Chpt 1:

Assets = Liabilities + Equity

- Current Assets (inc. Cash)
- Fixed Assets
  - 1. Tangible
  - 2. Intangible

Liabilities
- current Liabilities
  - 1. Interest Bearing (Result of financing activities not operating ones)
    - ST Loans
    - Notes Payable
  - 2. Non interest bearing
    - Accounts Payable
- Long-term debt

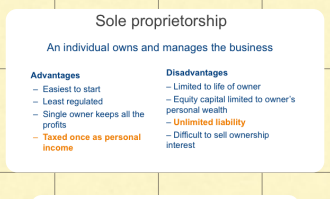
Equity
- common stock
- RE

Forms of Business Organization.

unincorporated = Not formed into a legal corporation.

1. Sole proprietorship.

- unincorporated business owned by 1 individual

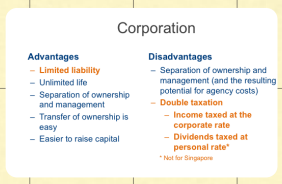


2. Partnership.

- unincorporated business owned by 2 or more persons.

3. Corporation:

- incorporated business owned by many shareholders.
  - > legal entity that is seperate from the owner
  - > E.g Bill Gates don't pay for Microsoft vice versa
  - > ownership denoted by shares
  - > can be public or private.



Sources of financing for corporations.

Unit 2:

Annual Report

1. Balance Sheet

Sample Balance Sheet
December 31, 2019
Numbers in thousands ($'000s)

Assets		Liabilities	
Cash & Equivalents	3,171	Accounts Payable	313,286
Accounts Receivable	1,095,118	Notes Payable	227,848
Inventory	388,947	Other CL	1,239,651
Other CA	314,454	Total CL	1,780,785
Total CA	1,801,690	LT Debt	1,389,615
Net FA	3,129,754	S/H Equity	
		Common Stock	963,841
		Retained Earnings	797,203
Total Assets	**4,931,444**	Total Liab. & Equity	**4,931,444**

Equity = Assets - Liabilities

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3. Statement of Retained Earnings

Sample Statement of Retained Earnings
Numbers in thousands ($'000s)

Retained Earnings, beginning of year	720,807
Add: Net Income	471,916
	1,192,723
Less: Dividends	-395,520
Retained Earnings, end of year	797,203

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ΔRE
= Beginning RE + Net Y
- Dividends.

2. Income Statement

Sample Income Statement
For Year Ending December 31, 2019
Numbers in thousands ($'000s)

Revenues	$4,335,491
Cost of Goods Sold	1,762,721
Operating Expenses	1,390,262
Depreciation	362,325
EBIT	$820,183
Interest Expense	52,841
Taxable Income	$767,342
Taxes	295,426
Net Income	$471,916

Shows:
1. Revenues
2. Expenses
3. Taxes associated with those revenues

For some financial period, typically a month, a quarter or a year

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4. Statement of Cash Flows

*Want to know cash generated from operations

Sample Statement of Cash Flows
Numbers in thousands ($'000s)

Refer to Income Statement

Cash, beginning of year	6,489	***Financing Activity***	
Operating Activity		Increase in Notes Payable	141,217
Net Income	471,916	Increase in LT Debt	517,764
Plus: Depreciation	362,325	Decrease in Common Stock	-36,159
Increase in Other CL	141,049	Dividends Paid	-395,520
Less: Increase in A/R	-46,127	Net Cash from Financing	227,301
Increase in Inventory	-93,692	Net Decrease in Cash	-3,318
Increase in Other CA	-82,150	**Cash End of Year**	3,171
Decrease in A/P	-26,934		
Net Cash from Operations	726,387		
Investment Activity			
Fixed Asset Acquisition	-957,007		
Net Cash from Investments	-957,007		

Refer to Balance Sheet

- (Change in net fixed assets + depreciation for the year)

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Profits vs. cash flows

Differences
- *"Profits"* subtract depreciation (a non-cash expense)
- *"Profits"* ignore cash expenditures on new fixed assets (the expense is capitalized)
- *"Profits"* record income and expenses at the time of sales, not when the cash exchanges actually occur
- *"Profits"* do not consider changes in working capital (consider, why do changes in working capital not show up in the 'profits',i.e., Income Statement?)

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Sources of Cash
- ↓ in Assets (other than cash) (↓ Acc Receivable, ↓)
- ↑ equity & liabilities

Use of Cash
- ↑ Assets (other than cash)
- ↓ Equity & liabilities.
  (i.e. ↓ Acc Payable)

Changes divided into 3 major categories:
1. Operating Activities – includes net income and changes in most current accounts (A/P, A/R, Inv)
2. Investment Activities – includes changes in fixed assets
3. Financing Activities – includes changes in notes payable, long-term debt and equity accounts as well as dividends

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Book value vs Market value

By IFRS, GAAP

& current trading values.

type1: market value of firms assets
- use Assets = Liabilities + Equity.

type2: market value of shareholders Equity
= Share Px * No. of outstandin shares.

CFFA conveys what cash the firm's operations were able to generate and return to investors, after taking into account all net investments needed in both ST operating assets & fixed assets.

Financial statements & market value

(excludes non-operating working capital (i.e Notes payable (interest bearing liabilities))

1. Cash flow from Assets (CFFA) = Operating cash flow (OCF) − Net capital Spending (NCS) − Changes in NOWC (Net operating working Capital)

8. NOWC = Current Assets − Net capital Spending. (Accounts Payable)

2. Cash flow from Assets (CFFA) + Interest tax shield = cash flow to Creditors + cash flow to stockholders.

3. operating cash flow (OCF) = EBIT (1 − tax Rate) + Depreciation.

4. Net Capital spending (NCS) = Ending Net fixed Assets − Beginning Net fixed Assets + Dep^n

5. Δ in NOWC = Ending NOWC − Beginning NOWC

6. Cash flow to Creditors = Interest paid − Net new borrowing (LT debt & Notes Payable)

7. Cash flow to stockholders = dividends paid − net new equity raised.

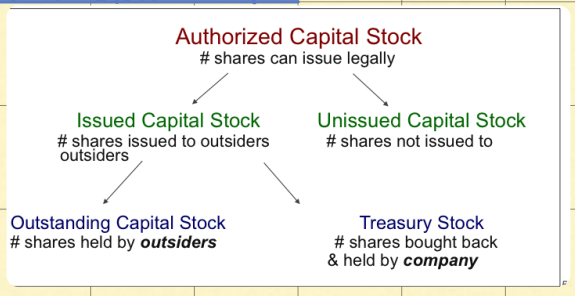
> NOWC represents the CA required in operations that are financed by investors given that payables & accruals are generated spontaneously by operations & thus "free".

Enterprise value.

- Assess value of underlying (operating) biz assets while excluding non-operating assets (i.e excess cash, unused land etc.)

Enterprise value = market value of Equity + Debt − Excess cash.

Basic Stock Concepts



Interest tax shield
cash generated from the reduction in the amt of taxes paid due to tax deductibility
= Interest Paid × tax Rate.

Ratio Analysis

time-trend. Peer-group.

TYPE 1: LIQUIDITY RATIOS (ST Solvency)

> measures firm's ability to pay bills in ST.

1. current Ratio = $\frac{\text{current Assets}}{\text{current Liabilities}}$.
2. Quick Ratio = $\frac{(CA - Inv)}{CL}$
3. Cash Ratio = $\frac{\text{Cash}}{CL}$
4. NWC to total Assets = $\frac{NWC}{TA}$
5. Interval measure = $\frac{CA}{\text{ave daily operating cost}}$

Dupoint Identity. (ROA)

ROE = Profit margin (PM) × total Asset turnover (TATO) × Equity multiplier (EM)

Others

dividend Payout Ratio = $\frac{\text{dividends}}{\text{Net y}}$

TYPE 2: LT SOLVENCY RATIOS (Financial leverage)

> show how heavily the company is in debt.

1. Total debt Ratio = $\frac{\text{total debt}}{\text{Total Assets}}$.
2. debt/Equity Ratio = $\frac{(TA - TE)}{TE}$
3. Equity multiplier = $\frac{TA}{TE} = 1 + \frac{\text{debt}}{\text{Equity}}$ ratio
4. LT debt Ratio = $\frac{\text{LT debt}}{\text{LT debt} + TE}$

coverage Ratios.

1. Times Interest Earned Ratio = $\frac{EBIT}{\text{interest}}$
2. cash coverage Ratio = $\frac{(EBIT + dep^{n})}{\text{interest}}$

TYPE 3: ASSET MANAGEMENT RATIOS (Turnover ~~Efficiency~~)

> measure how productive firm is using its assets.

Inventory Ratios

1. Inv turnover = $\frac{COGS}{Inv}$
2. Days' sales in Inv = $\frac{365}{\text{Inv turnover}}$

Receivable Ratios.

1. Rec turnover = Sales/Rec
2. day sales outstanding (DSO) or AR days or Ave Collection period

$= \frac{AR}{\text{Ave daily sales}}$ $= \frac{365}{\text{Rec turnover.}}$

$\frac{\text{Sales}}{365}$

FA & TA turnover ratio

1. FA turnover = $\frac{\text{sales}}{\text{Net FA}}$
2. TA turnover = $\frac{\text{sales}}{\text{total Asset.}}$

TYPE 4: PROFITABILITY RATIOS

> measure firm's ROI

1. Profit margin = $\frac{\text{Net Income}}{\text{sales}}$
2. BEP, Basic Earning power = $\frac{EBIT}{TA}$
3. ROA = $\frac{\text{Net Y}}{TA}$
4. ROE = $\frac{\text{Net Y} - \text{Perfered div (if any)}}{\text{total common Equity.}}$

Effects of Debt on ROA and ROE

- ROA is lowered by debt
  - Interest expense lowers net income, which also lowers ROA
- However, the use of debt lowers equity, and if equity is lowered more than net income, ROE would increase

Problems with ROE

- ROE and shareholder wealth are correlated, but problems can arise when ROE is the sole measure of performance
  - ROE does not consider risk
  - ROE does not consider the amount of capital invested
  - Might encourage managers to make investment decisions that do not benefit shareholders
- ROE focuses only on return. It is better to have measures that consider both risk and return.

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TYPE 4: MARKET VALUE RATIOS.

> Provide indications on firm's prospects on how market values the firm.
> relate firm's stock px to earnings, cash flows & Book value per share.

1. P/E = Price/Earnings per share.

How much investors willing to pay for $1 of earnings

2. M/B = mkt px per share / Book value per share

How much investors willing to pay for $1 of book value

Chpt 3: Time value of money.

1. FUTURE VALUES.

> value of cash flow some point in the future. t>0

> Compounding = find future value of cash flo

TYPE 1: Simple Interest

principle + (time period) x Principle (Interest)

Interest earned at the end of each year.

TYPE 2: compounding.

