FUNDAMENTALS OF CAPITAL BUDGETING

By Shushu Liao

Outline

1. Forecasting Earnings
2. Determining Free Cash Flow and NPV
3. Further Adjustments to Free Cash Flow (Salvage value, MACRS methods, Terminal value)
4. Analyzing the Project (breakeven analysis, sensitivity analysis, football field valuation chart)

Concept check

What is EBIT (earnings before interest and tax)

Revenue – cost - Depreciation

What is EBITDA (earnings before interest and tax, depreciation and amortization)

Revenue – cost

Relevant Cash Flow

- Stand-alone principle: focus on the projects' resulting relevant cash flows only
- The relevant cash flows consists of any and all changes in the firm's current and future cash flows that are a *direct consequence of taking the project*
- Any cash flow that exists **regardless of whether or not a project** is undertaken is *not relevant.*

Opportunity Cost - Relevant

Indirect effects of the project that may affect the profits of other business activities of the firm.

- **Cannibalization** is when sales of a new product displaces sales of an existing product.
- The value a resource that could have provided in alternative use (e.g., space used for warehousing not for rents).

Sunk Cost - Irrelevant

Sunk costs are costs that have been or will be paid regardless of the decision whether or not the investment is undertaken

- Sunk costs should not be
- Examples:
  - **Past** Research and Development Expenditures or marketing research expenses
  - Fixed Overhead Expenses
  - Unavoidable Competitive Effects

Question

Home Builder Supply, a retailer in the home improvement industry, currently operates seven retail outlets in Georgia and South Carolina. Management is contemplating building an eighth retail store across town from its most successful retail outlet. The company already owns the land for this store, which currently has an abandoned warehouse located on it. Last month, the marketing department spent $10,000 on market research to determine the extent of customer demand for the new store. Now Home Builder Supply must decide whether to build and open the new store.

Which of the following should be included as part of the incremental earnings for the proposed new retail store?

a. The cost of the land where the store will be located.

b. The cost of demolishing the abandoned warehouse and clearing the lot for the store.

c. The loss of sales in the existing retail outlet, if customers who previously drove across town to shop at the existing outlet become customers of the new store instead. Cannibalization(Opportunity costs)

d. The $10,000 in market research spent to evaluate customer demand. Sunk costs

e. Construction costs for the new store.

f. The value of the land if sold. Opportunity costs

g. Interest expense on the debt borrowed to pay the construction costs. Interests are Not Considered in the capital budgeting

Interest Expense

In capital budgeting decisions, interest expense is typically not included.

The rationale is that the project should be judged on its own, not on how it will be financed.

Revenue And Cost Estimates

Sunk costs

Linksys has completed a $300,000 feasibility study to assess the attractiveness of a new product, HomeNet. The project has an estimated life of four years.

- Revenue Estimates
  - Sales = 100,000 units/year
  - Per Unit Price = $235
- Cost Estimates
  - Up-Front R&D for the project = $15,000,000
  - Up-Front New Equipment = $7,500,000
    - Expected life of the new equipment is five years.
    - Housed in existing lab
  - Annual Overhead = $3,000,000
  - Per Unit Cost = $95

Capital Expenditures And Depreciation

The $7,500,000 million in new equipment is a cash expense, but it is **not** directly listed as an expense when calculating *earnings*.

It belongs to **Capital Expenditures (CapEx).**

The firm deducts a fraction of the cost of these items each year as depreciation.

- Straight Line Depreciation
  - The asset's cost is divided equally over its life. Annual Depreciation

$$= \frac{\$7.5\,\text{million}}{5\ \text{years}} = \$1.5\,\text{million/year}$$

Taxes

Marginal Corporate Tax Rate

- The tax rate on the marginal dollar of pre-tax income
  - Note: A negative tax is equal to a tax credit

$$\text{Income Tax} = \text{EBIT} \times \tau_c$$

accounting statement: (EBIT - interest) x tax

Unlevered Net Income Calculation

$$\begin{aligned} \textbf{\textit{Unlevered Net Income}} &= EBIT \times (1 - \tau_c) \\ &= (\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c) \end{aligned}$$

Incremental Earnings Forecast

Relevant Information: The project has an estimated life of **four** years (Unit: Thousand).

- Revenue & Cost Estimates
  - Sales = 100 per year
  - Per Unit Price = $235 Per Unit Cost = $95
  - Up-Front R&D for the project = $15,000 up-front: occur once at year 0
  - Annual Overhead = $3,000 Annual: each year over the project life
  - Up-Front New Equipment = $7,500
    - Expected life of the new equipment is **five years** – five-year depreciation.

