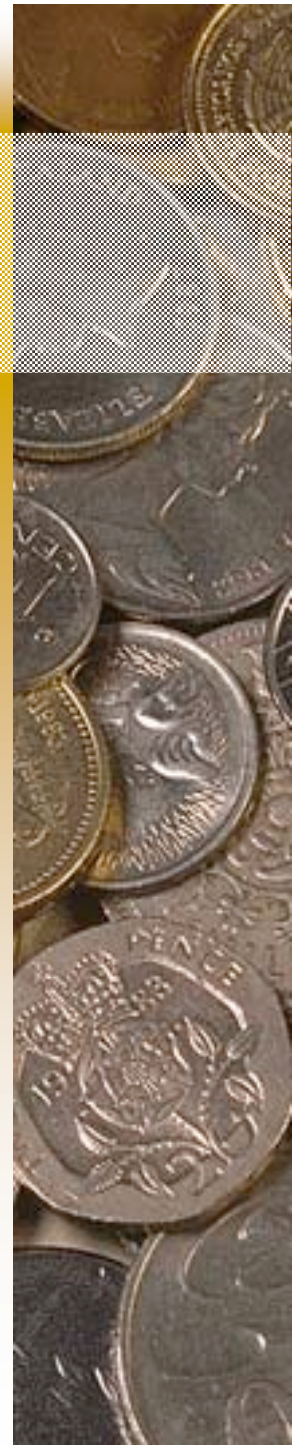
To Find the Crossover Rate

1. Find cash flow differences between the projects. See data at beginning of the case.
2. Use these differences in CF to calculate IRR. 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 r favors small projects.
2. **Timing differences.** Project with faster payback provides more CF in early years for reinvestment. If r is high, early CF especially good, $NPV_S > NPV_L$.