$FV = PV(1+r)^t = PV(1+i)^n$ → # of periods.

future value, present value, period, i/r

Future value interest factor (FVIF)

$= (1+r)^t$

2. PRESENT VALUE

> value of something today t

> discounting: process of finding the present value of CF of a series of CF

= Find PV of CFs.

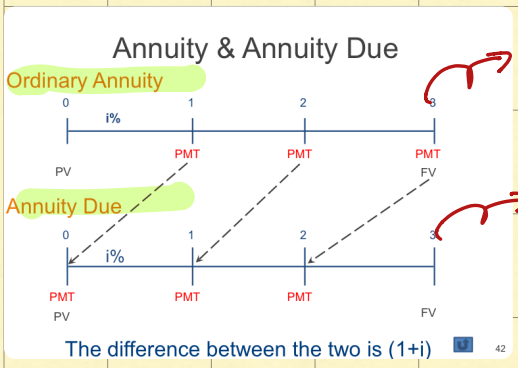
$PV = FV/(1+i)^n$

$= FV\left(\frac{1}{1+i}\right)^n$

PV factor.

3. Annuity.

> series of CF in which the same (payment) CF takes place each period for a set no. of periods



end of period 1

beginning of period 1

Growing Annuity: set of payments which grow at a constant rate, g, up to a certain maturity date.

PV of ordinary Annuity $= PMT \times \frac{1}{r} \times \left(1 - \frac{1}{(1+r)^n}\right)$

PV of Annuity Due $= PV \text{ of Annuity} \times (1+r)$

PV of Growing Annuity $= PMT(\text{first payment}) \times \left[\frac{1-\left(\frac{1+g}{1+r}\right)^t}{r-g}\right]$

FV of Ordinary Annuity $= PV \text{ of Annuity} \times (1+r)^n$

$= PMT \times \left[\frac{1}{r} \times \left(1 - \frac{1}{(1+r)^n}\right)\right] \times (1+r)^n$

$= PMT \times \left[\frac{1}{r} \times \left[(1+r)^n - 1\right]\right]$

FV of Annuity Due = FV of Annuity $\times (1+r)$

FV and PV of both Annuity

- For both PV and FV, annuity due will always be greater than ordinary annuity (ANNUITY DUE > ORDINARY ANNUITY!)
  - FVA_{due} earns one more period of interest
  - PVA_{due} is discounted one period less
- $FVA_{due} = FVA_{ord}(1+I)$
- $PVA_{due} = PVA_{ord}(1+I)$

→ All annuity due need to x (1+I)!

4. Perpetuity.

> set of equal payments that are paid each period forever

$$PV = \frac{PMT}{r} \quad \text{← } 1/r$$

Growing Perpetuity: set of payments which grow at a constant rate (g) forever, with 1st payment at end of 1st period

$$PV \text{ of growing perpetunity} = \frac{PMT \text{ (first payment)}}{r-g}$$

$$FV \text{ of growing perpetunity} = PMT_{(\text{first payment})} \times \left[\frac{(1+r)^t - (1+g)^t}{r-g}\right]$$

5. EAR, Effective Annual Rate

> Annual actual rate of interest being earned, accounting for compounding.

Used for comparing inv to diff compounding period.

$$EAR = \left[1 + \frac{APR}{m}\right]^m - 1$$

m ← compounding freq per yr

6. APR, Annual Percentage Rate, Nominal Annual Rate, Quoted Rate, Stated Rate

APR = Period Rate × # periods per yr. → Given in on most of time

∇ make sure I/R & time period match.

$$\text{Period rate} = \frac{APR}{\#\text{ of periods per yr.}}$$

I/R for period (e.g. yrs / mths)

> basically I/R not compounded annually.

E.g., If you have an APR based on monthly compounding, you have to use monthly periods for lump sums, or adjust the interest rate appropriately if you have payments other than monthly.

APR = Bank A pays 4% interest compounded annually.

∇ Sign matters when keyed!!(-)

7. Implied Discount Rate.

$$FV = PV(1+i)^n \Rightarrow i = \left(\frac{FV}{PV}\right)^{\frac{1}{n}} - 1$$

Example:
You are looking at an investment that will pay $1200 in 5 years if you invest $1000 today. What is the implied rate of interest?

Using a Calculator – (note that the sign convention matters!)
- N = 5
- PV = -1000 (you pay 1000 today)
- FV = 1200 (you receive 1200 in 5 years)
- Compute I/Y = 3.714%

8 different Types of Loans (read slides)

Different Types of Loans

a. **Pure Discount Loans**
   - No interim interest; entire original 'principal' and accumulated interest are paid at maturity; The loan is issued at discount which means initial funds received are less than the total amount paid at maturity

b. **Interest Only Loans**
   - Interest paid throughout the loan period; principal entirely paid at maturity

c. **Loans with Fixed Principal Payments**
   - Interest and fixed amount of principal paid throughout the loan period.

d. **Amortized Loans**
   - Interest and a portion of the principal paid throughout the loan period

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Chp 14: Risk & Return. I

most investors are RISK-AVERSE ; dislike risk & require HIGHER rate of return to encourage them to hold riskier securities.

> 'Extra' return earned for taking on risk = RISK PREMIUM.
>> Return over & above RISK-free rate.

RISK premium = nominal return − risk-free rate (nominal)

If an ask for real find real values.

Benchmark for Risk-free rate
1. Treasury Bills
2. Treasury Bonds

Risk-return trade-off
LOW RISK ⇔ LOW returns
High RISK ⇔ High returns

Investment Returns
> measure financial results of an investment

Returns (Nominal) ↷ b4 inflation.

Dollar terms = Amt received (End of Period) − Amount Invested (Beg Period)

Percentage terms = $\frac{\text{Amt received (End of Period)} - \text{Amount Invested (Beg Period)}}{\text{Amt Invested (Beg Period)}}$

% Return for the Period (Nominal)

1. dividend Yield = $\frac{\text{Dividend}}{\text{Initial share Px}} = \frac{D_1}{P_0}$

2. Capital Gain Yield = $\frac{\text{Capital Gain}}{\text{Initial share Px}}$ ⇒ Total Return (Required Return) − dividend yield.

Total % return = dividend Yield + Capital Gain Yield

Real Rate of returns
= Returns adj for inflation.

convert from nominal to real:

$1 + \text{real return} = \frac{1 + \text{nominal return}}{1 + \text{inflation rate}}$

Approx method:

Real return ≈ Nominal return − Expected Inflation.

Individual stock - standalone / total Risk

Expected return for each investment: $\hat{r} = \sum_{i=1}^{n} r_i P_i$

∀ n possible returns exist.

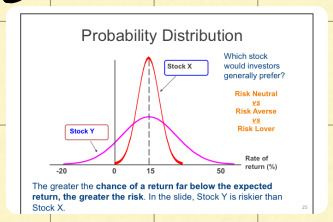
r_i = possible return
P_i = Prob of possible return.
$\hat{r}$ = Expected return of stock

can also be used for required return ONLY if MKT in equilibrium Exp = req.

Arithmetic Average return / Arithmetic mean : $\bar{r} = \frac{\sum_{t=1}^{T} r_t}{T}$

RISK

> uncertainty in future possible outcomes.



To measure how gd an inv is
> compare to benchmark (Req. rate of return) on inv
↳ depends on RISK

S.D, σ used to measure standalone / total risk
or
σ^2, var

$\sigma = \sqrt{var} = \sqrt{\sigma^2}$

$= \sqrt{\sum_{i=1}^{n} (r_i - \hat{r})^2 p_i}$ ($\hat{r}$: Expected return.)

Historical data

estimated $\sigma = \sqrt{\frac{\sum_{t=1}^{n} (r_t - \bar{r}_{avg})^2}{n-1}}$ (Ave annual return (arithmetic mean) over last n yrs.)

Coefficient of Variation (CV)

> measure of relative variability; standardized measure about the expected value that shows risk per unit of return.

$CV = \frac{S.D}{\text{Expected rate of return.}}$ OR $CV = \frac{S.D}{mean} = \frac{\sigma}{\hat{r}}$

Higher CV = higher risk (standalone)

Stocks in a Portfolio - Portfolio Risk.

↓
set of Assets by investor.

Expected Portfolio Return

Weighted Ave of expected returns : $\hat{r}_p = \sum_{i=1}^{N} w_i \hat{r}_i$

w_i - Weightage of stocks (40% A, 60% B)
$\hat{r}_i$ - Expected returns of X Pdt

Portfolio SD

method 1: same as indv stock

$r = \sqrt{var} = \sqrt{\sigma^2}$

$= \sqrt{\sum_{i=1}^{n} (r_i - \bar{r})^2 \, p_i}$ (Expected return)

= volitility of portfolio, which is the total risk of the portfolio

cov, corr, corr coeff

method 2:

Portfolio Standard Deviation: Alternative Way

By definition, the standard deviation of a 2-stock portfolio is:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)Corr(R_1,R_2)\sigma_1\sigma_2}$$
$$= \sqrt{w_1^2\sigma_1^2 + (1-w_1)^2\sigma_2^2 + 2w_1(1-w_1)\rho_{12}\sigma_1\sigma_2}$$

$$\sigma_p = \sqrt{(1/2)^2\,20^2 + (1/2)^2\,13.4^2 + 2(1/2)(1/2)\rho(20)(13.4)}$$

We need to know the **covariance** and/or the **correlation coefficient** between the two assets to calculate standard deviation in this way. So how do we get the correlation coefficient?

Portfolios – Historical Risk => Covariance

When looking at the risk of a portfolio of assets, it is important to recognize and consider the interaction between the individual stocks with one another. This leads us to the concept of **covariance**; that is, how the performance of two assets "move" or "do not move" together.

The covariance of the annual rates of return of 2 different investments is used to measure **how the two assets' rates of return vary together over the same mean time period**. For example, for n periods of measured returns of stock X and stock Y, the *covariance of X and Y* is found as follows:

$$\text{Covariance} = \frac{(r_{X1} - \bar{r}_X)(r_{Y1} - \bar{r}_Y) + (r_{X2} - \bar{r}_X)(r_{Y2} - \bar{r}_Y) + \cdots (r_{Xn} - \bar{r}_X)(r_{Yn} - \bar{r}_Y)}{n-1}$$

and

$$Cov_{i,j} = \sum_{s=1}^{S} \Pr(s) * \left(R_{i,s} - \mathrm{E}(R_i)\right) * \left(R_{j,s} - \mathrm{E}(R_j)\right)$$

and

$$\text{Covariance} = \sigma_{XY} = \rho_{XY}\sigma_X\sigma_Y$$

ρ_{XY} = the correlation coefficient between stock X and stock Y

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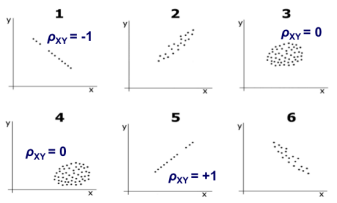
Portfolios – Correlation Coefficient

The **correlation coefficient** between two stocks (X and Y), denoted by ρ_{XY}, measures the extent to which two securities X and Y move together

Rho – pronounced "roe"



In general $1 \geq \rho_{XY} \geq -1$

Perfectly positively correlated

Perfectly negatively correlated

The variance of a portfolio depends on the correlation coefficients between the assets included in the portfolio.