	Y0	Y1	Y2	Y3	Y4	Y5
Sales rev.		23500	23500	23500	23500	
COGS(cost of goods sold)		9500	9500	9500	9500	
Gross profits		14000	14000	14000	14000	
SGA(sell,general,admin costs)		3000	3000	3000	3000	
R&D	15000					
Depreciation		7500/5=1500	1500	1500	1500	1500
EBIT(GP-SGA-RD-dep.)	-15000	9500	9500	9500	9500	-1500
tax (20%)	-3000	1900	1900	1900	1900	-300
Unlevered Net income	-12000	7600	7600	7600	7600	-1200

unlevered net income = EBIT x (1 - tax rate)

Incremental Earnings Forecast

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1 Sales		-	23,500	23,500	23,500	23,500	-
2 Cost of Goods Sold		-	(9,500)	(9,500)	(9,500)	(9,500)	-
3 **Gross Profit**		-	14,000	14,000	14,000	14,000	-
4 Selling, General, and Administrative		-	(3,000)	(3,000)	(3,000)	(3,000)	-
5 Research and Development **(up-front)**		(15,000)	-	-	-	-	-
6 Depreciation		-	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT (earnings before interest and taxes)**		(15,000)	9,500	9,500	9,500	9,500	(1,500)
8 Income Tax at 20%		3,000	(1,900)	(1,900)	(1,900)	(1,900)	300
9 **Unlevered Net Income**		**(12,000)**	**7,600**	**7,600**	**7,600**	**7,600**	**(1,200)**

Preview of Free Cash Flow (FCF)

Guess about

1. Unlevered free cash flow (FCF) are cash available to

a) All equity holders

b) All stakeholders including equity and debt holders

2. NOPAT (net operating profit after tax) is

a) EBIT x (1 –tax rate)

b) (EBIT – interest) x (1 – tax rate)

3. Should you ___ depreciation to compute FCF

a) Subtract

b) Add back

4. Should you ___ accounts receivable (sales on credit) to compute FCF

a) Subtract

b) Add back

Preview of Free Cash Flow (FCF)

Guess about

1. Unlevered free cash flow (FCF) are cash available to

a) All equity holders

b) All stakeholders including equity and debt holders

b

2. NOPAT (net operating profit after tax) is

a) EBIT x (1 –tax rate)

b) (EBIT – interest) x (1 – tax rate)

a

3. Should you ___ depreciation to compute FCF

a) Subtract

b) Add back

b

4. Should you ___ accounts receivable (sales on credit) to compute FCF

a) Subtract

b) Add back

a

Determining Free Cash Flow (from unlevered net income) and NPV

The incremental effect of a project on a firm's available cash is its *Free Cash Flow (FCF)*.

A project's NPV should be computed based on Free Cash Flow.

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

change in net working capital
NWC=receivable (non-cash rev) + cash + Inventory - payable

Calculating the FCF from Earnings (1/3)

- Capital Expenditures and Depreciation
  - Capital Expenditures are the actual cash outflows when an asset is purchased
    - These cash outflows are included in calculating free cash flow
  - Depreciation is a non-cash expense
    - The free cash flow estimate is adjusted for this non-cash expense

Calculating the FCF from Earnings (2/3)

- Net Working Capital (NWC)

$$\begin{aligned}\text{Net Working Capital} &= \text{Current Assets} - \text{Current Liabilities} \\ &= \text{Cash} + \text{Inventory} + \text{Receivables} - \text{Payables}\end{aligned}$$

Most projects will require an investment in net working capital. The increase in net working capital is defined as

$$\Delta NWC_t = NWC_t - NWC_{t-1}$$

Example of NWC

Calculate the cash flows associated with changes in working capital for the first five years of this investment.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash		6	12	15	15	15
Accounts Receivable		21	22	24	24	24
Inventory		5	7	10	12	13
Accounts Payable		18	22	24	25	30
NWC (net working capital)	0	6+21+5-18 =14	12+22+7-22=19	25	26	22
Change in NWC		14 - 0=14	19-14=5	25-19=6	26-25=1	22-26=-4

Example of NWC

Calculate the cash flows associated with changes in working capital for the first five years of this investment.

	Year 1	Year 2	Year 3	Year 4	Year 5
Cash	6	12	15	15	15
Accounts Receivable	21	22	24	24	24
Inventory	5	7	10	12	13
Accounts Payable	18	22	24	25	30
NWC (net working capital)	**14**	**19**	**25**	**26**	**22**
Change in NWC	**14**	**5**	**6**	**1**	**-4**

Calculating the FCF from Earnings (2/3)

- HomeNet

Assume that accounts receivables/payables is equal to 15% of sales/cost of goods sold, what is its net working capital (NWC) and change in NWC?

