1 Week 4

1.1 Recap: Week 3

Weeks 1, 2→Time Value of Money (TVM) (No Risk)

Week 3 → Decision criteria:

- NPV
  - Cash Flows
  - Discounting
- Payback
  - easy of communication/calculation
    - issue: if cash flows change sign you could have up to two IRRs.
  - how soon you get your money back
- IRR
  - calculation (rate of return on project)
    - if you calc it on your project, $IRR = 0$
    - if $IRR > r$, cost of capital, what similar businesses are making, you should do the project, this implies $NPV > 0$
  - cash flow - belongs to project

1.2 IRR: Bias I

1.2.1 IRR: Mutually Exclusive Projects

An intuitive deicsion rule when comparing mutually exclusive projects would be to accept the project with the highest IRR.

This rule is, unfortunately, incorrect as the following examples demonstrate.

Ex.: Consider two projects, A and B, with the following cash flows. Which one would you choose?

Year	Project A	Project B
0	-$2000	-$2000
1	$400	$2000
2	$2400	$625
IRR	20%	25%

IRR A

=irr(A1:C1)= 20%

IRR B

=irr(A2:C2)= 25%

So according to this, B, would be the better choice. This may not be the right choice - **short term bias**

Project A gives higher returns later.

This is comparing internally, the benchmark for IRR is what the cost of capital outside.

Year	Project A	Project B
0	-$2000	-$2000
1	$400	$2000
2	$2400	$625
NPV	558	472

The 0.05 is what the investor will compare the numbers against.

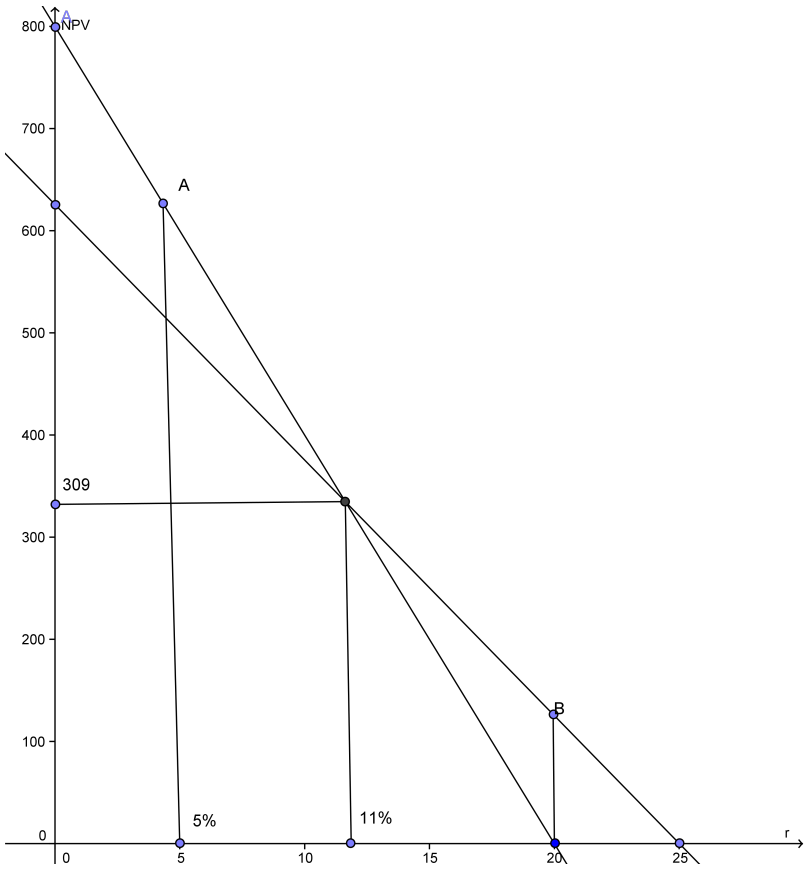
=npv(.05, B1:C1)+a1= $557.82

=npv(0.05, B2:C2)+a2= $471.66

Based on this you'd choose A.

Suppose the bets alternative is earning 20%. At 20% A is 0, B is 101. At 11, the numbers are 308 and 309 for A and B respectively.

1.2.2 IRR Bias: Graphic Representation



You would not pick any if $IRR > 25\%$

IRR is biased in favor of short term projects.

1.3 IRR Bias II

1.3.1 IRR Issues: Small Investment Bias

Consider two projects, A and B, with the following cash flows. Which one would you choose?