Note: the correlation coefficient standardizes the units of covariance measure.

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The correlation coefficient between CGI and DSC is :

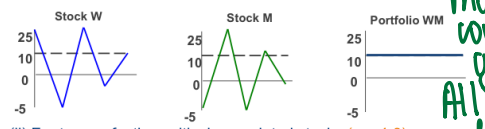
$$Cov(CGI, DSC) = \sigma_{CGI,DSC} = \sum_{s=1}^{S} p_s (r_{CGI,s} - \bar{r}_{CGI})(r_{DSC,s} - \bar{r}_{DSC})$$

$$\rho_{CGI,DSC} = \frac{Cov(r_{CGI}, r_{DSC})}{\sigma_{CGI}\sigma_{DSC}}$$

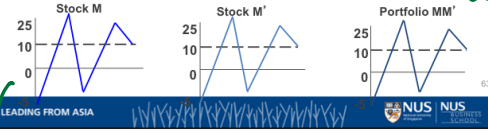
Returns Distribution

Invest an equal amount in both Stock W and Stock M

(i) For two perfectly negatively correlated stocks (ρ = -1.0)



(ii) For two perfectly positively correlated stocks (ρ = 1.0)



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LEADING FROM ASIA

Riskless portfolio: moves counter cyclically. All risk diversified

Stocks & portfolio have same returns at each point in time; No risk diversified

Two-stock portfolio: ρ & risk reduction

Two stocks can be combined to form a riskless portfolio if ρ = -1

- Risk is not reduced at all if the two stocks have ρ = +1
- In general, stocks have $\rho \approx 0.65$, so risk is lowered but not eliminated.
- $\sigma \approx 35\%$ for an average stock.

Ability to get rid of risk increases as $\rho \rightarrow -1$

NONE ρ = +1

ALL ρ = –1

Risk of portfolio gets smaller as $\rho \rightarrow -1$

We looked at 2-security portfolios, results are essentially the same for N-security portfolios!

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LEADING FROM ASIA

- Diversification benefits exists as long as stocks are not perfectly positively correlated
- Eventually the diversification benefits of adding more stocks dissipates, and for large stock portfolios, σp tends to converge to 20% ; Combining stocks with portfolios reduces risk, portfolio's risk DECLINES at a DECREASING RATE as stocks are added

2 certain diff corr coeff when combined all diversifiable risk are diversified. MKT risk left

Market Portfolio don't have diversifiable risk! only for indv stocks.

Breakdown of Sources of Risk

Stand Alone RISK

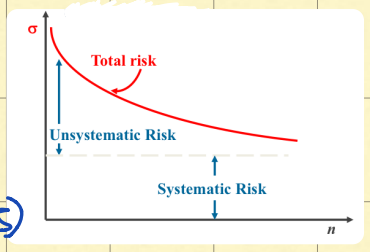
unsystematic risk

Systematic Risk

Total Risk = Company-Specific Risk + MKT Risk

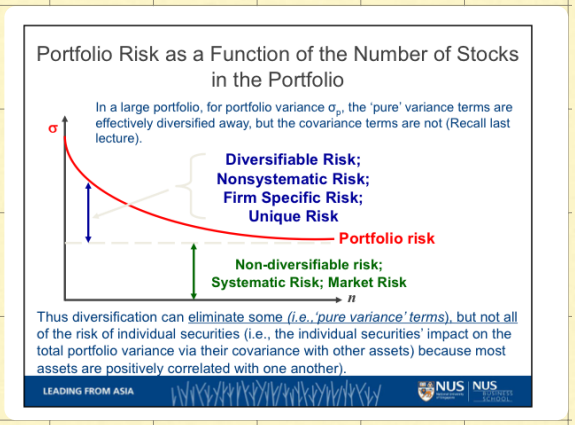
TYPE 1: Diversifiable Risk (company specific, unsystematic)
> caused by random events i.e: (lawsuit, workers strike)
> portion of stand-alone risk can be eliminated through proper diversification; stocks you add to portfolio shouldn't have perfectly +ve corr
> No compensation for holding unnecc. diversifiable risk

TYPE 2: market Risk (Systematic, undiversiable)
> cannot be eliminated by diversification
> measured by BETA
> caused by macro factors (recess, inflation, wars)



For well-diversified portfolio
1. unsystematic risk is v. small
2. total risk measure(σ) = systematic risk!

Pt 2 not the case for indv asset (i.e total risk measure(σ) for an indv asset != systematic risk as most indv asset will have unsystematic risk)



Arithmetic & Geometric Mean

$$\bar{r} = \frac{\sum_{t=1}^{T} r_t}{T}$$

$$\bar{r} = \sqrt[T]{(1+r_1)(1+r_2)(1+r_3)(1+r_4).....(1+r_T)} - 1$$

where r_t are the actual nominal returns in year 1, year 2, ...

If an investor buys an asset at time 0 and holds it till time T:

1. The ***geometric mean*** is what s/he actually earned per year on average compounded annually
   - Also known as the mean holding period return or average compound return earned per year over a multi-year period. what was you avg compound return per yr over a particular period?
2. The ***arithmetic mean*** is what s/he earned in a typical year. what was your return in an ave year over a particular period

Chpt 5: Risk & Return 2.

market Risk Premium (Rm - Rf)
> represents excess return of market portfolio over Rf
> measure investor risk adversion
> slope of SML.

1. Capital Asset Pricing Model (CAPM) → states that excess return should be ∝ to β ↑β ↑ER

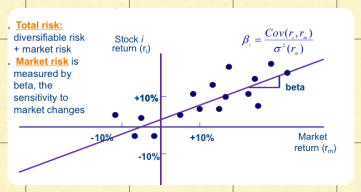
> States that required return on risky asset depends only on SYSTEMIC risk (mkt risk) as unsystemic (diversifiable) risk can be diversified away when the asset is placed in a portfolio.

> Rs btw mkt risk & required return

Risk premium for bearing systemic risk

$$R_i = R_f + \beta_i (R_m - R_f)$$

= Risk free rate + systemic risk measure-β * mkt risk premium.



2. BETA

Best measure of MKT RISK when held in large portfolio

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2}$$

> Beta measures the responsiveness of a security to movements in the mkt portfolio; How a stock is expected to move relative to mkt in future.

> = slope of the regression line of asset's returns on the mkt portfolio return

R_m = mkt portfolio return.

R_i = stock i return.

Interpreting β

= 1.0 - security same systemic risk as overall mkt; security as risky as ave stock.
> 1.0 - " more " ; security riskier than ave stock.
< 1.0 - " less " security less risky than ave stock.
= 0 - fixed returns, treasury (no risk)

▽ stocks can have -ve β; Inv moves in opp dir^n from stock mkt → offers a hedge against serious mkt downturns.

diversified stock qn are usually linked to β.

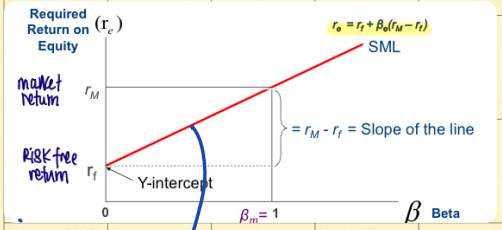
β_i = the measured beta for asset i = $\beta_i = \frac{Cov(r_i, r_m)}{\sigma^2(r_m)}$
⇒ the risk premium on any asset i is proportional to its β_i

Recall that $\beta_{market} = \frac{Cov(r_m, r_m)}{\sigma^2(r_m)} = \frac{\sigma^2(r_m)}{\sigma^2(r_m)} = 1$ thus $r_i = r_m$

$\beta_{risk\ free\ asset} = \frac{Cov(r_f, r_m)}{\sigma^2(r_m)} = \frac{\rho_{f,m}\sigma_f\sigma_m}{\sigma^2(r_m)} = \frac{0 \times 0 \times \sigma_m}{\sigma^2(r_m)} = 0$ thus $r_i = r_f$

3. Security market Line (SML)

depicts the relationship btw β and its required rate of return.

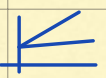


> Slope Ⓒ = Risk premium Ⓒ

Factors that Δ SML:

- Expect Higher inf = // shift of SML (Rf↑)

- ↑ risk Adversion = Δgrad (Rm - Rf Δ)
  = ↑ market risk premium.



Reward-to-Risk.

Slope of the line: $\frac{\Delta Y}{\Delta X} = \frac{(Rm - Rf)}{Bm - 0}$ → $Bm = 1$ ALWAYS.

$= \frac{Rm - Rf}{1 - 0} = Rm - Rf$ = market risk premium.

Meaning: for every unit of β (risk taken), required additional return over risk-free rate = $Rm - Rf$

In equilibrium, all assets and portfolios must have the same reward-to-risk ratio. Thus under SML, all assets' excess return over the risk-free rate will be proportionate to their beta measure.

↳ If reward to risk ratio ends up same but $E Rf > E Rm$, investors will only invest in Rf assets.

Calculating β for portfolio.

$$\beta_p = \sum_{j=1}^{m} w_j \beta_j$$

Expected Returns & *Required* Returns

Investment	$\hat{r}$	*Required* return	Attractive?
Alta	17.4%	17.0%	Underpriced
Market	15.0	15.0	Fairly Valued
Am. F.	13.8	12.8	Underpriced → Above SML
T-bonds	8.0	8.0	Fairly Valued → ON SML.
Repo Men	1.7	2.0	Overpriced → Below SML

Required > Expected : Over px

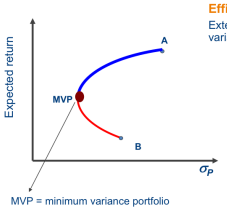
- ▶For a fairly priced asset, the expected return is on the SML.
- ▶For an underpriced asset, it would be above the SML.
- ▶For an overpriced asset, it would be below the SML.

4. Markowitz Portfolio Theory.

> Efficient portfolio: portfolio that provides the greatest expected portfolio return for a given level of portfolio (risk) S.D or lowest portfolio risk.

> Efficient frontier: line representing all efficient portfolio

Example of Efficient Frontier of a 2-asset Portfolio of Assets A and B



MVP = minimum variance portfolio

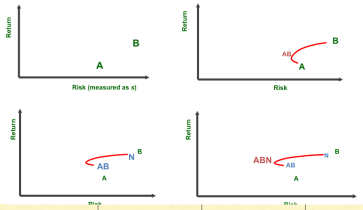
Efficient Frontier:

Extends from the MVP (minimum variance portfolio to A).

- For the same return, risk is minimized.
- For the same risk, return is maximized.
- **Efficient portfolios** are the ones we get maximum expected return for a given level of risk.
- Rational investor should not choose any other portfolios.