Calculating the FCF from Earnings (2/3)

Spreadsheet HomeNet's Net Working Capital Requirements

sales rev. 23500 23500 23500 23500
COGS 9500 9500 9500 9500

Year	0	1	2	3	4	5
Net Working Capital Forecast ($000s)						
1 Cash Requirements	—	—	—	—	—	—
2 Inventory	—	—	—	—	—	—
3 Receivables (15% of Sales)	—	3,525	3,525	3,525	3,525	—
4 Payables (15% of COGS)	—	(1,425)	(1,425)	(1,425)	(1,425)	—
5 **Net Working Capital**	—	**2,100**	**2,100**	**2,100**	**2,100**	—

23500 x 15%
9500 x 15%
0
0

Year	0	1	2	3	4	5
Increase in NWC	0	2100	0	0	0	-2100

Calculating the FCF from Earnings (3/3)

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

dep
=7500/5=1500

Year	0	1	2	3	4	5
Increase in NWC	0	2100	0	0	0	-2100

Year	0	1	2	3	4	5
Unlevered Net Income	-12,000	7,600	7,600	7,600	7,600	-1,200

(+) Depreciation		1500	1500	1500	1500	1500
(-) CapEx	7500					
(-) change in NWC	0	2100	0	0	0	-2100
FCF (free cash flow)	-12000-7500=-19500	7600+1500-2100 =7000	7600+1500 =9100	9100	9100	-1200+1500-(-2100) 2400

$$-19500 + \frac{7000}{1+12\%} + \frac{9100}{(1+12\%)^2} + \frac{9100}{(1+12\%)^3} + \frac{9100}{(1+12\%)^4} + \frac{2400}{(1+12\%)^5} = 7626.7$$

Calculating the FCF from Earnings (3/3)

- From unlevered net income to FCF
  - **FCF=Unlevered Net Income + Dep – CapEx – Increases in NWC**

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1	Sales	—	23,500	23,500	23,500	23,500	—
2	Cost of Goods Sold	—	(9,500)	(9,500)	(9,500)	(9,500)	—
3	**Gross Profit**	—	14,000	14,000	14,000	14,000	—
4	Selling, General, and Administrative	—	(3,000)	(3,000)	(3,000)	(3,000)	—
5	Research and Development	(15,000)	—	—	—	—	—
6	Depreciation	—	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7	**EBIT**	(15,000)	9,500	9,500	9,500	9,500	(1,500)
8	Income Tax at 20%	3,000	(1,900)	(1,900)	(1,900)	(1,900)	300
9	**Unlevered Net Income**	**(12,000)**	**7,600**	**7,600**	**7,600**	**7,600**	**(1,200)**
Free Cash Flow ($000s)							
10	Plus: Depreciation	—	1,500	1,500	1,500	1,500	1,500
11	Less: Capital Expenditures	(7,500)	—	—	—	—	—
12	Less: Increases in NWC	—	(2,100)	—	—	—	2,100
13	**Free Cash Flow**	**(19,500)**	**7,000**	**9,100**	**9,100**	**9,100**	**2,400**

Calculate the NPV

$$PV(FCF_t) = \frac{FCF_t}{(1+r)^t} = FCF_t \times \frac{1}{\underbrace{(1+r)^t}_{t=\text{year discount factor}}}$$

HomeNet's NPV with a discount rate of 12%.

$$\begin{aligned} NPV &= -19,500 + \frac{7000}{1.12} + \frac{9100}{1.12^2} + \frac{9100}{1.12^3} + \frac{9100}{1.12^4} + \frac{2400}{1.12^5} \\ &= \$7627 \end{aligned}$$

Practice in Excel

Linksys has completed a $300,000 feasibility study to assess the attractiveness of a new product, HomeNet.

The project has an estimated life of four years.

- Revenue Estimates
  - Sales Volume= 100,000 units/year
  - Per Unit Price = $235 Per Unit Cost = $95

Cost Estimates

- Up-Front R&D for the project = $15,000,000
- Up-Front New Equipment = $7,500,000
  - Expected life of the new equipment is five years.
- Annual Overhead = $3,000,000 (after lost rent)
- Accounts receivables/payables is equal to 15% of sales/cost of goods sold
- Discount rate is 12% and tax rate is 20%.

Recommend to start with Gross Profit and Change in NWC.

Exercise (Q1)

A project has an estimated life of 2 years.