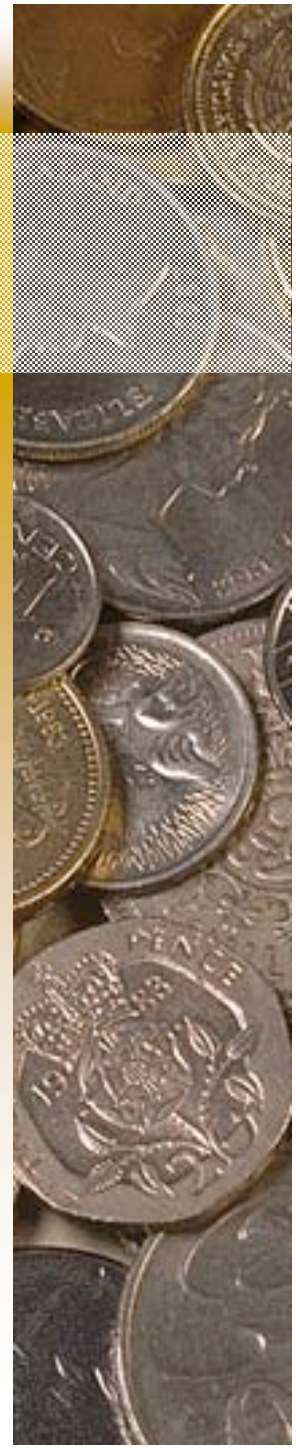
Reinvestment Rate Assumptions

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

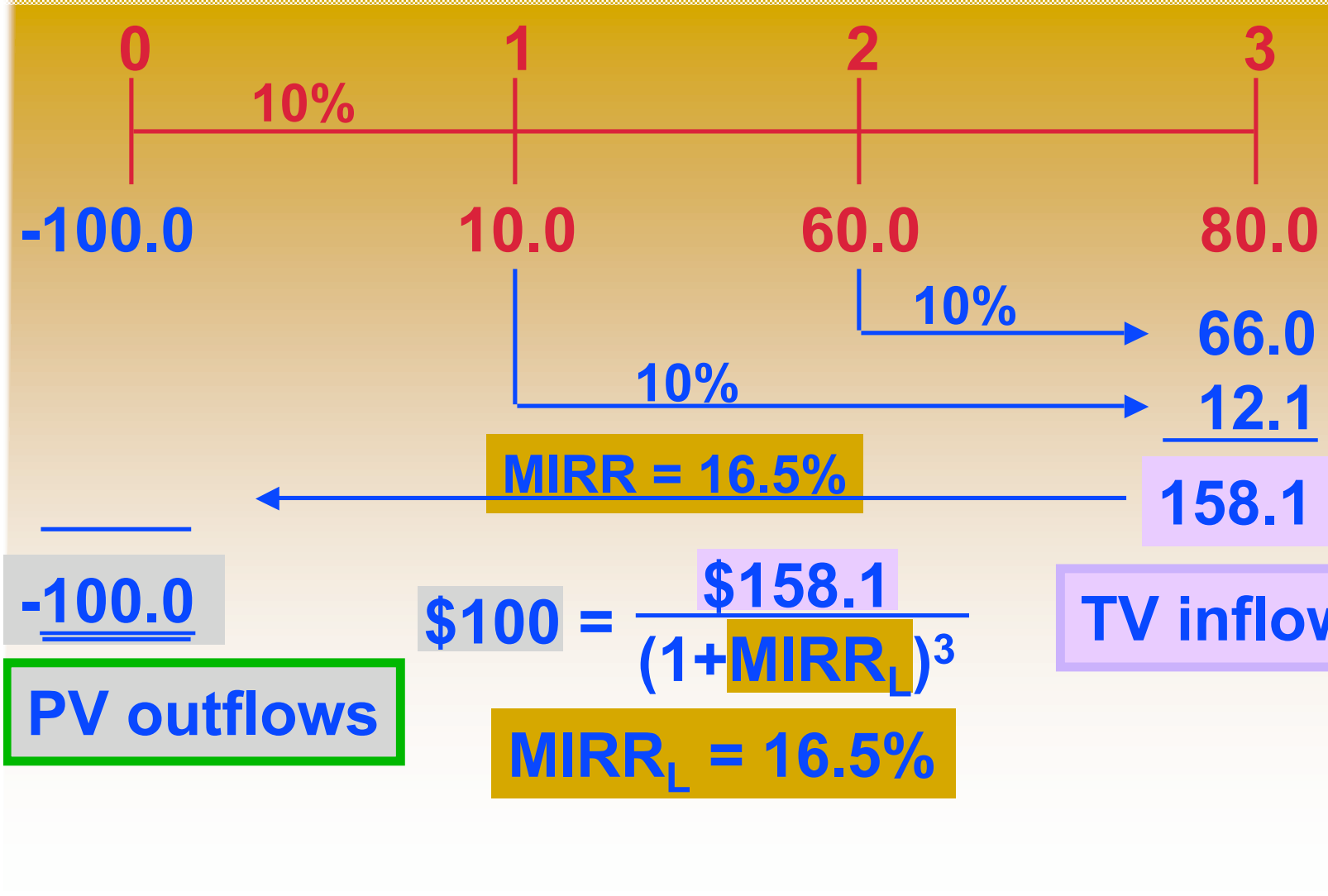
Is there a better IRR?