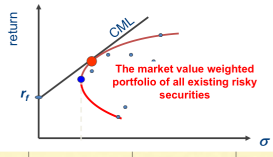
Developing the Efficient Frontier of All Possible Assets

Start with 2 assets A and B, and keep adding assets to new MVP formed



Now Introduce Riskless Borrowing and Lending to Efficient Frontier of All Possible Risky Assets

If there is *riskless borrowing and lending* then we draw the steepest line from the risk-free rate with the efficient frontier. Investors are able to allocate their money across the *risk-free asset* and the *market portfolio* with optimal result.



The Market Portfolio on the Efficient Frontier

- The **market portfolio** is the portfolio at the tangent line of the risk-free asset with the efficient frontier of all risky assets available.
- In theory, all risky assets are included in the true market portfolio in proportion to their market value (in practice, we use proxies for this portfolio, e.g., the S&P 500, MSCI, etc.)
- The **market portfolio**, because it contains all risky assets, is a completely diversified portfolio, which means that all the unique risk of individual assets (unsystematic risk) is diversified away, and thus only the systematic risk of all the assets remains in the portfolio (and gives a beta of 1).

Chpt 6: Bonds.

Bond: long term debt instrument sold to raise money

>one who buys corporate bond is creditor NOT owner.

coupon rate ↑ = ↑ ytm

Bond Terminologies.

Par value: face value of bond (principal amt), which is paid at maturity.

maturity: date on which the bond principal (par) amount must be repaid.

Coupon: Bond periodic interest payment

Coupon Rate: Stated annual interest rate paid by the issuer.

$$\text{Coupon Payment} = \frac{\text{Stated Annual Coupon Rate} \times \text{Par Value}}{\text{Number of Coupon Payments per year.}}$$

Term: time remaining until the principal repayment date

Callability: feature whereby the issuer can redeem the bond before it matures.

Putability: feature whereby buyer can redeem the bond before it matures.

Seniority: Preference in lender position over other lenders & debts – senior / junior

e.g. some debts are subordinated.

Zero Coupon Bond.

(deep / pure discount bond)

>pays no interest until the maturity date.

> At maturity, zero coupon bond holder will receive the principal + interest for entire period the money was borrowed.

>make no periodic interest payment? (coupon rate = 0%)

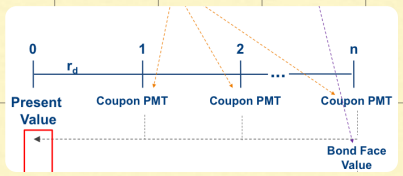
∴ No coupon PMT → No current yield → Any yield = YTM. = Return = Interest Rate.

☑ 0 coupon bond ALWAYS trades at / below its par value.

Bond valuation

Bond value = PV of Coupons + PV of par

= PV annuity + PV of lump sum.



More Bond Terminologies (cont.)

- **Debenture:** A bond backed by the issuer's general credit and ability to repay and not by an asset or collateral (unlike a secured bond).
- **Basis points**: A unit of measure, used to express yields or interest rates. Most often used to express differences between yields.
  - The basis point unit is one one-hundredth of one percent (0.01% = 0.0001)
  - For example, if a bond begins with a yield of 5.50% and the yield increases over time to 5.62%, the increase is 12 basis points

More Bond Terminologies (cont.)

- **Convertibility:** The option to exchange a bond for a specified amount of stock in the same issuing company. Bonds with this feature are called **convertible bonds**.
  - Conversion must occur at specified times, specified prices and under specified conditions, all of which are indicated in writing at the time of bond issue.
- **Protective Covenants:** That part of the indenture or loan agreement that limits certain actions a company might otherwise wish to take during the term of the loan.
  - E.g., limiting the amount of additional debt the company can take on, requiring a minimum working capital ratio, etc.

Bond pricing Equation

For coupons paid annually:

PV Annuity factor

$$\text{Bond value} = \text{Coupon}\left[\frac{1-\frac{1}{(1+rd)^N}}{rd}\right] + \frac{\text{Face value}}{(1+rd)^N}$$

PV of coupons | PV of Par value.

$$= \frac{\text{coupon}}{(1+rd)^1} + \frac{\text{coupon}}{(1+rd)^2} + \dots + \frac{\text{coupon}}{(1+rd)^n} + \frac{\text{Par/Face Value}}{(1+rd)^N}$$

∀ rd = discount rate = required rate of return on bond = yield to maturity.

rd ≠ coupon rate unless bond price at par

semi-Annual coupon bond:

$$\text{value} = \frac{\text{coupon}/2}{(1+rd/2)^1} + \frac{\text{coupon}/2}{(1+rd/2)^2} + \dots + \frac{\text{coupon}/2}{(1+rd/2)^{M\times N}} + \frac{\text{Par}}{(1+rd/2)^{M\times N}}$$

$$= \frac{\text{coupon}/2}{rd/2}\left[1-\frac{1}{(1+rd/2)^{M\times N}}\right] + \frac{\text{Par}}{(1+\frac{rd}{2})^{M\times N}}$$

∀ $\frac{\text{coupon}}{2}$ & $\frac{Rd}{2}$ & (N x 2)

Return on Bond.

> if you hold bond to maturity ⇒ wouldn't lose principal as long as borrower doesn't default.

> if buy & sell b4 maturity ⇒ can make/lose $$ → depends on exact maturity date, i/r movements, trans cost.

1Yr Holding Period Return

$$= \frac{(\text{Annual Coupon} + (\text{current Price of Bond} - \text{Beginning Bond Price}))}{\text{Beginning Price}}$$

current Yield

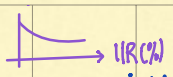
> Annual interest paid by a bond, expressed as a % of current market Px

> does NOT take into account any capital gain/loss associated to principal to be paid at maturity.

- Because you can buy a bond above or below par value, YTM includes not only the interest payments you will receive all the way to maturity, but it also takes into account any difference between the par value of the bond and the actual trading price of the bond at that time.

Yield to Maturity (YTM)

YTM↑, Bond Px↓ vice versa.



1. Rate earned if a bond is held to maturity.
2. Rate which discounts all future bond CF to their current value (Px)
3. market rate for bond in question, r_d is the IIR required in the market on the bond.
4. YTM = Bond's yield.
5. Rate implied by current bond Px

Par, discount & Premium Bond.

When using financial calculator
- PMT & PV same sign.
- FV opposite sign.

> YTM = coupon rate ⇒ Bond price = par value ⇒ par bond.

> YTM < coupon rate ⇒ Bond price > par value ⇒ premium bond.

> YTM > coupon rate ⇒ Bond price < par value ⇒ discount bond.

At maturity, value of ANY bond = par value

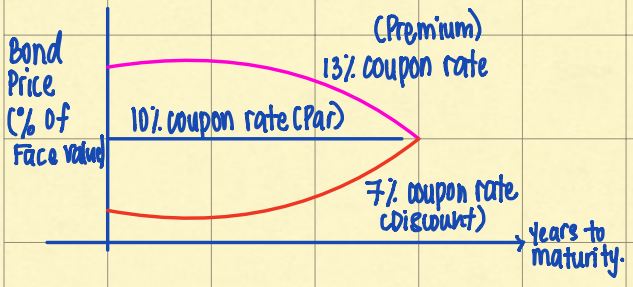
Expected Total Return = YTM = Interest rate

$$= \frac{\text{Annual coupon payment}}{Px_t} + \frac{Px_{t+1} - Px_t}{Px_t}$$

Bond Pricing Theorems.

- Bonds of similar risk (and maturity) will be priced to yield about the same return (the same YTM), regardless of the coupon rate.
- If you know the price of one bond, you can estimate its YTM and use that to find the price of the second bond.
- This is a useful concept that can be transferred to valuing assets other than bonds.

Changes in Bond value over Time.



Why ↑ IIr ↓ bond px

i.e you bought bond at x px with 5% return

Newly issued bond has yield 10% ⇒ drives bond px down to continue to make it attractive

Chpt 8: Stock Valuation

Stockholders: ways to receive cash
1. Pay dividends.
2. Sell shares

Bonds: value of stock = present value of expected CFs

Stock: Dividends

- Dividends are cash disbursements to shareholders.
  - Firms are not required to pay dividends to their shareholders (each period dividends may be declared at the discretion of the Board of Directors).
  - Dividends are **NOT** a liability of the firm until a dividend has been declared by the Board.
- Consequently, a firm cannot go bankrupt for not declaring dividends.
- Dividends and Taxes
  - Dividend payments are not considered a business expense; therefore, they are not tax deductible.
  - In most jurisdictions, dividends received by individuals are taxed as ordinary income.
  - In Singapore, however, dividends are tax exempt at the individual shareholder recipient level.

Value: Several Kinds

There are several types of value, for example

1. **Book Value:** The price paid to acquire the asset (including betterments), less accumulated depreciation.
2. **Market Value:** The price of an asset as determined in a competitive marketplace.
3. **Intrinsic Value:** What an asset is really worth in theory. In finance, this real worth is estimated by the **present value** of the expected future cash flows discounted at the decision maker's required rate of return from CAPM or its true required rate of return.

Stock Value: 1-Period Example

Using a Time-Line

0 | 20% | 1 | 2 | 3

D_1=\$2 ← Expected dividend
+
P_1=14 ← Expected to sell stock at this price
\$16 ← Total Funds Expected to be received at the end of year 1

P_0 = \$16 * 1/(1.20) = Value of the stock at time 0

Stock Value: 1-Period Example

- Compute the PV of the expected cash flows, i.e. compute P_0
  - Scientific Calculator:
    - Price = (14 + 2) / (1.2) = \$13.33
  - Financial Calculator:
    16 <FV>
    20 <I/YR>
    1<N >
    ⇒ <CPT><PV > -13.33
    ↓
    Recall the reversal of sign for PV computation

Determinants of Intrinsic Value

- The primary determinants of the intrinsic value of an asset to an individual are:
  - **Size** and **timing** of the expected future cash flows.
  - The individual's **required rate of return** (as we've seen, this is determined by a number of other factors such as risk/return preferences, returns on competing investments, expected inflation, tax rates applicable to the individual, etc.)
- Note that the **intrinsic value** of an asset can be, and often is, different for each individual (that's what makes markets work).
  - If markets are efficient, market value should equal intrinsic value for the marginal investor

Stock Value: 1-Period Example

- Suppose you are thinking of purchasing the stock of Moore Oil, Inc. and you expect it to pay a \$2 dividend in 1 year and you believe that you can sell the stock for \$14 at that time.
- If you require a return of 20% on investments of this risk, what is the maximum you would be willing to pay?

Stock Value: 2-Period Example

- Now what if you decide to hold the stock for 2 years?
- In addition to the dividend in one year, you expect a dividend of \$2.10 and a stock price of \$14.70 at the end of year 2. Now how much would you be willing to pay?