Year	Project A	Project B
0	-$5000	-$50000
1	$7500	$62500
IRR	50%	25%

FV-PV=2500

A→ $\frac{7500-5000=}{5000} \frac{2500}{5000} = 50\%$

B→ $\frac{12500}{50000} = 25\%$

$NPV_{50\%} = \frac{-5000+7500}{1.5} = 5000$

Problem: Almost anybody would say do Project A, but the answer is it depends.

IRR likes small ideas, the smaller the investment, the higher the IRR.

NPV calculations

If $r = 15\%$ or 30% or 22%. Which one would you choose?

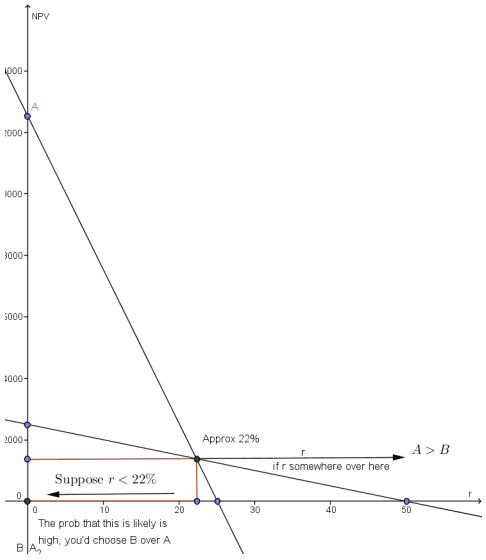
Year	Project A	Project B	r
0	-$5000	-$50000	
1	$7500	$62500	
NPV	1522	4348	15%
NPV	769	1923	30%
NPV	1148	1230	22%

=npv(15%, 7500)+(-5000)

etc.

Which one to choose, it depends on the competition

IRR Bias: Graphic Representation



1.4 IRR: Properties

Makes Sense?

Maybe. At a gut level.

Unit of measurement?

% →what does it mean in terms of relationship with value measurement measured in $. This process hides value behind percentage.

Benchmark obvious?

r is the benchmark, need to compare to what you would earn elsewhere.

Easy to communicate?

Yes by itself? Not in value creation.

Easy to compare ideas?

Not, deceptive because it favors short term, small value biases

Easy to calculate?

Not really

1.5 Cash Flows: Basics

$$NPV = -I_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \dots \frac{C_n}{(1+r)^n}$$

where I_0 (or C_0) is the investment cost of the project and C_n is the cash flow in period n.

1.5.1 A Snap-Shot of Project/Firm/You

Assets	Liabilities
Real Assets	Equity Debt

Real assets are things that generate value - cash flows, machines used to execute the idea.

Real assets are doing two things:

- generating cash flows
- then you figure out what r is and evaluate the cash flows

On liability side you finance the idea.

Timeline is again important

When doing cash flows, you decide what the periods are.

Figure out what starting point you're at, then figure out Cash Flows, C_0, $C_1, \dots C_n$.

1.5.2 Valuing an Idea/Project

All value is relative: Law of on price. Value depnds on closest comparable.

There are two basic ingredients to conducting a valuation:

- Cash Flows: Who do they belong to?
- Cost of Capital, r: Who does this belong to?

Detailed rules to cash flow estimation may vary by country.

1.5.3 Cash Flows: Important Background

All about future cash flows for the life of the project/firm

Sources: Pro forma Income Statements & Balance Sheets

Income Statement: Year's flows

Balance Sheet: A snapshot of assets/stocks

1.6 Cash Flows: A Template

1.6.1 Estimating Cash Flows for a Specific Year

Cash Flows from Project/Operations (assume this is for years 1-10)

Revenues	$5m$	$(Price \cdot Quantity)$ - Price depends on market/place, assume $P_1 \cdot Q_1 = 5m$
- Cost of Goods Sold	$2m$	$(Price \cdot Quantity)$ - it has many prices and quantities, like production cost, assume $P \cdot Q_1 = 2m$
- Selling, General & Administration cost	$0.5m$	how much of this is actually variable? assume $0.5m$
- Depreciation	$1m$	use of machinery or building that can be allocated to this project, assume $1m$. This number is largely imaginary, it's that part of the machine that you used in a year. You substract that.
= Operating Profits	$5 - 2 - 0.5 - 1 = 1.5$	boloney - this has good parts and bad parts, the bad part is the precision, it's a number based on some estimation, the part of the machinery that you used. Somebody tells you that you can depreciate a machine at 10% every year, straight line depreciation, hence $1m$. You can be allowed to subtract it before you pay taxes - good idea.
- Cash Taxes on Operating Profits	$\frac{1}{3} \approx 33\% \approx 0.5m$	
= Net Operating Profits After Tax	$+1.0m$	This is per year, so you ave to do next years 2..10

1.7 Cash Flows: Capital Items

This is boloney.