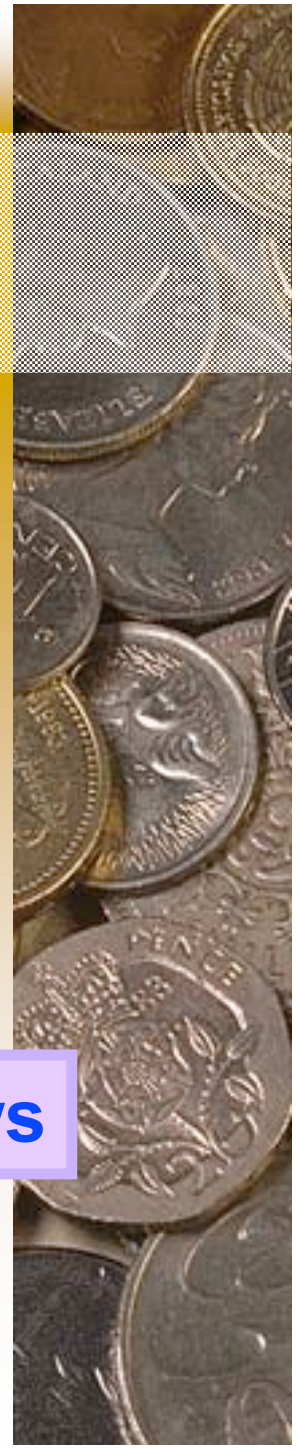
Yes, MIRR is the discount rate which causes the PV of a project's terminal value (TV) to equal the PV of costs. TV is found by compounding inflows at WACC.

Thus, MIRR assumes cash inflows are reinvested at WACC.



MIRR for Franchise L (r = 10%)



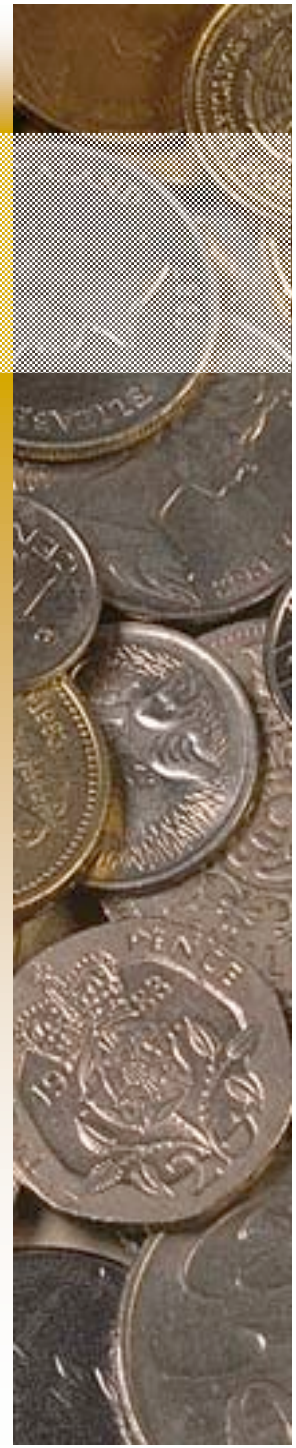


Why use MIRR versus IRR?

MIRR correctly assumes reinvestment at opportunity cost = WACC. MIRR also avoids the problem of multiple IRRs.

Some managers like rate of return comparisons, and MIRR is better for this than IRR.

Besides, you cannot use IRR when flows change signs more than once



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.

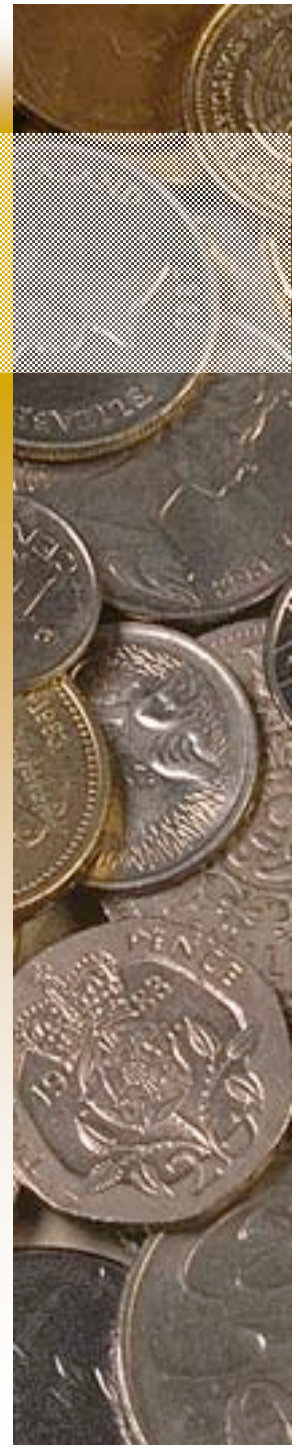
Consider a project with a 3-year life.