❖ PV = 2 / (1.2) + (2.10 + 14.70) / $(1.2)^2$ = 13.33
⇒ NPV = 13.33

Stock Value: 2-Period Example

Using a Time-Line

0 | 20% | 1 | 2 | 3

1.667 ← 1/(1.2)x D_1 = \$2
+
D_2=\$2.10
P_2=14.70
11.667 ← $1/(1.2)^2$x \$16.80
P_0 **\$13.33**

Dividend Growth Model

Dividend discount model

1. Constant Dividend (Zero-Growth Dividend)

> Firm pay a constant dividend forever
> Use PERPETUITY FORMULA

General formula for perpetuity

$PV = \frac{PMT}{i}$ ⟷ formula for Px of stock paying constant dividend

$P_0 = \frac{D_1}{r_E}$ ← cost of equity - required return of stockholders. usually estimated using CAPM.

Constant Dividend Example

Suppose a stock is expected to pay a \$0.50 dividend every quarter and the required return is ***10% with quarterly compounding***. What is the price?

❖ P_0 = .50 / (.1 / 4) = \$20

The quoted rate is divided by 4 to get the quarterly rate

Scenario 2: Constant Dividend Growth

The General Dividend Discount Model (DDM):

$$P_0 = \frac{D_1}{(1+r_E)^1} + \frac{D_2}{(1+r_E)^2} + \frac{D_3}{(1+r_E)^3} + \ldots + \frac{D_\infty}{(1+r_E)^\infty}$$

becomes

$$P_0 = \frac{D_0(1+g)^1}{(1+r_E)^1} + \frac{D_0(1+g)^2}{(1+r_E)^2} + \frac{D_0(1+g)^3}{(1+r_E)^3} + \ldots$$

With a little algebra, this reduces to:

$$P_0 = \frac{D_0(1+g)}{r_E - g} = \frac{D_1}{r_E - g}$$ ← Dividend in 1 year's time

Price at time, t = Present value of all expected future dividends

$$\leftrightarrow P_t = \frac{D_{t+1}}{(1+r_E)^1} + \frac{D_{t+2}}{(1+r_E)^2} + \ldots + \frac{D_\infty}{(1+r_E)^\infty}$$

r_E ← CAPM
↳ Req. rate of return.

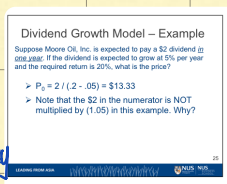
2. Constant Dividend Growth (Stable Growth)

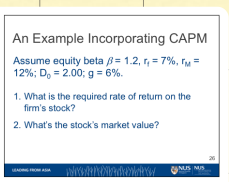
> Firm will ↑ dividend by constant % every period.
> firms experiencing long-term stable growth
> Stable firms are assumed to grow at the rate = LT nominal growth rate of the economy (Inflation + Real Growth in GDP)

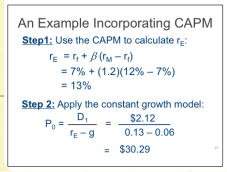
$P_0 = \frac{D_1}{r_E - g}$ requires $r_E > g$. (D_1 = dividend in 1yr time) $D_1 = D_0(1+g)$

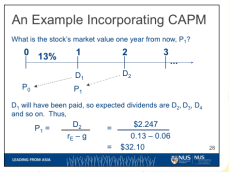
$r_E \leq g$, stock price infinite
makes no economic sense can't use model
(1) $r_E > g$ &
(2) g is expected to be constant forever.

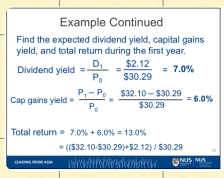
$D_1 = D_0(1+g)$

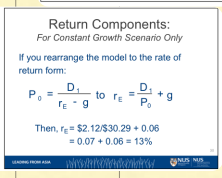


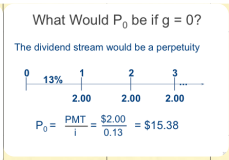




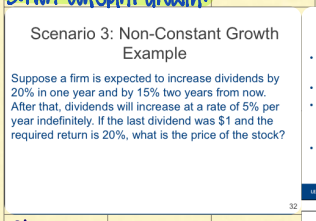


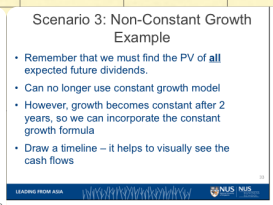


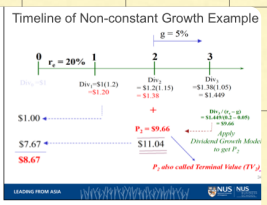




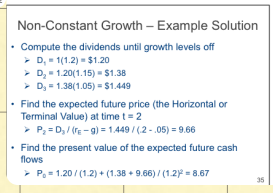
3. Non-constant growth.

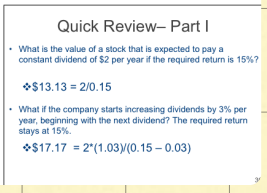






Steps
1. Find px of stock when dividend level of at constant growth & return rate
2. Current Px
= PV price in + PV of first x dividends payout.
Step 1



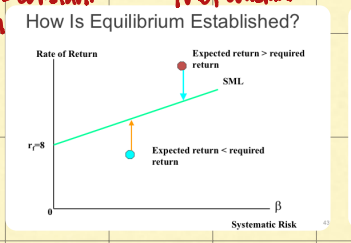


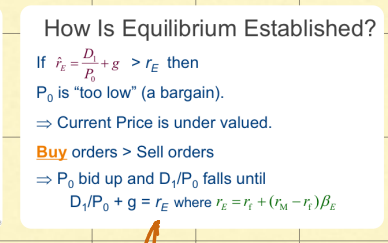
$P_0 = \frac{D_1}{(1+R)^1} + \frac{D_2}{(1+R)^2} + \ldots + \frac{D_n}{(1+R)^n} + \frac{P_n}{(1+R)^n}$

PV of Non-constant growth | TV of constant growth

Market Equilibrium.
> Stock prices are stable & only Δ with relevant new info
> No general tendency for people to buy vs sell
> Expected Return = Required Return

$\hat{r}_E = \frac{D_1}{P_0} + g = R_E = R_f + (R_M - R_f)\beta_E$

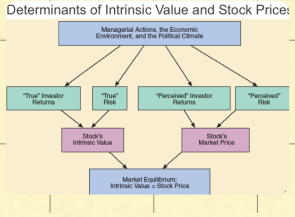




Req return?

Expected Return vs Required Return
↳ obtain from CAPM
↳ obtained by estimating dividends & expected capital gains.
> Expected return is the return implied by asset expected future CF & current Px

Why do stock price change?
$P_0 = \frac{D_1}{r_E - g}$
1. r_E could Δ
$r_E = r_f + (r_m - r_f)\beta_i$ → Real Rf rate
$r_f \approx r^* +$ Inflation premium for expected inflation
2. g could Δ due to a macro-economic or firm specific situation



Features of Preferred Stock.

1. Preferred dividends
   - Stated dividend must be paid before dividends can be paid to common stockholders
   - not a liability of the firm (can be deffered indefinitely.
   - most are cumulative
     - Any missed preferred dividends have to be paid b4 common dividends get paid.
   - do not carry voting rights.

Features of Preferred Stock

If preferred stock with an annual dividend of \$5 sells for \$50, what is the preferred stock's expected return ($\hat{r}_p$)?

V_p = D / r_p (a perpetuity)
\$50 = \$5 / r_p
= \$5 / \$50
$\hat{r}_p$ = 0.10 = 10%

Corporate Value Model (free cash flow method)

- value of entire firm = PV of firm free CF → DCF (discounted CF) to find firm's value today.
- About finding projected CFFAs. → Expected to be generated & belongs to firm's provider of capital → ∴ discounted back to firm's cost of capital WACC

$$\text{Firm value} = \sum_{t=1}^{\infty} \frac{\text{free CF}_t}{(1+\text{WACC})^t}$$

If free CF grows at g% rate forever

$$\text{Firm value} = PV_{t=0} = \frac{FCF_1}{R-g}$$

Equity value = Firm Value - mv of debt

value per share = Equity Value / Total # of outstanding shares

method

1. Find MV of firm → finding PV of firm's future CFFAs.
2. MV of firm's debt − preferred stock = MV of common stock
3. Intrinsic stock px = MV of common stock / # of shares outstanding

Using The Corporate Value Model

- This method is often preferred to the dividend growth model, especially when considering the number of firms (e.g. Amazon & Google) that *don't pay dividends* and/or when dividends are hard to forecast.
- Similar to dividend growth model as it assumes at some point free cash flow will grow at a constant rate.
- Terminal value (TV_N) represents value of firm as a whole ***at the point that growth becomes constant***, i.e., time N.
  - It is similar to the Dividend Growth Model (also called the Dividend Discount Model) where we have terminal value estimate for the price of the stock P_N at time N.

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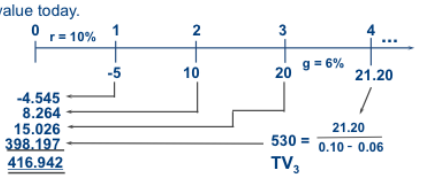
LEADING FROM ASIA

Example: Corporate Value Model

The below timeline indicates the firm's ***projected*** CFFAs (in \$Millions): $CFFA_1$ = -5, $CFFA_2$ = 10, $CFFA_3$ = 20. After year three, the firm is expected to have a long-run constant g_{CFFA} = *6%*. It has a Weighted Average Cost of Capital (WACC) of 10%. Use the corporate value model to find the firm's intrinsic value today.



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LEADING FROM ASIA

Example: Corporate Value Model

If the firm has \$40 million in debt and has 10 million shares of stock, what is the firm's intrinsic value per share?

- ***MV of equity*** = MV of firm – MV of debt
  = \$416.94 - \$40
  = \$376.94 million
- ***Value per share*** = MV of equity / # of shares
  = \$376.94 / 10
  = \$37.69

LEADING FROM ASIA

Summary

Corporate Value Model:
The value of the ***entire firm*** equals the present value of the ***firm's*** free cash flows

How do we compute stock price using CVM?

1. Find the PV of the firm's future CFFAs
2. Then subtract Market Value of firm's debt and preferred stock to get Market Value of common stock
3. Then Divide this Market Value of common stock by the number of shares outstanding to get intrinsic stock price (value) per share

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LEADING FROM ASIA

Chpt 8: Capital Budgeting.

∀ Goal: max shareholder wealth.

Refers to process of deciding how to allocate the firm's scarce capital resources (land, labor and capital) to its various investment alternatives.
Consider whether proj worth undertaking. (worth capital expenditure)
↳ ST, expense in yr incurred, exp are capitalized & dep over period of yrs.
↳ exp on fixed assets that will be used for prod^n over period of yrs.

Accept: cost ≤ Benefit, vice versa.