Revenues	$5m$	$(Price \cdot Quantity)$ - Price depends on market/place, assume $P_1 \cdot Q_1 = 5m$
- Cost of Goods Sold	$2m$	$(Price \cdot Quantity)$ - it has many prices and quantities, like production cost, assume $P \cdot Q_1 = 2m$
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- Cash Taxes on Operating Profits	$\frac{1}{3} \approx 33\% \approx 0.5m$	
= Net Operating Profits After Tax	$1.0m$	This is per year, so you ave to do next years 2..10
+ Depreciation	$1.0m$	Depreciation - classic non-cash-flow item, implication of something that happened in the past for the future - taxes. Taxes are lower because of this.
- Capital Expenditures	0	We're talking about fixed costs - Capital Expenditures (CapEx) - is the amount of money you spend on things that last a while. So this is likely to be low in a specific year, not necessarily 0. You may need after couple years an injection of a smaller machine into the system. The number comes from the balance sheet.
- Increases in Working Capital	$0.1m$	or decreases (change-Δ) - to produce something you have to spend resources. Capital to manage your system.
= Cash Flows from Operations	$+1.9m$	

Q: How much taxes have we saved subtracting depreciation

For year 0 and last, you may not need to worry about some of this stuff.

1.8 Cash Flows: Important Principles

Revenues	$5m$	
- Cost of Goods Sold	$2m$	
- Selling, General & Administration cost	$0.5m$	
- Depreciation	$1m$	
= Operating Profits	$1.5m$	
- Cash Taxes on Operating Profits	$0.5m$	
= Net Operating Profits After Tax	$1.0m$	
+ Depreciation	$1.0m$	
- Capital Expenditures	0	
- Increases in Working Capital	$0.1m$	
= Cash Flows from Operations	$+1.9m$	

1. Estimate all cash flows on an **incremental** (Δ) basis.
   Draw two timelines - with, B, and without project, A. $\Delta_{project}$ means $B_1 - A_1 \dots B_{10} - A_{10}$. If you do it this way, you never double count - costs that are not important to the future because you've already spent them.

2. Do not forget the importance of year 0 and the last year of the chosen timeline for the project.
   Why is time 0 different from the others?
   CapEx - cost upfront, you'd like to take the tax advantage of it and expense it, but you can't. Let's say it's 10m, building, machinery lumped into one. You need to convert it into some kind of cash flow. Assume a straight line/10 years, so depreciation= $\frac{1m}{year}$. The depretiation comes in the future.
   Working Capital - starts at near 0→some cash + inventory + account receivables (AR) - account payables. **Account Receivables** are things sold on credit. If given the chance of selling \$100m worth of stuff but 50% of it on credit, you'd prefer 100% cash, because of the time value of money. But you'd rather make a sale than not. **Account Payables** are on stuff you pay for later. This is good. The higher the working capital, the less efficient you are.

3. Accounting issues are important.

   (a) Depreciation (because it's made up) and similar non-cash items

   (b) Total capital - come from balance sheet, Δs

      i. Capex

      ii. Working capital

4. Do not mix financing with operations. While you're doing project analysis, stay on the assets side, because Real Assets give you cash flows and later we worry about what the discount rate, r, is. The value is generated on the asset side of the balance sheet and is extremely important.
   If you start thinking about financing while doing project analysis, you are worrying about an issue that doesn't add value. What adds value is whether your idea is good or not. Discount rate will reflect that (later).

Assets	Liabilities
Real Assets	Equity and Debt

   Money is not generated by financing
   When you're discounting cash flow, you're taking financing into account.

5. Include the effects of inflation/deflation.
   Every item in the cash flow statement has different inflation.

6. Do not compare projects with unequal lives.
   Suppose you have projects A and B.
   values in million

	0	1	2	3
A	20	2	2	
B	25	1	1	1

One is 2 years long, other 3 years long. You have to choose between machines. So machine A costs 20m in year 0 and 2m every year in maintenance. This is cost minimization, can you do the present value of these machines? Yes, if you have the discount rate. Say, $r = 5\%$.
$PV_A = 23.72$
$PV_B = 27.72$
If you choose cheaper machine, you'll be choosing the shorter lived one. Can you compare these two? No. You could do this analysis over 6 ears by converting PV into annuity.
$PMT_A = 12.76$
$PMT_B = 10.18$
Per year cost works out lowe for machine B.