- Revenue & Cost Estimates
  - Sales = 1,000 units/year
  - Per Unit Price = $47 Per Unit Cost = $19
  - Up-Front R&D for the project = $15,000
  - Up-Front New Equipment = $7,500
    - Expected life of the new equipment is two years.
  - Annual Overhead = $3,000
  - NWC: Accounts receivables/payables is equal to 15% of sales/cost of goods sold
  - Discount rate is 12% and tax rate is 20%.

Step One: Estimate Gross Profit and Change in NWC for Y0, Y1, Y2, and Y3
Step Two: Estimate EBIT for Y0, Y1, Y2, and Y3
Step Three: Estimate Unlevered Net Income for Y0, Y1, Y2, and Y3
Step Four: Estimate Free Cash Flow for Y0, Y1, Y2, and Y3

	Y0	Y1	Y2	Y3
NWC	0	15%x(28000)=4200	4200	0

	Y0	Y1	Y2	Y3
Sales		47000	47000	
COGS		19000	19000	
Gross profit		28000	28000	

Capex=7500
Depreciation=7500/2=3750

	Y0	Y1	Y2	Y3
NWC	0	15%x(28000)=4200	4200	0

	Y0	Y1	Y2	Y3
Sales		47000	47000	
COGS		19000	19000	
Gross profit		28000	28000	
(-)R&D upfront	15000			
(-)SGA		3000	3000	
(-)Dep		3750	3750	
EBIT	-15000	21250	21250	0
Tax (=0.2xEBIT)	-3000	4250	4250	0
Unlevered Net income	-12000	17000	17000	0

	Y0	Y1	Y2	Y3
NWC	0	15%x(28000)=4200	4200	0

	Y0	Y1	Y2	Y3
Sales		47000	47000	
COGS		19000	19000	
Gross profit		28000	28000	
(-)R&D upfront	15000			
(-)SGA		3000	3000	
(-)Dep		3750	3750	
EBIT	-15000	21250	21250	0
Tax (=0.2xEBIT)	-3000	4250	4250	0
Unlevered Net income	-12000	17000	17000	0
Plus: Dep		3750	3750	
Less: CapEx	7500			
Less: Increase of NWC	0	4200	0	-4200
FCF	-19500	16550	20750	4200
FCF with SV	-19500	16550	20750	4200

Capex=7500 Depreciation=7500/2=3750

FCF =Unlevered NI +Dep-CapEx- Increase of NWC

NPV=-19500+ 16550/1.12 + 20750/1.12^2 + 4200/1.12^3=14808.02

Free Cash Flows to other items (come back to this later)

- Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

Based on the above formula, let us figure out what is

- Net Income
- Depreciation Tax Shield/ EBITDA
- CFO -> Operating Cash Flow

FCF and Net Income

- Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

$$\text{Free Cash Flow} = \underbrace{(\text{Revenues} - \text{Costs} - \text{Deprecation} - \text{Interest}) \times (1 - \tau_c)}_{\textbf{Net Income}} + \text{Depreciation} + \text{Interest} \times (1 - \tau_c) - \text{CapEx} - \Delta\text{NWC}$$

FCF and Depreciation Tax Shield

- Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

$$\text{Free Cash Flow} = (\text{Revenues} - \text{Costs}) \times (1 - \tau_c) - \text{CapEx} - \Delta\text{NWC} + \tau_c \times \text{Depreciation}$$

(Revenues−Costs) is EBITDA

The term $\tau_c \times$Depreciation is called the depreciation tax shield.

FCF and CFO

- Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

Net Income + Depreciation-ΔNWC is **CFO (Operating cash flow)**

$$\textbf{Free Cash Flow} = \textbf{CFO} + \underbrace{\textbf{Interest} \times (1 - \tau_c) - \textbf{CapEx}}_{\textit{Cash Flow Related to Finanical Activities}}$$

Concept check

- depreciation tax shield

  =depreciation x tax rate

- net income

  =(EBIT - Interest) x (1 - tax rate)

  =(revenue - cost - depreciation - Interest) x (1- tax rate)

- unlevered net income

  = EBIT x (1 - tax rate)

  =(revenue - cost - depreciation) x (1 - tax rate)

- Operating cash flow (CFO)

  = net income + Depreciation - change in NWC

- Free cash flow

  = CFO - CapEx + interest x (1- tax rate)

  =EBIT x (1- tax rate)+depreciation - CapEx - change in NWC

Question (Q2)

- Assume all costs and expenses occur in the same year.
- Vidia Inc. is a company that produces plant and machinery for use in the automotive sector. During the last year it generated net income of $69m and operating cash flows of $74m, paid dividends of $12m, bought $23m of property, plant and equipment to maintain the capital base, increased $14m of inventory and redeemed $10m of bonds. The after-tax cost of debt (after-tax interest) was $5m during the year.
- Vidia's change of net working capital (ΔNWC) is closest to:
- Vidia's depreciation is closest to:
- Vidia's free cash flow to the firm is closest to:

Question 2.1

- Assume all costs and expenses occur in the same year.
- Vidia Inc. is a company that produces plant and machinery for use in the automotive sector. During the last year it generated net income of $69m and operating cash flows of $74m, paid dividends of $12m, bought $23m of property, plant and equipment to maintain the capital base, increased $14m of inventory and redeemed $10m of bonds. The after-tax cost of debt (after-tax interest) was $5m during the year.
- Vidia's change of net working capital (ΔNWC) is closest to:

Answer : 14m

Question 2.2

Assume all costs and expenses occur in the same year.