Steps:
1. Estimate CF & subsequent cash i/o flows
2. Assess riskiness of CF & determine appropriate risk-adjusted cost of capital for discounting CF - Find discount rate.
3. Find NPV / IRR / MIRR.

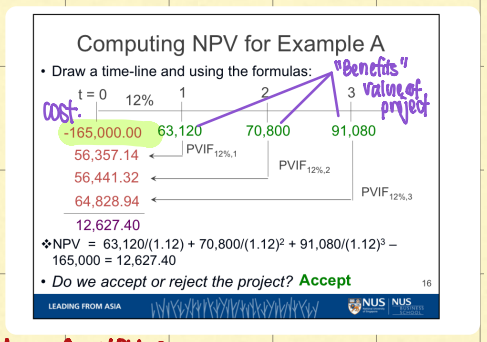
Method 1: Net Present Value (NPV)

NPV(% Rate, Initial outlay, {CF}, {CF#})

1. Estimate expected future CF (Amt & timing - use timeline)
2. Estimate req return for risk (may use CAPM)
3. NPV = PV of CF - Inital Inv
   = PV of inflows - PV of cost outflows = Net Gain in wealth.

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

NPV Rule:
1. Indep: Accept both if NPV > 0
2. Mutually Exclusive: Accept proj w highest +ve NPV.

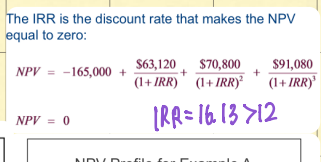


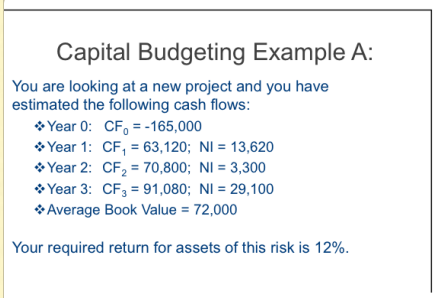
Method 2: Internal Rate of Return (IRR)

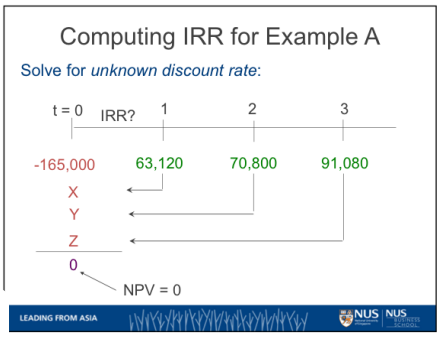
function IRR(Initial outlay, {CF}, {CF#})

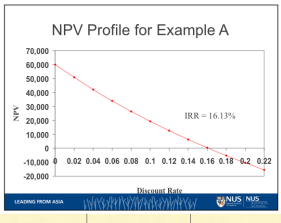
- Return that makes the NPV = 0 (X-intercept of NPV profile graph)

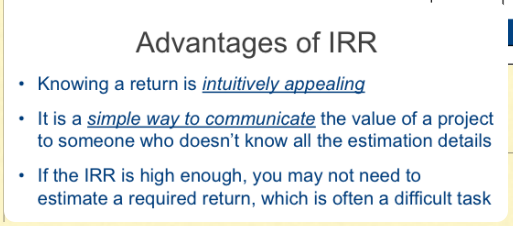
General IRR Rule: Accept the project if the IRR is greater than the required return





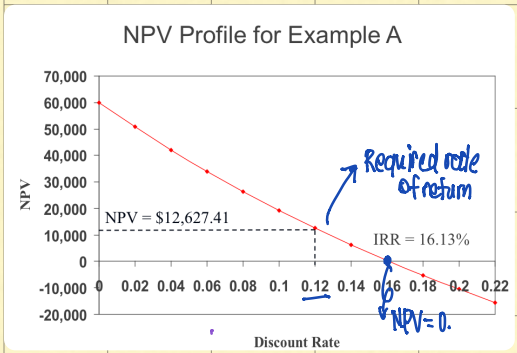






IRR Rule
Indep: Accept both if IRR > cost of capital
Mutually Exclusive: Accept higher IRR.

NPV versus IIR.



Required rate of return

NPV = 0.

Indep proj: CFs of 1 proj is unaffected by the acceptance of other.

- generally gives us the same decisions

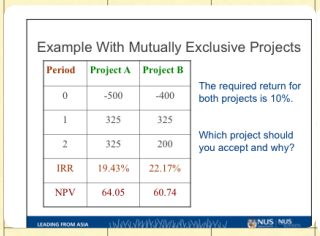
Exceptions:

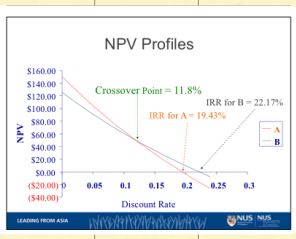
1. mutually exclusive projects. → Refers to if one proj accepted the other rejected.

Discount Rate > Crossover Rate — same decision.

" < " — diff "

This is due to differences in timing of CF and initial investment.





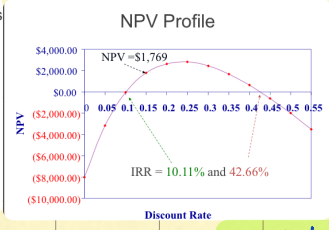
Reasons Why NPV Profiles Cross

- ***Size (scale) differences***: at discount rate = 0, the NPV of smaller project B is less than (hence below the) larger project A (on the y-axis).
- ***Timing differences:*** the project with faster payback provides more CF in early years for reinvestment. It is less sensitive to changes in discount rate. If r is high, early CF is especially good, $NPV_B > NPV_A$.

2. Non conventional CFs. - CF Δ more than once.
> likely to have more than one IRRs.

Another Example – Non-Conventional Cash Flows

- Suppose an investment will cost $90,000 initially and will generate the following cash flows:
  - Year 1: 132,000
  - Year 2: 100,000
  - Year 3: -150,000 (Decommissioning costs)
- The required return is 15%.
- Should we accept or reject the project?



Summary of Decision Rules

- The NPV is positive at a required return of 15%, so you should ***Accept***
- If you use the financial calculator, some models (e.g. yours!) would give an IRR of 10.11% which would tell you to ***Reject***
- You need to recognize that there are non-conventional cash flows and look at the NPV profile

NPV is superior to IRR.

1. Reinvestment Rate assumptions.
> IRR assumes CFs are reinvested at the IRR.
> NPV assumes CFs are reinvested at company's weighted average cost of capital i.e opportunity cost of capital.
> Assuming reinvestment at cost of capital more realistic, NPV better.

2. Projects with different scales.

- Assume choosing between 2 projects
- According to NPV, choose L
- According to IRR, choose S

} Of the 2, will choose NPV since much more profit!

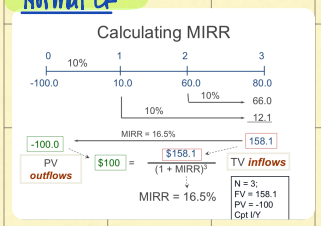
	Project Large (L)	Project Small (S)
CF_0	-$100,000	-$1.00
CF_{1-10}	$50,000	$0.60
WACC	10%	10%
NPV	$207,228	$2.69
IRR	49.1%	59.4%

Method 3: Modified IRR (MIRR)

Combination Approach

> MIRR is the discount rate that causes the PV of a project terminal value (TV) = PV of costs. (Refers to firm's overall IIR.)
> TV is found by compounding the proj inflows at WACC to the date of maturity
> PV of costs found by discounting the project CF to time zero using WACC.
MIRR assumes CF are reinvested at WACC.

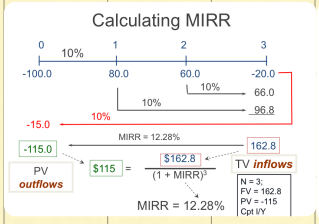
Normal CF

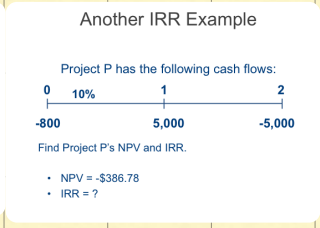


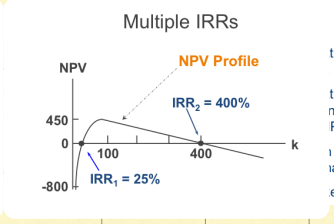
1. Calc FV of all CFs
2. Sum all FV at TV
3. discount FV at MIRR to t=0.
4. Equate value at step 3 to Terminal cost.

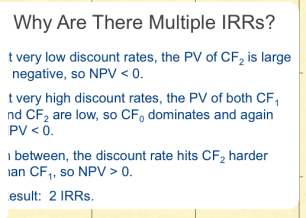
$$\sum \text{PV of Outflows} = \frac{\overbrace{\sum \text{FV of inflows}}^{\text{TV}}}{(1+\text{MIRR})^{N}} \quad N = \text{period.}$$

Non Normal CF



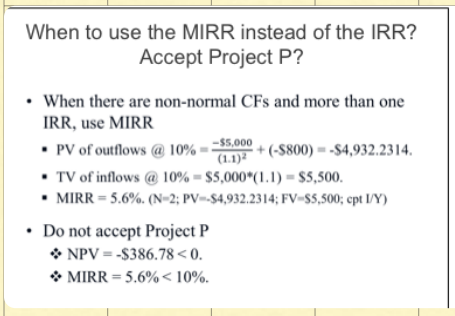


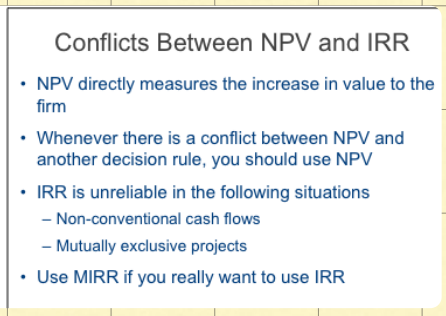




Why use MIRR vs IRR.
> Managers like rate of return comparisons and MIRR is better for this than IRR.
> IRR incorrectly assumes reinvestment at opportunity cost = WACC. MIRR also avoids the problem of multiple IRR.
⇒ NPV superior to MIRR superior to IRR.

makes more sense to reinvest at least of the cost than reinvestment rate of IRR for IRR.





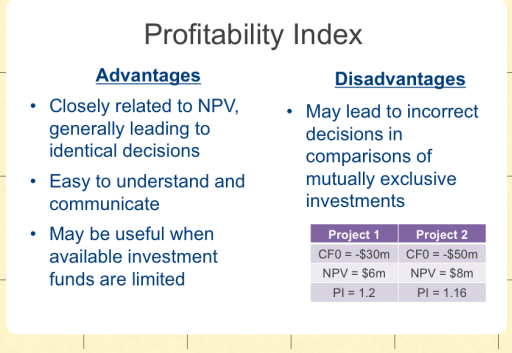
Method 4: Profitability Index.