If terminated prior to Year 3, the machinery will have positive salvage value.

Year	CF	Salvage Value
0	($5,000)	$5,000
1	2,100	3,100
2	2,000	2,000
3	1,750	0

CFs Under Each Alternative (000s)

	0	1	2	3
1. No termination	(5)	2.1	2	1.75
2. Terminate 2 years	(5)	2.1	4	
3. Terminate 1 year	(5)	5.2		

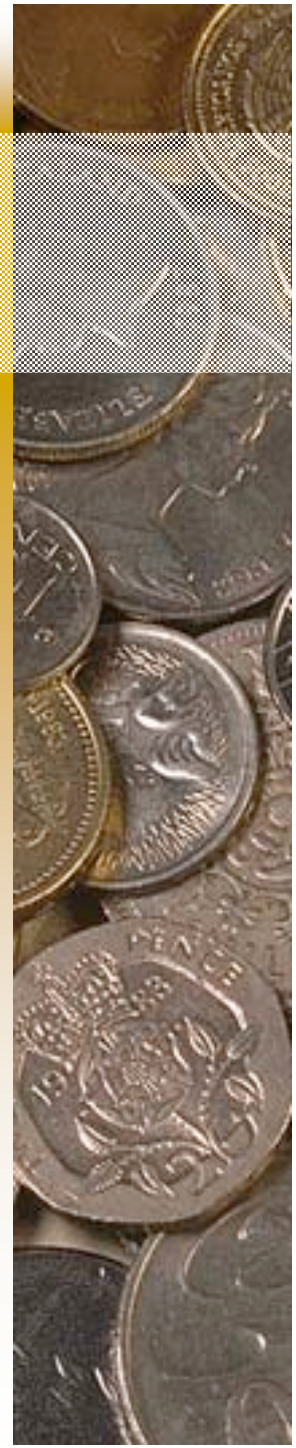


Assuming a 10% cost of capital, what is the project's optimal life?

$NPV_{(no)}$ = -$123.

$NPV_{(2)}$ = $215.

$NPV_{(1)}$ = -$273.



Conclusions

- The project is acceptable only if operated for 2 years.
- A project's engineering life does not always equal its economic life.

Choosing the Optimal Capital Budget

- Finance theory *generally* says to accept all positive NPV projects.
- Two problems can occur when there is not enough internally generated cash to fund all positive NPV projects:
  - An increasing marginal cost of capital.
  - Capital rationing

Increasing Marginal Cost of Capital

- Externally raised capital can have large flotation costs, which increase the cost of capital.
- Investors often perceive large capital budgets as being risky, which drives up the cost of capital.

(More...)

- **If external funds will be raised, then the NPV of all projects should be estimated using this higher marginal cost of capital.**

Capital Rationing

- Capital rationing occurs when a company chooses not to fund all positive NPV projects.
- The company typically sets an upper limit on the total amount of capital expenditures that it will make in the upcoming year.

(More...)

Reason: Companies want to avoid the direct costs (i.e., flotation costs) and the indirect costs of issuing new capital.

Solution: Increase the cost of capital by enough to reflect all of these costs, and then accept all projects that still have a positive NPV with the higher cost of capital.

(More...)

Reason: Companies don't have enough managerial, marketing, or engineering staff to implement all positive NPV projects.

Solution: Use linear programming to maximize NPV subject to not exceeding the constraints on staffing.

(More...)

Reason: Companies believe that the project's managers forecast unreasonably high cash flow estimates, so companies "filter" out the worst projects by limiting the total amount of projects that can be accepted.

Solution: Link the managers' compensation to the subsequent performance of projects.