FIN 325 Corporate Finance

L2 (Techniques): Investment Decision Rules

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What do we look for in a decision rule?

- Accounts for the time value of money.
- Accounts for risk.
- Does the rule tell us how much value the project creates?

Example project

- Throughout this lecture, we'll consider a project. Let's call it **Project A**.
- The cash flows generated by project A are as follows:
  - Invest \$100 at $t = 0$.
  - Receive \$30 each year after until $t = 5$ inclusive, (i.e. for $t = 1, 2, 3, 4, 5$).

Method 1: NPV rule (1)

- The big daddy of decision rules.
- Weighs up the marginal cost and benefit associated with a particular project after discounting.
- Rule:
  - Accept the project if NPV ≥ 0
  - Reject the project if NPV < 0
- $NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+r_t)^t}$
- The NPV captures exactly the additional value created by the project for the firm.
- The value of the firm is the sum of the NPVs of all of its projects.

Method 1: NPV rule (2)

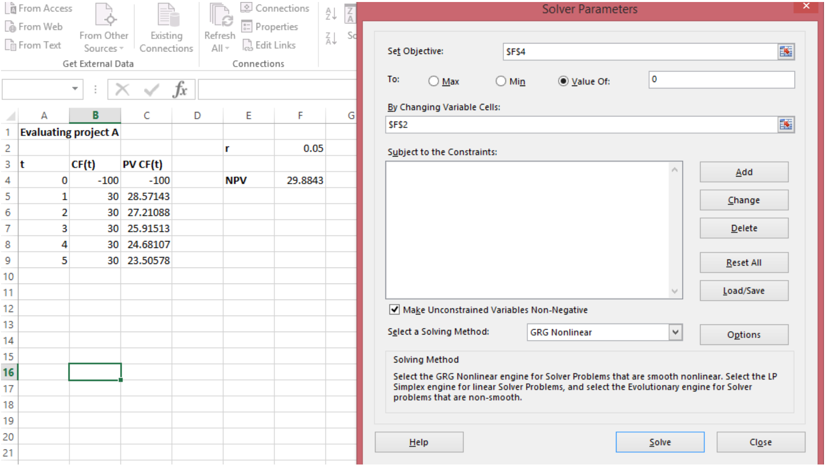
	A	B	C	D	E	F
1	**Evaluating project A**					
2					**r**	0.05
3	**t**	**CF(t)**	**PV CF(t)**			
4	0	-100	=B4/(1+$F$2)^A4		**NPV**	=SUM(C4:C9)
5	1	30	=B5/(1+$F$2)^A5			
6	2	30	=B6/(1+$F$2)^A6			
7	3	30	=B7/(1+$F$2)^A7			
8	4	30	=B8/(1+$F$2)^A8			
9	5	30	=B9/(1+$F$2)^A9			

Method 2: IRR rule (1)

- A commonly used decision rule in the private sector.
- The internal rate of return (IRR) is the discount rate such that the NPV of the project is set to zero.
- $\sum_{t=0}^{T} \frac{CF_t}{(1+IRR)^t} = 0$.
- Rule:
  - Accept project if IRR $\geq$ required rate of return.
  - Reject project if IRR $<$ required rate of return.
- Intuitively, if the IRR rule leads to acceptance, then the project is generating you a return higher than the next best use of your funds.

Method 2: IRR rule (2)

- Use Solver in excel.
  - Found under Data $\Rightarrow$ Analysis $\Rightarrow$ Solver.

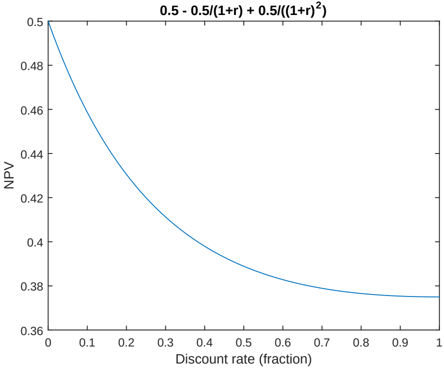


Method 2: IRR rule (3)

- This decision rule is intuitive, but it has problems!
  - Can have **multiple** IRRs.
  - IRR may **not exist**!
- The warning sign is cash flows that alternate in sign many times between periods.
- Obviously also if the cash flows **never** change sign!

Method 2: IRR rule (4)

- Consider the following example:
  - Receive \$0.5 at $t = 0$.
  - Pay \$0.5 at $t = 1$.
  - Receive \$0.5 at $t = 2$.
  - $\text{NPV} = 0.5 - \frac{0.5}{1+r} + \frac{0.5}{(1+r)^2}$.
  - NPV function never crosses the r axis for any $r \in [0, 1]$.



Method 3: payback rule (1)

- The amount of time required for an investment to generate after-tax cash flows that are sufficient to cover the initial cost.
- This method is evil. It doesn't take account of the time value of money or risk!
- Very intuitive though.
- Rule:
  - Accept if the payback period is less than some specified amount of time.
  - Reject if the payback period is greater than some specified amount of time.

Method 3: payback rule (2)

- Just look for the year such that the total positive cashflows exceed the initial investment.
- Payback period for project A is between four and five years.
- We'd accept the project if the cutoff was 5 years or above.

Evaluating project A			
t	CF(t)	Amount to be made	Cumulative CF(t)
0	-100	100	
1	30	100	30
2	30	100	60
3	30	100	90
4	30	100	120
5	30	100	150

Method 4: discounted payback rule (1)

- The length of time for the discounted cash flow receipts to offset the initial cost.
- Rule:
  - Accept if discounted payback year is less than specified cutoff year.
  - Reject if discounted payback year is above specified cutoff year.
- Again we require an arbitrary cutoff year.
- At least this method accounts for discounting though!

Method 4: discounted payback rule (2)

- Again the discounted payback period is between four and five years.
- Same conclusion as payback rule.

Evaluating project A							
						r	0.05
t	CF(t)	Amount to be made	PV CF(t)	Cumulative PV CF			
0	-100	100	-100			NPV	29.8843
1	30	100	28.57143	28.57142857			
2	30	100	27.21088	55.78231293			
3	30	100	25.91513	81.69744088			
4	30	100	24.68107	106.3785151			
5	30	100	23.50578	129.8843001			

Method 5: profitability index (1)

- Measures the benefit per unit of upfront cost.
- $PI = \frac{PV_1}{C_0}$ where PV_1 is the present value of positive cash flows starting next period onwards and C_0 is upfront cost.
- A PI value of 1.2 means that we create an additional \$0.2 of value per dollar of investment up front.
- Rule:
  - Accept if $PI \geq 1$ (creates value).
  - Reject if $PI < 1$ (destroys value).
- Not getting an idea of the absolute value created though.

Method 5: profitability index (2)

- Would accept project A under the PI rule.

Evaluating project A					
				r	0.05
t	CF(t)	PV CF(t)			
0	-100	-100		PI	1.298843
1	30	28.57143			
2	30	27.21088			
3	30	25.91513			
4	30	24.68107			
5	30	23.50578			

Takeaways

- NPV rule is supreme!
- Other rules might be used because they are more intuitive.
- Other rules though can be inconclusive or lead to **wrong** investment decisions being made.
- Payback **can** be badass (see below), but not when it comes to decision-making!