Vidia Inc. is a company that produces plant and machinery for use in the automotive sector. During the last year it generated net income of $69m and operating cash flows of $74m, paid dividends of $12m, bought $23m of property, plant and equipment to maintain the capital base, increased $14m of inventory and redeemed $10m of bonds. The after-tax cost of debt was $5m during the year.

- Vidia's depreciation is closest to:

Net Income+Depreciation-ΔNWC is CFO (Operating cash flow)

- **Answer: 74-69+14=19m**

Question 2.3

- Assume all costs and expenses occur in the same year. Vidia Inc. is a company that produces plant and machinery for use in the automotive sector. During the last year it generated net income of $69m and operating cash flows of $74m, paid dividends of $12m, bought $23m of property, plant and equipment to maintain the capital base, increased $14m of inventory and redeemed $10m of bonds. The after-tax cost of debt (after-tax interest) was $5m during the year.
- Vidia's free cash flow to the firm is closest to:

Answer : 74 (CFO) – 23 (CapEx) +5 (after-tax interest) = 56m

Further adjustments to cash flows

- Liquidation / Salvage Value
  - Cash flows when you liquidate the assets
- Accelerated Depreciation
  - Modified Accelerated Cost Recovery System (MACRS) depreciation

Liquidation or Salvage Value

When the lab is shut down in year 5, the equipment will have a **after-tax** salvage value of $640,000. What adjustments must we make to HomeNet's free cash flow in this case?

	Year	0	1	2	3	4	5
1 Free Cash Flow w/o	—	-19,500	7,000	9,100	9,100	9,100	2,400
2 After-Tax Salvage Value	—	—	—	—	—	—	640
4 Free Cash Flow with salvage value	—	-19,500	6,800	9,100	9,100	9,100	3,040
5 NPV at 12%		7,811					

MACRS method (1/2)

Computing Accelerated Depreciation

What depreciation deduction would be allowed for HomeNet's equipment using the MACRS method, assuming the equipment is put into use by the end of year 0 and designated to have a five-year recovery period?

	Year	0	1	2	3	4	5
MACRS Depreciation							
1	Lab Equipment Cost	(7,500)					
2	MACRS Depreciation Rate	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
3	Depreciation Expense	(1,500)	(2,400)	(1,440)	(864)	(864)	(432)

MACRS method (2/2)

As long as the equipment is put into use by the end of year 0, the tax code allows us to take our first depreciation expense in the same year (year 0).

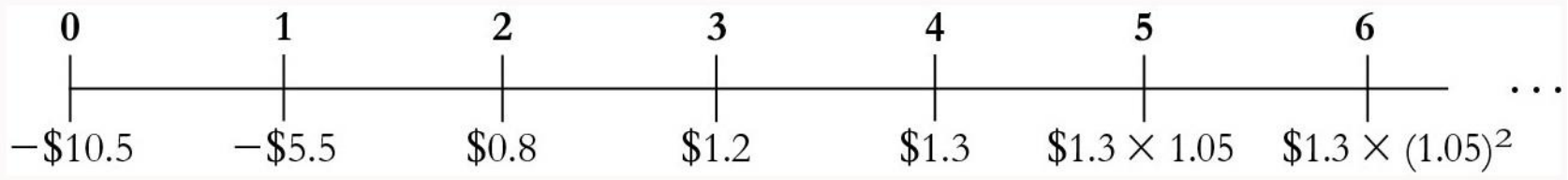
Compared with straight-line depreciation, the MACRS method allows for larger depreciation deductions earlier in the asset's life, which increases the present value of the depreciation tax shield and so will raise the project's NPV .

What is HomeNet's NPV under MACRS method? $7,785.27

Terminal Value

This amount represents the market value of the free cash flow from the project at all future dates.

