Finance Formulas

Unit 1

$$Return = \frac{P_{t+1} + D_{t+1} - P_t}{P_t}$$

$P_{t+1} = Price\ in\ the\ future\ (Future\ Cash\ Flow)$

$D_{t+1} = Payouts\ in\ the\ future\ (dividends, coupons, etc.)$

$P_t = Price\ today\ (Present\ Value)$

Time Value of Money:

$\text{Present Value (PV)} = \frac{FV}{(1+r)^n} = FV * \frac{1}{(1+r)^n}$

$\text{Discount Factor} = \frac{1}{(1+r)^n}$

$\text{Future Value (FV)} = PV(1+r)^n$

$$\text{n} = \frac{\ln\left(\frac{FV}{PV}\right)}{\ln(1+r)}$$

$$\text{r} = \left(\frac{FV}{PV}\right)^{1/n} - 1$$

Time Value of Money Multiple Time Periods:

$$\text{PV} = \sum_{i=1}^{n} \frac{FV_i}{(1+r)^n}$$

$$\text{FV} = \sum_{i=1}^{n} PV_i * (1+r)^n$$

Adjusting TVM formulas for multiple compounding periods per year:

r/m

n*m

If there’s a PMT: pmt/m

$m = Number\ of\ periods\ per\ year$

Unit 2

$DCF_{pv} = \sum \frac{Cash\ Flow_n}{(1+r)^n} = \sum Cash\ Flow_n * \frac{1}{(1+r)^n} = \sum PV_n$

$DCF_{fv} = \sum Cash\ Flow_n (1+r)^n = \sum FV_n$

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

$\text{Peretuity PV} = C/r$

$$\text{Growing Annuity PV} = C\left(\frac{1 - \left(\frac{(1+g)}{(1+r)}\right)^n}{(r-g)}\right)$$

$\text{Growing Peretuity PV} = C/(r-g)$

$$\text{EAR} = \left(1 + \frac{PR}{m}\right)^m - 1$$

$\text{APR} = PR * m$

$PR = Periodic\ Rate$

$m = Number\ of\ periods\ per\ year$

Unit 3

$Bond_{value} = \sum \frac{Coupon_n}{(1+YTM)^n} + \frac{Par_N}{(1+YTM)^n}$

Bond to TVM terminology:

Price= PV

Face Value= FV

Maturity= n

Yield to Maturity=r

Coupon= PMT

Fisher Effect:

Simple: $r_n = r_r + i$

Compound: (1+r_n) $= (1 + r_r) * (1 + i)$

Duration $= \frac{\sum N * \frac{CF_N}{(1+YTM)^n}}{\sum \frac{CF_N}{(1+YTM)^n}}$

Gordon Growth Model (Dividend Growth Model)

$P_t = D_{t+1}/(r - g)$

$P_t = Stock\ Price\ \ today$

$D_{t+1} = Dividend\ in\ t + 1$

r= discount rate

g= dividend growth rate

If g=0, then

$P_t = D/r$

Expected Return from GG Model:

r=$\frac{D_{t+1}}{P_t} + g$

$\frac{D_{t+1}}{P_t}$=dividend yield

g= capital gains yield

Nonconstant Growth Formula (MUCH easier to use a cash flow table)

$P_t = \frac{D_{t+1}}{r-g_1} * \left(1 - \left(\frac{1+g_1}{1+r}\right)^n\right) + \frac{P_T}{r-g_2}$

$$P_T = \frac{D_{t+n}}{r - g_2} = \frac{D_t * (1 + g_1)^n * (1 + g_2)}{r - g_2}$$

Unit 4

$$Arithmetic\ Average(Mean) = \frac{\sum_{n=1}^{N} r_n}{N}$$

$r_n = nth\ return$

$N = Total\ Number\ of\ Observations$

$Geometric\ Average(Mean) = (\prod_{n=1}^{N}(1 + r_n))^{(1/N)}$-1

Equal-Weighted Returns

Just the average that was calculated

Value-Weighted Returns= $\sum_{n=1}^{N} r_n * w_n$

$w_n = Weight\ of\ Security\ n$

$$Variance(\sigma^2) = \frac{\sum_{n=1}^{N}(r_n - \bar{r})}{N - 1}$$

$\bar{r}$=average return

Measure of dispersion

$$Standard\ Deviation\ (\sigma) = \sqrt{\frac{\sum_{n=1}^{N}(r_n - \bar{r})}{N - 1}}$$

Better measure of dispersion

$$Expected\ Return = \sum_{i=1}^{n} p_i * r_i$$

$p_i = \ probability\ of\ outcome\ i\ occurring$

$r_i = return\ if\ outcome\ i\ occurs$

Portfolio Weight

Amount of a portfolio held in a particular asset

$$Portfolio\,Weight = \frac{\$\,held\ in\ asset}{\$\,in\,portfolio} = w_i$$

Portfolio Return

Overall return on all the assets in the portfolio

$$Portfolio\ Return = \sum_{i=1}^{n} w_i * r_i$$

$$Return = Expected\ Return + Unexpected\ Return$$

Capital Asset Pricing Model (CAPM): $(E(R)) = R_f + \beta(E(R_m) - R_f)$

Where:

$$E(R) = Expected\ Return$$

$$R_f = Risk\ Free\ Rate$$

$$\beta = Beta\ (Systematic\ Risk) = \frac{Covariance(E(R), E(R_m))}{Variance\ (E(R_m))}$$

$$E(R_m) = Expected\ Return\ of\ the\ Market$$

$$R2R_i = \frac{E(r_i) - r_f}{\beta_i}$$

Unit 5

Operating Cash Flow

Cash generated from a firm’s normal business activities

OCF=EBIT+Depreciation-Taxes

Capital Expenditures (Spending)

