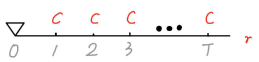
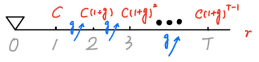
Present Value

- Annuity



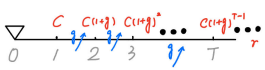
$$PV = \frac{C}{r}\left(1 - \frac{1}{(1+r)^T}\right)$$



$$PV = \frac{C}{r-g}\left(1 - \left(\frac{1+g}{1+r}\right)^T\right)$$

- Perpetuity

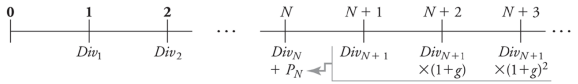
$$PV = \frac{C}{r}$$



$$PV = \frac{C}{r-g}$$

Flaws: uncertainty, deviation

- DDM: $P_0 = \sum_{n=1}^{\infty} \frac{Div_n}{(1+r_E)^n}, Div = EPS \cdot TPR$



^ TPM: $P_0 = \frac{PV(payouts)}{shares}, take\ g\ and\ equity\ for\ all$

> Dupont Growth Model: $g = \frac{\Delta E}{E} = (1 - TPR) \times RONI$

- Bond Pricing: $P_B = \sum_{t=1}^{T} \frac{C}{(1+y)^t} + \frac{F}{(1+y)^T}$, note: YTM & coupon ate

→ Dirty price and Clean price

→ r_D(cost of debt)= $r_f + risk\ premium = IRR\ of\ E(cash\ flow)$

$promised\ YTM = r_D + default\ premium; YTM_{corporate} = YTM_{treasury} + spread$

→ DIY-YTM: $\sum_{t=1}^{T} \frac{C_t}{(1+y_t)^t} = \sum_{t=1}^{T} \frac{C}{(1+y)^t} + \frac{F}{(1+y)^T}$

$$(1+y_n)^n(1+f_n^k)^k = (1+y_{n+k})^{n+k}$$

→ Duration (Note: zero-coupon bond)

$$\%\ change\ in\ price \approx (-1) \cdot MD \cdot \Delta y = -\Delta y \cdot \frac{Duration}{1+y} = -\frac{\Delta y}{1+y} \cdot \sum_t \frac{t \times PV(C_t)}{P}$$

- DCF Valuation: $EV^L = PV(FCF) = \sum_{n=1}^{\infty} \frac{FCF_n}{(1+r_{WACC})^n}$

^ $EV^L + Cash = Debt + Equity$

Assets		Liabilities
	Cash	Debt
Enterprise Value = PV(FCF)	Tangible: Plant/Prop/Equip, Net Working Cap, etc. Intangible: IP, Human Cap, Brands, etc.	Equity

^ $FCF^U = EBIT \cdot (1-\tau) + Depreciation - Capex - \Delta NWC$

> EBIT

Sales	
(Cost)	Gross Profit
(Depreciation & Amortization)	
(Necessary Expense)	
(R & D)	Operating Income
Other Income	EBIT
Interest Income (Expense)	Net Income Before Tax
(Income Tax)	Net Income
(Dividends)	Retained Earnings

> NWC: $NWC = AR + Inv. - AP$

^ r_{WACC}: $r_{WACC} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1-\tau_C)$, ↓ with leverage

> $FCFE = FCF^L = FCF^U - Int.Exp + NB. = NI + NB. + (Adjs), Equity = \sum_i \frac{FCFE_i}{(1+r_E)^i}$

> CAPM: $r_E = r_f + \beta_i(E(r_{MKT}) - r_f), \beta_i = \frac{SD(r_i)Corr(r_i, r_{RMK})}{SD(r_{MKT})} = \frac{Cov(r_i, r_{RMK})}{Var(r_{MKT})}$

$$Sharpo\ Ratio = \frac{E(R_P) - r_f}{SD(R_P)}, SD(R_P) = \sum_i x_i SD(R_i) Corr(R_i, R_P), \beta_P = \sum_i x_i \beta_i$$

$$R_A = \frac{E}{V} R_E + \frac{D}{V} R_D, \beta_A = \frac{E}{V}\beta_E + \frac{D}{V}\beta_D$$

> r_U: $r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$, unchanged by leverage ratio

> APV: $V^L = V^U + PV(Interest\ Shield); V^U = \sum_{n=1}^{\infty} \frac{FCF_n}{(1+r_U)^n}$

$$PV(TS) = \tau_C D\ (D\ perpetuity, regardless\ of\ risk\&rate)$$

> Multiple Valuation

Flaws: postulate, deviation, overestimate

- Earnings ratios
  - Net earnings or income: EBITDA (earnings before interest, taxes, depreciation, amortization); EBIT (earnings before interest, taxes)
  - P/E or P/(Estimated E) (price to earnings ratio)
  - yield=D/P (dividend yield)
  - Payout D/E (payout rate)

$$forward\ \frac{P}{E} = \frac{P_0}{EPS_1} = \frac{TPR}{r_E - g_e}$$

$$PEG = \frac{PE}{growth\ ratio}\ with\ 1$$

- Leverage
  - Interest Coverage: EBIT/Interest expense
  - Leverage = Assets/Equity = 1 + Debt/Equity
- Liquidity
  - Quick ratio: (Cash + Marketable securities + Receivables)/Current liability
  - Cash Ratio: (Cash + Marketable securities)/Current Liability
- Price ratios
  - Market to Book: Mkt CAP/Book value
  - Price to earnings: Price per share/earnings per share
  - Earnings yield: Earnings per share/price per share

$$\frac{P}{B} = \frac{ROE - g}{r_E - g}$$

$$EV\ Multiples: \frac{V_0}{EBITDA_1} = \frac{FCF_1/EBITDA_1}{r_{WACC} - g_{FCF}}\ (valid\ with\ lev.\ and\ depre.)$$

· Other ratios:

P/S, P/CF, EV/S, Click & Bullet

- ROA (return on assets) = (EBIT)/(ASSETS)
- ROE (return on equity) = (1-TaxRate)*(EBIT-Interest Expenses) / EQUITY

$$ROE = \frac{Net\ profit}{Pretax\ profit} \times \frac{Pretax\ profit}{EBIT} \times \frac{EBIT}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

Concepts:

- APR & EAR & IRR & YTM
- Expected return rate & YTM

$$expected\ cash\ flow \xrightarrow{discount\ rate} price \xrightarrow{promised\ payment} YTM$$

- Payback & Discounted Payback
- Break-even & sensitivity analysis
- Efficiency frontier & tangent → efficient $\xrightarrow{\text{mutual fund theorem}}$ market portfolio $\begin{cases} CML\ (expected\ return\ and\ SD) \\ SML\ (expected\ return\ and\ \beta) \end{cases}$
- Linear regression for β $R_i - r_f = \alpha_i + \beta_i(R_{MKT} - r_f) + \varepsilon_i$; α and SML

$$Profitability\ index = \frac{NPV}{Resource\ consumed}$$

Total Payouts		Stock Price
FCF	→	Enterprise Value
FCFE		Equity Value

MM law: EV is independent on leverage, r_U fixed when frictionless

Tax shield: return of principal **not** included

IRR: fuzzy in some cases

Depreciation: deducted in EBIT, added back in FCF

Gain (loss): tax levied in EBIT

!!DRAW A TIMELINE!!