- Example: Base Hardware is considering opening a set of new retail stores. The free cash flow projections for the new stores are shown below (in millions of dollars). Base Hardware expects cash flows to growth at 5% in year 5 and beyond. Assume the cost of capital is 10%

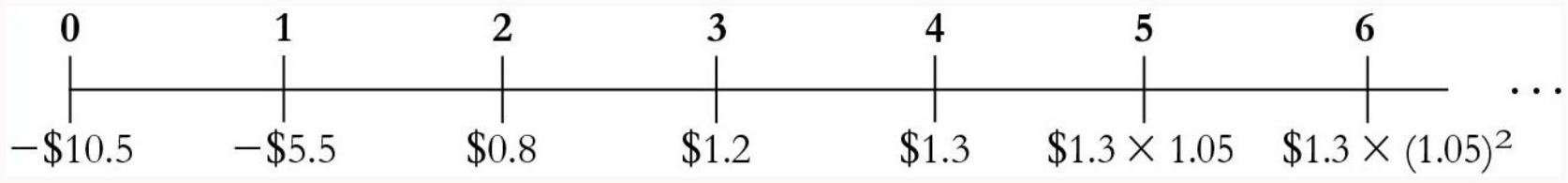


After year 4, Base Hardware expects free cash flow from the stores to increase at a rate of 5% per year.

What continuation value in year 4 (PV @ t=4) captures the value of future free cash flows in year 5 and beyond?

What is the NPV of the new stores?

Answer (1/3)



Because the future free cash flow beyond year 4 is expected to grow at 5% per year, the continuation value in year 4 of *the free cash flow in year 5 and beyond* can be calculated as a growing perpetuity:

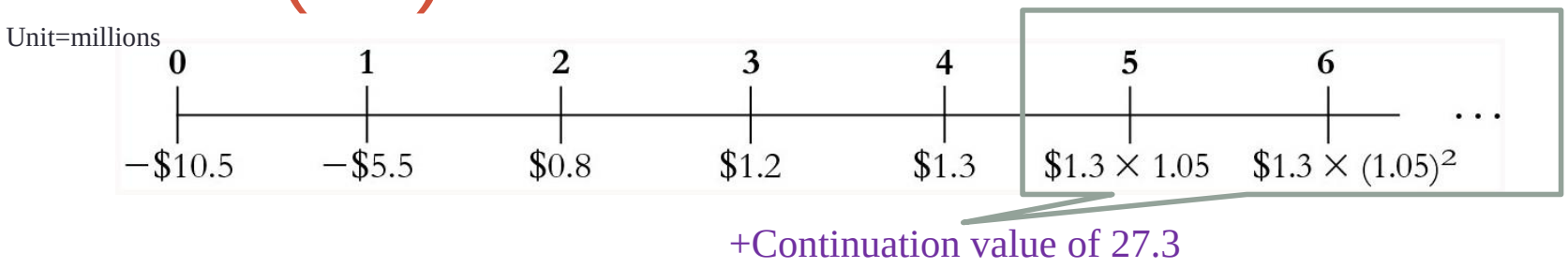
Recall that-> Present value of a growing perpetuity : $\frac{C}{r-g}$ What is *C*?

C is the cash flow in year **5** when we are interested in value in year **4**.

$$\begin{aligned}\text{Continuation Value in Year 4} &= PV(FCF \text{ in Year 5 and Beyond}) \\ &= \frac{FCF_4 \times (1+g)}{r-g} = \$1.30 \text{ million} \times \frac{1.05}{0.10-0.05} \\ &= \$1.30 \text{ million} \times 21 = \$27.3 \text{ million}\end{aligned}$$

Answer (2/3)

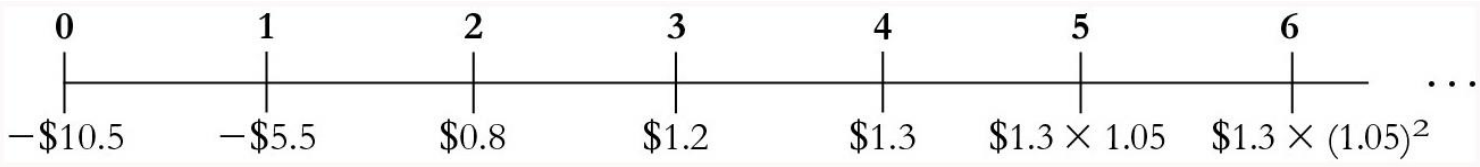
Unit=millions



The NPV of the investment in the new stores is

$$NPV = -10.5 - \frac{5.5}{1.10} + \frac{0.8}{1.10^2} + \frac{1.2}{1.10^3} + \frac{28.6}{1.10^4} = \$5.597$$

Answer (3/3)



Alternative methods:

- C is the cash flow in year **4** when we are interested in the continuation value in year **3**.
- Continuation value at year **3** is $\frac{\mathbf{1.3}}{\mathbf{0.10-0.05}}=\mathbf{2.6}$
- NPV = $-10.5-\frac{5.5}{1.10}+\frac{0.8}{1.10^2}+\frac{1.2+2.6}{1.10^3}=5.597$

Exercise Q3

Bay Properties is considering starting a commercial property. It has prepared the following 4-year forecast of free cash flow. Assume cash flow after 4 year will grow at 3% per year. What is the continuation value at year 4 and the value of today assuming the cost of capital of 14%.