> measures the benefit per unit cost, based on the time value of money.
"benefit-cost" ratio

$$PI = \frac{\text{Total PV of future CFs}}{\text{Initial cost}} \quad \leftarrow \text{"benefits"} \quad \leftarrow \text{"costs"}$$

e.g. PI of 1.1 means for every $1 of investment, we create additional $0.10 in value

PI decision Rule: Accept if PI > 1

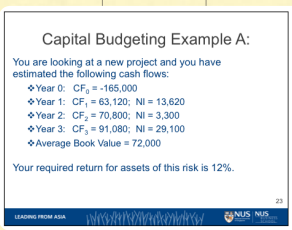


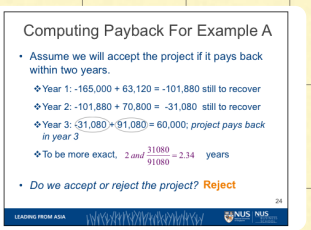
Method 5: Payback & Discounted Payback

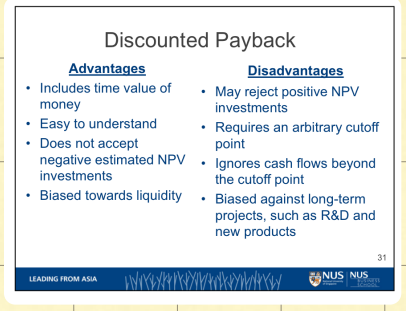
Payback period: # of yrs to recover initial cost.

1. Estimate the CF
2. Add future CF to the initial cost until the initial investment has be recovered

Payback Period Decision Rule: Accept if the payback period is less than some period limit (Qn)



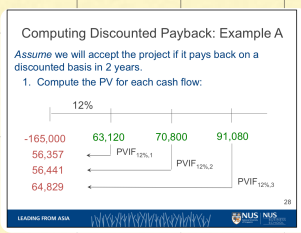


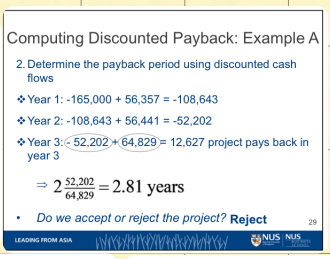


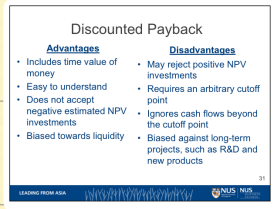
Method 5.1: Discounted Payback Period.

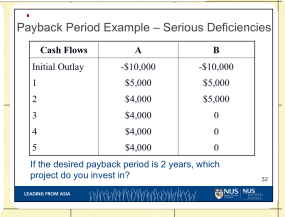
1. Compute the present value of each CF & determine how long it takes to payback on a discounted basis.
2. Compare to a specified required period.

Discounted Payback Decision Rule: Accept the project if it pays back on a discounted basis within the specified time (Qn)









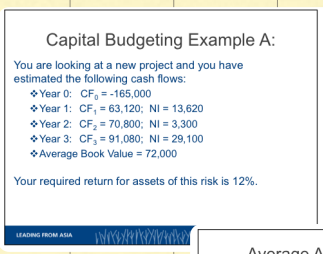
Method 6: Average Accounting Return (AAR).

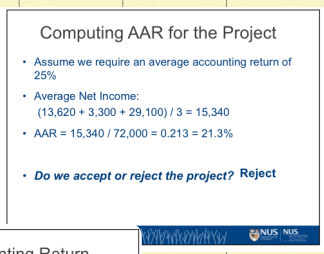
1. Average Net Income / Average book value.
2. Note that the average book value depends on how the asset is depreciated.

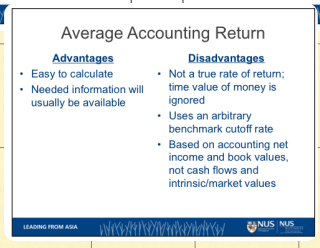
Need to have target cutoff rate.

AAR decision rule:
Accept the proj if AAR > preset rate (Qn)

$$AAR = \frac{\text{Ave Net Y}}{\text{Ave Book Value}}.$$







Chpt 9: WACC

Relevant Cash Flows

What are considered relevant cash flows. → ∀ finance nse CF NOT accounting earnings.

① depreciation
- Acc: upfront CF to buy & set up equipment not recognised as exp in yr 0
  - → cash outlays appear as dep exp over course of useful life ∴ do not correspond to ACTUAL cash outflows.

② Taxes
- > CF measured on after-tax basis.

③ Incremental
- > CF measured on after-tax basis.

④ ΔNOWC
- relevant to cash outflow & inflow though may not appear on Y stats
- WACC calc at point in time & it reflects marginal cost of raising an additional dollar of capital today.

⑤ CF must be on INCREMENTAL basis
- refers to firm's CF when undertaking proj − firms CF when not undertaking proj
- CF should only be in capital budgeting analysis ONLY those that proj is ACCEPTED.

Effects of CF

① Sunk cost
- cost accurred in past & cannot be altered by present decisions ∴ NOT RELEVANT

② opportunity cost
- > cost of next best alternative option which must be forgone by taking the proj → relevant

③ Side Effects / Externalities.
- +ve: benefit other proj in firm
- -ve: costs to other proj

④ Financing cost
- Ignore in estimating CF. ∴ exclude interest expense & tax effect of interest exp in estimating projected CF & CFFAs.

WACC - Weighted Average Cost of Capital.

$$WACC = r_d * (1 - T_c) \times \frac{D}{V} + r_E \frac{E}{V}$$

- r_d: required rate of return on debt
- $(1 - T_c)$: marginal corporate tax
  - > only interest payments are tax deductible
- D: market value debt
- E: Market value Equity.
- V: Total value $= D + E$
- r_E: required rate of return on capital
  - > dividend payments are not.

- use after-tax equity & debt financing costs

> use WACC when discounting firm's CF / firm's proj CF
> WACC weights are after-tax cost of debt & after tax cost of equity.

Pro Forma Statements and Cash Flow. ⇒ Know how to calculate projected total cash flows OCF, NCS, ΔNOWC

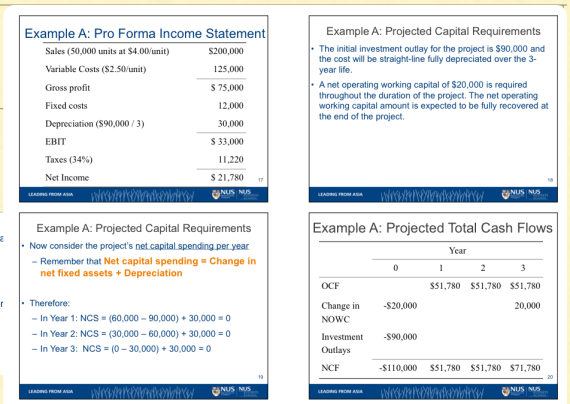
↳ projected accounting statements, particularly income statement

Sales-variable cost-Annual fixed cost + depreciation.

OCF = EBIT × (1 − tax rate) + dep^n

CFFA = OCF − Net Capital Spending (NCS) − Δin NOWC

NCS = ΔNFA + dep.



Terminal Cash Flow

- Net salvage value received upon termination of proj = Net salvage value − opp cost of salvaging old sys.
- Rem to include NOWC.

Depreciation Expense

↳ non cash expense

- only relevant because it affects taxes (results in lower taxes payable) and thus it affects CF through depreciation tax shield

using dep^n tax shield method.

OCF = (Sales − Cost)(1 − tax rate) + dep (tax rate)

depreciation tax shield = D × T_c

D: depreciation exp; T_c: marginal corporate tax rate

Straight Line Depreciation Expense

depreciation expense = $\frac{\text{cost of fixed Asset} - \text{salvage value}}{\text{useful life}}$ → 0 when full dep.

Accumulated depreciation

= Annual depreciation D × # of yrs in use

Book value (B)

= Initial cost − Accumulated dep.

Net salvage value

if salvage value diff from BV of asset ⇒ tax effect at end of proj life

After-tax salvage value = $S - T_c \times (S - B)$ (S: salvage value; T_c: tax rate; B: Book value)

If S > B: Gain on sale.

Tax on gained received · Net salvage value after tax < Salvage value.

If S < B: Loss on sale

Tax savings on loss incurred.

i.e $-T_c \times (S - B)$: tax saving (cash inflow) : Net salvage value after tax > salvage value.

Net Capital spending — How capital spending is treated in capital budgeting.

Net capital spending = Ending NFA − Beginning NFA + dep.

Refers to $ spent on fixed asset less money from sale of existing fixed assets.

Replacement Projects

For a replacement rather than a new project, how would the analysis change?

- Remember that we are interested in incremental cash flows
- If we buy the new machine, then we will sell the old machine
- The incremental cash flows would be the difference in cash flows between the old machine and the new machine.
- Thus our cash flow estimates must reflect all the cash flow consequences of selling the old machine today instead of at the end of its life

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Example: Replacement Problem

Original Machine	New Machine
❖ Initial cost = 100,000	❖Initial cost = 150,000
❖ Annual depreciation = 9000	❖5-year life
❖ Purchased 5 years ago	❖Salvage in 5 years = 17,000
❖ Book Value = 55,000	❖Cost savings = 50,000/year
❖ Salvage today = 65,000	❖Straight-line ***full*** depreciation = 30,000
❖ Salvage in 5 years = 10,000 if don't replace old machine	

- Required return = 10%
- Tax rate = 40%

Opportunity cost

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Replacement Projects

- If the old machine is sold today, the firm will not receive the salvage value at the end of the machine's life (as it otherwise would have).
  - Not receiving the salvage value of the replaced equipment is an opportunity cost of the replacement project.
  - Thus it is important to record the actual salvage value cash inflow to be received upon sale of the old equipment while also taking into account that this results in forfeiting obtaining the salvage value of the equipment some time in the future.
- The relevant annual depreciation expense would be the change in depreciation
  - i.e. the new equipment's depreciation less the old equipment's depreciation
  - This gives the **incremental depreciation**

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Example: Replacement Problem – Pro Forma Income Statements

Year	1 - 5
Cost Savings	50,000
Depreciation	
New Machine	30,000
Old Machine	9,000
Incremental	21,000
EBIT	29,000
Taxes (40%)	11,600
NI	17,400

→ *relevant*

What is the relevant OCF? 17,400 + 21,000 = 38,400

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Example: Replacement Problem – Incremental Net Capital Spending

- **Year 0**
  - ❖ Cost of new machine = 150,000 (***outflow***)
  - ❖ Net salvage value on old machine = 65,000 – 0.4(65,000 – 55,000) = 61,000 (***inflow***)
  - →Net capital spending = 150,000 – 61,000 = 89,000 (***outflow***)
- **Year 5 (Additional Cash Consequences)**
  - ❖ Net salvage value on old machine = 10,000 – 0.4(10,000 – 10,000) = 10,000

  An ***outflow*** because we no longer receive this. It's an opportunity cost.
  - ❖ Net salvage value on new machine = 17,000 – 0.4(17,000 – 0) =10,200 (***inflow***)

Note: If we do not sell the machine today, then we will have after-tax salvage of 10,000 in 5 years. Since we do sell the machine today, we LOSE the 10,000 cash flow in 5 years.

