Simple Interest: FV = $PV * (1 + r * t)$
Compounded interest: $FV = PV * (1 + r)^t$, $PV = \frac{FV}{(1+r)^{\wedge}t}$,
$t = \frac{\ln(\frac{FV}{PV})}{\ln(1+r)}$, $r = \left(\frac{FV}{PV}\right)^{\frac{1}{t}} - 1$
Cashflow annuity: $FV = C * (1 + r)^t + C * (1 + r)^{t-1} + \cdots$

$$PV = \frac{C}{(1 + r)^t} + \frac{C}{(1 + r)^{t-1}} + \cdots$$

Ordinary annuity: $C = \frac{PV * r}{\left(1 - \left(\frac{1}{(1+r)^t}\right)\right)}$

(Same C): $FV = C * (\frac{(1+r)^t - 1}{r})$, $PV = C * (\frac{1-(\frac{1}{(1+r)^t})}{r})$
, $C = \frac{FV * r}{(1+r)^t - 1}$
Cashflow perpetuity: $PV = \frac{C}{r}$
Growing perpetuity: $PV = \frac{C_1}{r-g}$
Growing annuity: $PV = \frac{C_1}{r*g} * (1 - \left(\frac{1-g}{1-r}\right)^t)$
Effective Annual Rate (EAR) = $\left[1 + \frac{APR}{m}\right]^m - 1$

$$APR = m * [(1 + EAR)^{\frac{1}{m}} - 1]$$

Continuous compounding EAR = $e^q - 1$
Nominal Rate: $R = r(Real\ Rate) + h(Inflation)$
Annuity Present Value Factor = $\frac{1-\frac{1}{(1+r)^t}}{r}$
Present Value Factor = $\frac{1}{(1+r)^t}$
$PV_{Annuity}\ or\ PV_{Coupon}$: $PMT * \frac{1-(1+r)^{-t}}{r}$, $n, t = \frac{\log\left(\frac{PMT}{PMT - P*r}\right)}{\log(1+r)}$

$$PV_{Annuity\ Due} = PMT * (1 + r) * \frac{1-(1+r)^{-n}}{r}$$

$$PMT_{Anuity\ Due} = \frac{PV * r}{\left(1 - \frac{1}{(1 + r)^t}\right) * (1 + r)}$$

$$PMT_{End\ of\ Month} = \frac{PV * r}{\left(1 - \frac{1}{(1 + r)^t}\right)}$$

$$PMT = \frac{Coupon\ rate}{Pro\ anno} * Face\ Value$$

$$PV_{Face\ value} = \frac{FV}{(1 + r)^t}$$

$$Bond\ Value = PV_{coupons} + PV_{Face\ Value}$$

PV of a lumpsum or Bond face value: $\frac{PV}{(1+YTM)^t}$
Bond annuity PV: $C * R * PV * (\frac{1-\frac{1}{(1+YTM)^t}}{YTM})$
Future Value Factor: $(1 + r)^t$

$$FV_{Annuity} = \frac{(1 + r)^t - 1}{r} * C$$

$$Bond\ Value = C * \left[\frac{1 - \frac{1}{(1 + r)^t}}{r}\right] + \frac{F}{(1 + r)^t}$$

Present Value of a single future cashflow: $\frac{F}{(1+R)^t}$

$$C = \left[PV - \frac{F}{(1 + R)^t}\right] * \frac{r}{\left(1 - \frac{1}{(1 + r)^t}\right)}$$

Fishers Equation: $(1 + R) = (1 + r) * (1 + h)$,

$$h = \frac{1 + R}{1 + r} - 1, r = \frac{(1 + r)}{(1 + h)} - 1$$

Capital Gain = Bought – Sold
Capital Yield Gain = $\frac{Sold - Bought}{Bought}$, Dividend Yield = $\frac{Income}{Bought}$
Total Dividend Dollar Return = $Div\ Per\ Share * \#Shares$
Total Capital Gain Dollar Return = $(Sold - Bough) * \#Shares$
Total Dollar return = TDDR + TCGDR
Percentage Total Return = $\frac{Total\ Dollar\ Return\ Per\ Share}{Bought}$
Total Real Rate Return = $\frac{1 + Percent\ Toral\ Return}{1 + Inflation}$
Total Nominal Rate of return: $\frac{D}{Bought}$
Arithmetic average return: $\bar{x} = \frac{\sum x}{n}$
$Var(x) = \frac{\sum x_i - \bar{x}}{n-1}$, $Std(x) = \sqrt{var(x)}$