Answer: 1,386,440

Exercise Q3

Bay Properties is considering starting a commercial property. It has prepared the following 4-year forecast of free cash flow. Assume cash flow after 4 year will grow at 3% per year. What is the continuation value at year 4 and the value of today assuming the cost of capital of 14%.

	Year 1	Year 2	Year 3	Year 4
Free cash flow	-185,000	12,000	99,000	240,000

Continuation value at year 4: $\frac{240{,}000 \times (1+3\%)}{14\%-3\%} = 2{,}247{,}272.727$

Value today (present value): $\frac{-185{,}000}{1.14} + \frac{12{,}000}{1.14^2} + \frac{99{,}000}{1.14^3} + \frac{240{,}000+2{,}247{,}273}{1.14^4}$

$= 1{,}386{,}440.21$

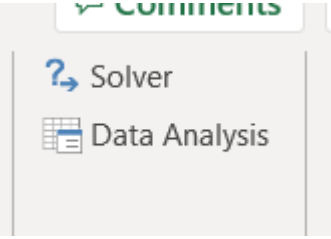
Analyzing the Project using Excel

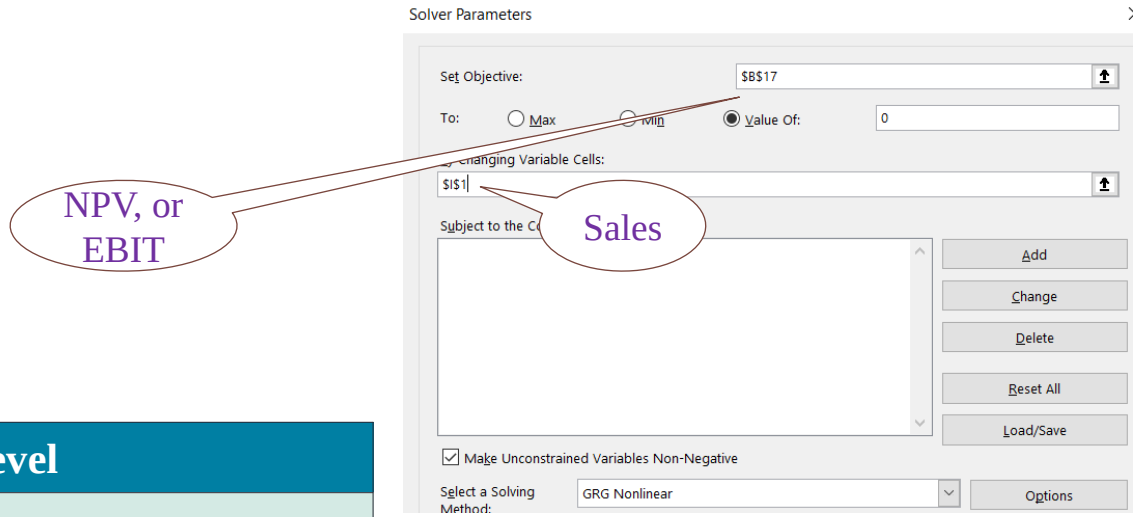
- Break-Even Analysis
- Sensitivity Analysis
- Football Field Chart
  - Let us go back to the HomeNet project

Analyzing the Project using Excel

- Break-Even Analysis
  - The **break-even** level of an input is the level that causes the NPV of the investment, or EBIT to equal zero.
    - What is the sales level that leads NPV of HomeNet project to Zero?

Break-even Analysis -> Practice with Excel Solver





Break-Even Levels for HomeNet

Parameter	Break-Even Level
Units sold	77,121 units per year
Wholesale price	$228 per unit
Cost of goods	$142 per unit
Cost of capital	27.9%

Practice 1. NPV Break-Even of Sales

- Level of sales that sets NPV equal to 0
- Make sure Sales revenues, COGS and NWC are all linked to sales units
- Answer: around 77.121

Practice 2. NPV Break-Even Level for MACRS depreciation methods

- Answer: around 76.645

Sensitivity Analysis

- Sensitivity Analysis shows how the NPV varies with a change in one of the assumptions, holding the other assumptions constant.