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Example: Replacement Problem – Cash Flow From Assets

Year	0	1	2	3	4	5
OCF		38,400	38,400	38,400	38,400	38,400
NCS	-89,000					
OppC (Old)						-10,000
NSV(New)						+10,200
ΔNOWC	0					0
NCF	-89,000	38,400	38,400	38,400	38,400	38,600

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Example: Replacement Problem – Analyzing the Cash Flows

- Now that we have the cash flows, we can compute the NPV and IRR
  - ❖Enter the cash flows
  - ❖Compute NPV = 56,690
  - ❖Compute IRR = 32.66%
- *Should the company replace the equipment?* **Yes**

Unequal life projects.

1. EAA Approach. (EAA)

1. Calculate NPV um
2. Calculate Equivalent Annual Annuities
   - find an equivalent annuity to lump-s NPV
   - use NPV as PV & solve for PMT, PMT = annual annuity
3. Apply appropriate decision rule.
   - Select highest EAA

2. EAC Approach

1. Find each project's present value of costs each year to operate the equipment (including the cost of equipment at t=0)
2. Find an annuity (EAC) that equates to the project's present value of costs over its individual life at project's cost of capital
3. Select project with lower EAC.

Mutually Exclusive Unequal Life Projects

- Suppose our firm is planning to expand and we have to select 1 of 2 machines. They differ in terms of economic life.
- How do we decide which machine to select?

The after-tax cash flows are:

Year	Machine 1	Machine 2
0	(45,000)	(45,000)
1	20,000	12,000
2	20,000	12,000
3	20,000	12,000
4		12,000
5		12,000
6		12,000

► Assume a required return of 14%

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Example: Unequal Life Projects

Step 1: Calculate NPV

- NPV_1 = $1,432
- NPV_2 = $1,664
- So, does this mean #2 is better?
- Not Necessarily – the two NPVs can't be compared simply as they are. Why?
  - They have non-equal useful lives

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Example: Unequal Life Projects

- This tells us that:
  - ❖NPV_1 is equivalent to receiving $617 per year.
  - ❖NPV_2 is equivalent to receiving $428 per year.

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Example: Unequal Life Projects

Step 3: Apply Appropriate Decision Rule

Decision Rule

Select the highest EAA → We would choose machine #1.

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Example: Unequal Life Projects

Step 2: Calculate Equivalent Annual Annuities (EAA) (or Replacement Chains)

- **If we assume that each project will be replaced an infinite number of times in the future**, then we can convert each NPV to an annuity.
- Note that the projects' EAAs can be compared to determine which is the best project.

EAA: Simply find an equivalent annuity to the lump-sum NPV.

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Example: Unequal Life Projects

Computing EAA

- Machine 1:
  Enter PV = 1,432, N = 3, I/Y = 14%
  <CPT> <PMT> **-$617**
- Machine 2:
  Enter PV = 1,664, N = 6, I/Y = 14%
  <CPT> <PMT> **-$428**
- What does this tell us?

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Another EAA Example

Machine A	Machine B
• Initial Cost = $5,000,000	• Initial Cost = $6,000,000
• Pre-tax operating cost = $500,000	• Pre-tax operating cost = $450,000
• Straight-line depreciated over 5-year life taking into account the expected salvage value of $400,000	• Straight-line depreciated over 8-year life taking into account the expected salvage value of $700,000

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Example: EAA Analysis

- The machine chosen will be replaced indefinitely and neither machine will have a differential impact on revenue. No change in NOWC is required.
- The required return is 9% and the tax rate is 40%.
- Which machine would you choose? Are the annuities representing cash inflows or outflows?

EAA_A = -$1,150,625.30; EAA_B = -$1,025,574

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Example: EAA Analysis

Machine A: Depreciate with salvage value.

	t = 0	t = 1 to 4	t = 5
Initial costs	-5m		
OCF (0-60k)*(1-0.4) + 9(0.4)*0.4		68,000	68,000
Salvage			400,000
NCF	**-5m**	**68,000**	**468,000**

Enter cashflows into <CF> worksheet, I = 9% and compute NPV_A you should get -4,475,531.16.

Enter NPV amount into PV, 5<N> and compute <PMT>, you get **1,150,625.30.**

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Example: EAA Analysis

Machine B: Depreciate with salvage value.

	t = 0	t = 1 to 7	t = 8
Initial costs	-6m		
OCF (0-60k)*(1-0.4) + 6(0.4)*0.4		-5,000	-5,000
Salvage			700,000
NCF	**-6m**	**-5,000**	**695,000**

Enter cashflows into <CF> worksheet, I = 9% and compute NPV_A you should get -5,676,367.70.

Enter NPV amount into PV, 8<N> and compute <PMT>, you get **1,025,574.20.**

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Example: EAA Analysis

Machine A	Machine B
-$1,150,625.30	**-$1,025,574.20**

This is a cost. So you should select the one with the *less negative* EAA, or interpreted as the lower ***Equal Annual Cost*** **(EAC)** → We will choose Machine B.

Note that only incremental cash flows are required. Since revenue/sales information are the same for both machines, they are irrelevant and can be left out.

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Summary

EAA is useful to compare two projects with unequal project life

- Assuming that the projects can be repeated
- First, calculated the NPV of the project
- Second, calculate the EAA and compare the periodic payments

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differential OCF (Replacement)

	0	1	2	Proj
cost savings				
new equipment dep[a]				
Old Equip[a] dep[b]				
Incremental dep[a]				
EBIT (cost savings - incremental dep[a])				
EBIT(1-T)				
OCF (EBIT(1-T)+dep)				
cost of New equip[a]				
Old Equip[a] Net salvage value[b] (BV)				
NCS				
New equip Net salvage value				
Opp[a] cost				
↑NOWC				
NCF				

initial cash outlay = initial cost + incremental cost − salvage value of old equip.

↑ salvage value − tax rate (salvage value − BV)

Net CF = After tax operating cost savings + incremental dep[b] tax shield.

↳ salvage value × tax rate

= OCF(1 − tax rate) + Δ(dep[a] × tax rate)

Chpt 10: Financial Planning & Forecasting

Percentage of sales method.

Generally

- dividends
  - > do not Δ directly w sales.
  - Addition to RE = Net Y - div

} → management decisions

- Notes payable, LT debt & equity
- Only liabilities like A/P & accured exp Δ w sales.

Steps

Y statement

Projected sales = current sales (1+g)

- compute each proj figure that Δ w sales.
- if div known, find out RE

Balance sheet

- compute each proj figure
- Find out RE if payout ratio / div known
- compute Δ in RE
  - ΔRE = NI - div
  - plug EFN to make B/S balance

AFN Equation method.

$$AFN = \left(\frac{A^*}{S}\right)\Delta S - \left(\frac{L^*}{S}\right)\Delta S - MS_1(1-d)$$

A^* = assets that Δ w sales.
L^* = Liabilities that Δ w sales.

S = original sales
S_1 = total sales projected for next year

ΔS = Δ in sales (base on projection)
M = profit margin
d = dividend payout ratio

assumes
1. each type of assets ∝ ΔS
2. Payables & Accurals ∝ ΔS
3. © PM
4. © dividend payout ratio.
5. Operating at full capacity.

if Fixed Assets < full capacity.

$$\text{Capacity sales} = \frac{\text{Actual Sales}}{\% \text{ of capacity}}$$

if capacity sales > forecasted sales ⇒ No new FA req,
if " < " ⇒ Buy FA., add'l FA to be bought < req, FA if FA operating at full cap.

EFN = Required ↑ assets − ↑ spontaneous liability − ↑ RE

Internal Growth Rate:

> max growth that can be achieved w/ no external financing of any kind.

$$\text{Internal Growth Rate} = \frac{ROA \times b}{1-(ROA \times b)}$$

b = Retention ratio.

Sustainable Growth Rate

> max growth rate a firm can achieve w/o external equity while maintaining constant debt to equity ratio.

$$\text{Sustainable growth Rate} = \frac{ROE \times b}{1-(ROE \times b)}$$

ROE = TATO × PM × EM.

Chpt 11: Working Capital Management

Working Capital

Gross Working Capital: Total CA

Net operating working capital (NOWC) = Operating CA - Operating CL
= (Cash + Inv + AR) - (Accruals + AP)

Net working capital: CA - CL

Working capital policy = deciding level of each type of CA to hold & how to finance CA

Recall the Balance Sheet Identity (Lecture 2)

Assets = Debt + Equity

Current assets + fixed assets = current liabilities + long-term debt + equity

- Net working capital + fixed assets = long-term debt + equity
- Cash + other CA – CL + fixed assets = long-term debt + equity

Therefore

- Cash = equity* + long-term debt + current liabilities – current assets other than cash – fixed assets

*Equity Includes **Retained Earnings** which is increased by Net Income - Dividends

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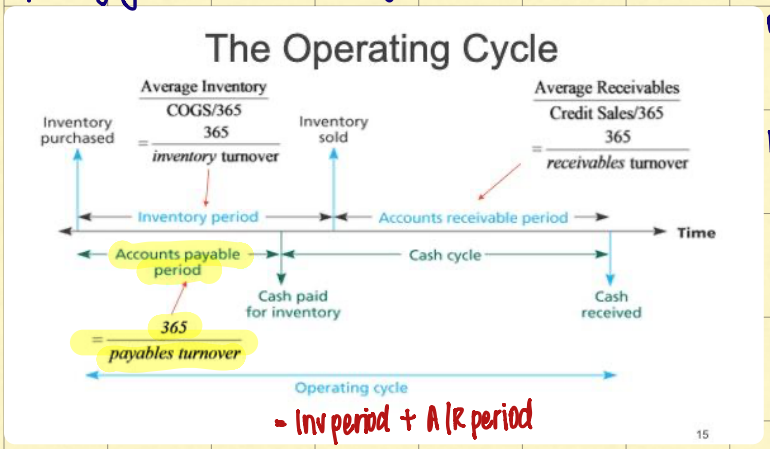
Operating Cycle & Cash conversion Cycle



operating cycle - time btw purchasing inv & collecting cash from selling the inv

Inv period - time required to purchase & sell the inv

A/R period (DSO) - time to collect on credit sales.

Payables deferral period: time btw purchase of inv and payment for the inv

Payables turnover = $\frac{\text{total Purchases from Suppliers.}}{\text{Average Payable}}$

$= \frac{\text{COGS} + \text{End Inv} - \text{Beg Inv}}{\text{Ave Payable}}$

Cash conversion cycle = Operating cycle − A/P period.