$$Var(X) = \sum p_i * (R_i - \bar{R})^2$$

Geometric Average Return = $[(1 + A_1) * \ldots * (1 + A_n)]^{\frac{1}{n}} - 1$
Std Dev: 1. Returns for all states = x_i, 2. Expected Return: $\sum p_i * E[R_{s_i}]$, 3. Var(X), 4. $\sqrt{var(x)}$.
Correlation of 2 stocks: $\sigma_p^2 = X_L^2\sigma_L^2 + X_U^2\sigma_U^2 + 2X_LX_U\ corr_{L,U,\sigma_U,\sigma_L}$
Systematic Risk (m) = Market Risk
Unsystematic Risk (e) = Asset Specific Risk

Total Return Equation: $R = E[R] + U,\ U = m + e$

$$CAPM: E[R] = R_f + \beta * MRP$$

$$MRP = E[R] - R_f$$

Risk to reward: $\frac{E[R] - R_F}{\beta}$, SML Slope = $E[R_m] - R_F$
Value of a stock with 0 growth: $\frac{DIV}{Discount}$

$$D_t = D_0 * (1 + g)^t, g = r - \frac{D_0}{P_0}, D_1 = P_0 * (r - g), P_0 = \frac{D_0 * (1 + g)^{t+1}}{r - g}$$

$$= \frac{D_1}{r - g}, D_0 = \frac{P_0(r - g)}{1 + g}, r = \frac{D_1}{P_0} + g$$

Discount = $P_0 * \frac{P_t}{(1+r)^t}$
Perpetuity: $P_0 = \frac{D}{r}, r = \frac{D}{P_0}$
Stock from div to growing perpetuity:

$$1. PV = \frac{D_1}{r - g}\left[1 - \left(\frac{1 + g}{1 + r}\right)^t\right], 2.\ PV_{Growing\ Perpetuity} = \frac{D_{t+1}}{r - g},$$

$$3. P_0 = PV_{t_0} + \left(\frac{P_t}{(1 + r)^t}\right)$$

$$P_t = D_t * \left(\frac{1 + g}{r - g}\right), P_0 = \frac{\frac{D_t}{r - g}}{(1 + r)^t}$$

$P = P/E + EPS$, $P_t = P/E * EPS_t$
Dividend Growth Rate = Capital Gains Yield
Profitability index = $\frac{PV\ of\ Cash\ inflow}{PV\ of\ cash\ flow\ output}$

$$NPV\ index = \frac{(PV\ of\ cash\ inflow - PV\ of\ cash\ outflow)}{PV\ of\ cash\ outflow}$$

NPV = $\frac{R_t}{(1+i)^t}$, $NPV\ index = Profitability\ Index - 1$
NPV decision rule is about the Magnitude of cash flow and the NPV is about the profitability rate.

$$Average\ Accounting\ return: AAR = 1. \frac{\sum R}{N}, 2. \frac{Cost + Remaining\ asset}{2}, 3. \frac{1.}{2.}$$

Weak Form: Stock prices already incorporate all past market information, rendering technical analysis ineffective.

Semi-Strong Form: Stock prices instantly reflect all public information, making fundamental analysis obsolete for gaining extra returns.

Strong Form: Stock prices fully account for all information, public and private, meaning no one can consistently achieve abnormal returns, not even with insider information.

Treasury Bills have a beta of 0

Non-cumulative shareholders do not have the right to previously missed dividends, but **cumulative** shareholders do, they also have the right to be paid on previous dividend before **commons**.

IRR (Internal Rate of Return): It's the discount rate at which the net present value (NPV) of all the cash flows from a project or investment equals zero.

Accept project if NPV > 0 or IRR > r

$$P_t = Benchmark \frac{P}{E} * EPS$$

$$P_t = Benchmark\ price\ sales\ ratio * sales\ per\ share$$

NPVGO: Net present value (Per share) of the growth opportunity
$NPVGO = Share\ price - Cash\ cow\ price$

$$EPS = DIV, Cash\ Cow = \frac{EPS}{r},$$

$$Stock\ price\ after\ new\ project = \frac{EPS}{R} + NPVGO$$

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return on an investment are comprised of dividends and capital appreciation

Dividend is where shareholders recieve cash

Capital gain = bought − sold , PV cash flow = $C\frac{1-\frac{1}{(1+r)^t}}{r}$

in the stock market there is potential for big win and big loss

You can earn money in the stock market either by dividend or capital gains.