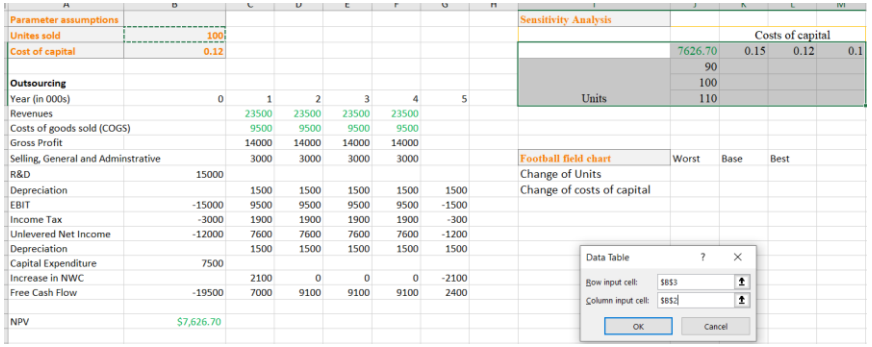
Best-and Worst-Case Parameter Assumptions for HomeNet

Parameter	Initial Assumption	Worst Case	Best Case
Units sold (thousands)	100	70	130
Cost of capital	12%	15%	10%

Sensitivity Analysis

- Create a table, and link the cell in the top left (7626.78) to the cell of your NPV (green part)
- Select the table
- Go to Data -> What-if analysis -> Data Table
- Row input -> (cost of capital)
- Column input -> (units)

Sensitivity Analysis				
		Costs of capital		
	7626.70	0.15	0.12	0.10
	70			
	100			
Units	130			



Football Field Chart

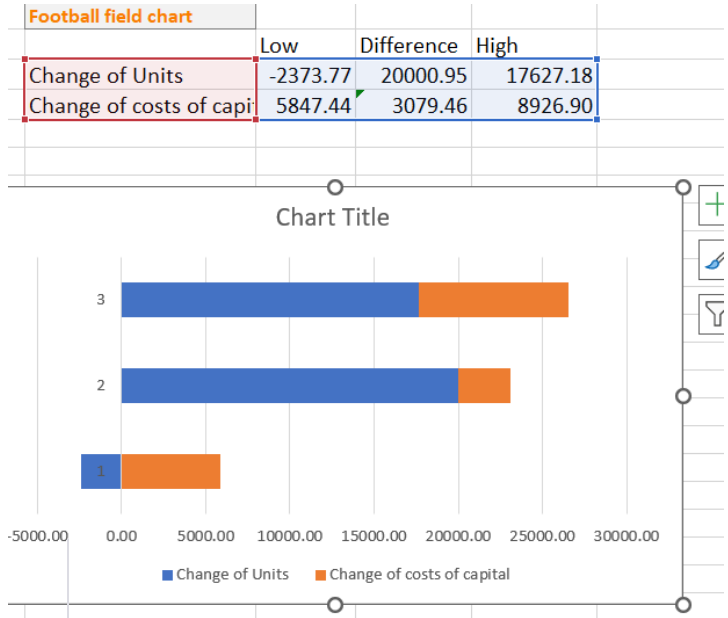
The purpose of the chart is to give a visual representation of the range of NPV given various assumptions.

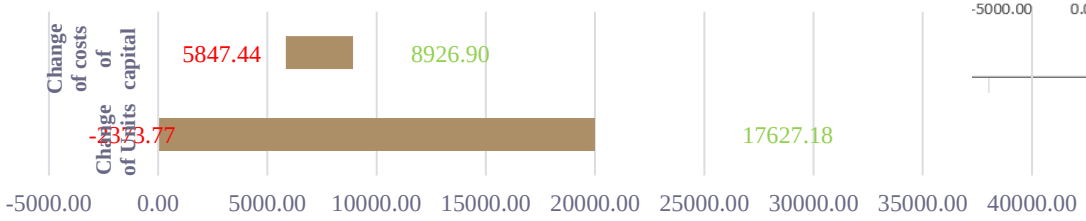
- Football Field Valuation Chart is one of the most common slides in an investment banking pitch book, as part of pitching a client.

Football Field Chart

- Produce table with NPV of worst-case and best-case scenario, and insert a column “Difference” that computes the differences
- Select the table, and insert a Stacked 2-D bar
- Click “Switch Row/Column”?
- Right click the left bar (blue) and far right bar (grey) and click “No-Fill”
- Add data label

	Low	Difference	High
Change of Units	-2373.77	20000.95	17627.18
Change of costs of capital	5847.44	3079.46	8926.90





HomeNet's NPV Under Various Parameter Assumptions