Chapter 10: The Basics of Capital Budgeting: Evaluating Cash Flows

- Overview
- Methods
  - Payback, discounted payback
  - NPV
  - IRR, MIRR
  - Profitability Index
- Unequal lives
- Economic life

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.

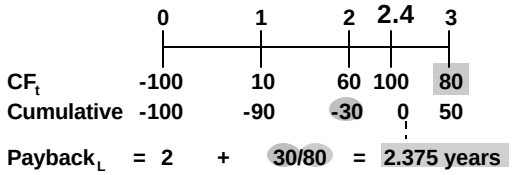
mutually exclusive, if the cash flows of one can be adversely impacted by the acceptance of the other.

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 business's money back?

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



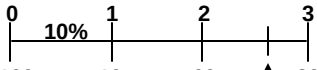
Strengths of Payback:

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: Sum of the PVs of inflows and outflows.

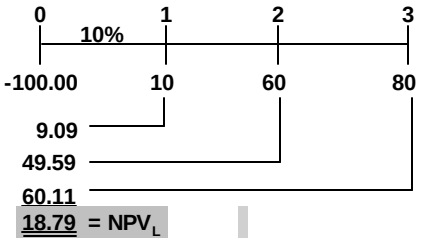
$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}.$$

Cost often is CF_0 and is negative.

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

What's Project L's NPV?

Project L:



Rationale for the NPV Method

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

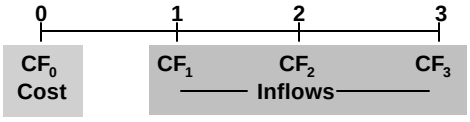
Accept project if NPV > 0.

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.

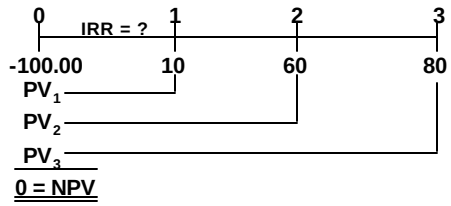
NPV: Enter r, solve for NPV.

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

IRR: Enter NPV = 0, solve for IRR.

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

What's Project L's IRR?



Enter CFs in CFLO, then press IRR:

$IRR_L = 18.13\%$.

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 $IRR_S > IRR_L$.

Reinvestment Rate Assumptions

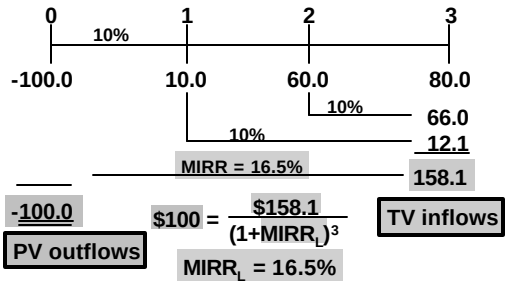
- NPV assumes reinvest at r (opportunity cost of capital).
- IRR assumes reinvest at IRR.
- Reinvest at opportunity cost, r, is more realistic, so NPV method is best. NPV should be used to choose between mutually exclusive projects.

Managers like rates--prefer IRR to NPV comparisons. Can we give them 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 Project L (r = 10%)



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.

S and L are mutually exclusive and will be repeated. r = 10%. Which is better? (000s)

	0	1	2	3	4
Project S:	(100)	60	60		
Project L:	(100)	33.5	33.5	33.5	33.5

	S	L
CF_0	-100,000	-100,000
CF_1	60,000	33,500
N_j	2	4
I	10	10
NPV	4,132	6,190

$NPV_L > NPV_S$. But is L better? Can't say yet. Need to perform common life analysis.

Replacement Chain Approach (000s)

Project S with Replication:

	0	1	2	3	4
Project S:	(100)	60	60		
			(100)	60	60
	(100)	60	(40)	60	60

NPV = $7,547.

Or, use NPVs:

	0	1	2	3	4
	4,132		4,132		
	3,415	10%			
	7,547				

Compare to Project L NPV = $6,190.

If the cost to repeat S in two years rises to $105,000, which is best? (000s)

	0	1	2	3	4
Project S:	(100)	60	60		
			(105)	60	60
			(45)		

NPV_S = $3,415 < NPV_L = $6,190. Now choose L.

Consider another 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, or economic 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 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.