Money spent on fixed assets net of money received for the sale of fixed assets

Capital Spending=Change in PPE

From BS or CFS

Change in Net Working Capital

CNWC=$(Current\ Assets_{t+1} - Current\ Liabilities_{t+1}) - (Current\ Assets_t - Current\ Liabilities_t)$

From BS or CFS

Depreciation Tax Shield Free Cash Flow $= (S - VC - FC)(1 - t) + D * t - \Delta NWC - CAPEX$

Where:

$S = Sales$

$VC = Variable\ Costs, generally\ Cost\ of\ Goods\ Sold$

$FC = Fixed\ Costs, generally\ Selling, General, \&\ Administrative$

$t = Tax\ Rate\ of\ the\ Firm$

$D = Depreciation$

$$\Delta NWC = Change\ in\ Net\ Working\ Capital$$
$$= (Current\ Assets_{t+1} - Current\ Liabilities_{t+1}) - (Current\ Assets_t - Current\ Liabilities_t)$$

$CAPEX = Capital\ Expenditures$

Bottom up Free Cash Flow $= NI + D - \Delta NWC - CAPEX$

NI= Net Income

Free Cash Flow to Equity $= FCF + Net\ Borrowing$

Financial Ratios

Short-term solvency (Liquidity) Ratios

Reflects how easily a firm's short-term assets can cover short-term obligations

The higher the Liquidity Ratio, the easier it will be to cover

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilites}$$

$$Quick\ Ratio\ = \frac{Current\ Assets - Inventory}{Current\ Liabilites}$$

$$Cash\ Ratio = \frac{Cash}{Current\ Liabilites}$$

Long-Term Solvency Ratios

Reflects how easily a firm's assets can cover long-term obligations

The higher the Solvency Ratio, the easier it will be to cover

$$Total\ Debt\ Ratio = \frac{Total\ Assets\ \ - Total\ Equity}{Total\ Liabilites}$$

$$TIE = \frac{EBIT}{Interest}$$

$$Cash\ Coverage\ Ratio = \frac{EBIT + Depreciation}{Interest}$$

Asset Management

Reflects how efficient a firm uses its assets

Higher the ratio, the more efficiently used (some exceptions)

$$Inventory\ Turnover = \frac{Cost\ of\ Goods\ Sold}{Inventory}$$

$$Days'Sales\ in\ Inventory = \frac{365\ Days}{Inventory\ Turnover}$$

Lower the better

$$Receivables\ Turnover = \frac{Sales}{Accounts\ Receivable}$$

$$Days'Sales\ in\ Receivables = \frac{365\ Days}{Receivables\ Turnover}$$

The lower the better

$$Total\ Asset\ Turnover = \frac{Sales}{Total\ Assets}$$

Profitability

Reflects how relatively high a firm's bottom line is relative to a base input

Efficiency of generating profits

The higher, the better

$$PM = \frac{Net\ Income}{Sales}$$

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

$$ROE = \frac{Net\ Income}{Total\ Equity}$$

Market Value Ratios

$$EPS = \frac{Net\ Income}{\#\ Shares\ Outstanding}$$

$$PE = \frac{Price\ per\ Share}{Earnings\ per\ Share}$$

$$PS = \frac{Price\ per\ Share}{Sales\ per\ Share}$$

$$MB = \frac{Market\ Value\ per\ Share}{Book\ Value\ per\ Share}$$

Determinants of Profitability and Growth

DuPont Identity: ROE= $\frac{Net\ Income}{Sales} * \frac{Sales}{Assets} * \frac{Assets}{Total\ Equity}$

DPR= $\frac{Cash\ Dividends}{Net\ Income}$

RR(b) $= \frac{Addition\ to\ Retained\ Earnings}{Net\ Income}$

Internal Growth Rate= $\frac{ROA*b}{1-ROA*b}$

Sustainable Growth Rate= $\frac{ROE*b}{1-ROE*b}$

Unit 6

Net Present Value=$\frac{\sum_{i=1}^{n} FCF_i}{(1+r)^i} - Capital\ Expenditures\ (startup\ cost)$

Internal Rate of Return= irr function

$$Profitability\ Index = \frac{PV(Cash\ Flows)}{Initial\ Investment}$$

PP=(Average Cash Flow)/(Start-up Cost) (if constant CFs)=# years to recoup + leftover/last year CF

Weight Average Cost of Capital $= \left(\frac{E}{V}\right) r_e + \left(\frac{D}{V}\right) r_d (1-t)$

Where:

$E = Market\ Value\ of\ Equity$

$D = Market\ Value\ of\ Debt$

$V = Market\ Value\ of\ the\ Firm = E + D$

$r_e = Cost\ of\ Equity$

$r_d = Cost\ of\ Debt$

$t = Tax\ Rate$

$$Reward - to - Risk = \frac{E(r) - r_f}{\beta}$$