Dividend is a component of a return in terms of income

History shows that greater risk bears greater reward

total cash available after sale is initial investment + total dollar return

Capital gain at the end of the year when not sold is counted as part of investors return

whether or not a stock is sold the capital gain is counted toward total return

Capital gains yeild is not considering dividend.

Consumer price index can be used to find the inflation

treasury Bills are issued by the federal government

value at risk is used by Banks to manage risk exposures

normal distribution can be decribed with Average returns and std dev.

capital yeild gain = $\frac{(\text{sold} - \text{bought})}{\text{bought}}$, dividend yield = $\frac{\text{income}}{\text{bought}}$, total dollar return = TDOR + TCGDR

total dividend dollar return = div pr share · shares#, total capital gain dollar return = (sold − bought) · shares#

Percentage total return = $\frac{\text{total dollar return pr share}}{\text{bought price}}$, total real rate return = $\frac{1 + \text{percent total return}}{1 + \text{inflation}}$

Arithmetic Average return = $\overline{X} = \frac{\sum X_i}{n}$, $var(x) = \frac{\sum (X_i - \overline{X})^2}{n-1}$, $std(x) = \sqrt{var(x)}$

Geometric Average return = $[(1+R_1)\cdot \ldots \cdot (1+R_n)]^{\frac{1}{n}} - 1$, Fishers equation = $1+R = (1+r)\cdot(1+h)$

Std dev = 1. returns for all states = X_i 2. expected return − $\sum P_i \cdot E[R_s] = \overline{X}$ 3. Var(x) 4. $\sqrt{var(x)}$

Strong form efficency: Prices reflect private and public info, weak, insiders still profitable

weak −11−: tech analysis will not lead to abnormal returns

Risk premium = expected return − R_f , $E[R] = \sum^{n} P_i \times R_i$, CAPM = $R_f + \beta \times MRP$; $E[R] = (E[R_m] - R_f)$

Return variance: 1. squared dev for each E[R] 2. squared dev × P_i 3. add each Sd with P_i

a portfolio has atleast 2 stocks, A portfolio that has lowest possible risk: minimum variance

correlation of 2 stocks ($\sigma_p^2 = x_L^2\sigma_L^2 + x_U^2\sigma_U^2 + 2x_L x_U \, corr_{L,U}\sigma_L\sigma_U$

systematic risk = market risk, unsystematic risk = asset specific risk

total return equation: $R = E[R] + U = E[R] + m + \epsilon$, m = systematic, ϵ = unsystematic

systematic risk principle only states that reward for risk depends soley on systematic risk

Risk-to-reward = $\frac{E[R] - R_f}{\beta}$, SML slope = $E[R_m] - R_f$, $g = r - \frac{D_1}{P_0}$, $D_1 = P_0(r-g)$

value of a stock with zero growth = $\frac{\text{div}}{\text{discount}}$, $D_t = D_0 \times (1+g)^t$

$P_0 = \frac{D_0(1+g)^{t+1}}{r-g} = \frac{D_1}{r-g}$, $D_0 = \frac{P_0(r-g)}{1+g}$, $r = \frac{D_1}{P_0} + g$, Discount = $P_0 = \frac{P_t}{(1+r)^t}$, $D_0 = \frac{P_0(r-g)}{(1+g)}$

Perpetuity: $P_0 = \frac{D}{r}$, $r = \frac{D}{P_0}$

stock from div to growing perpetuity: 1. $\frac{D_1}{r-g}[1-(\frac{1+g}{1+r})^t]$, 2. $\frac{D_{t+1}}{r-g}$, 3. $P_0 = PV_t + (\frac{P_t}{(1+r)^t})$

$P_t = D_t \times \frac{(1+g)}{(r-g)}$ $P_0 = \frac{\frac{D_t}{r-g}}{(1+r)^t}$ mistke? $P = P/E$ + earning per share , $P_t = P/E \times EPS_t$

Dividend growth rate = capital gains yield

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simple interest: $PV \cdot (1 + r \cdot t)$ Compounded interest: $FV = PV \cdot (1+r)^t$: $PV = \frac{FV}{(1+r)^t}$: $t = \frac{\ln(\frac{FV}{PV})}{\ln(1+r)}$: $r = (\frac{FV}{PV})^{\frac{1}{t}} - 1$

cash flow annuity: $FV = C \cdot (1+r)^2 + C \cdot (1+r) \ldots$: $PV = \frac{C}{(1+r)^t} + \frac{C}{(1+r)^{t-1}} \ldots$ } Different C

Same C: $FV = C \cdot (\frac{(1+r)^t - 1}{r})$: PV: $C \cdot (\frac{1 - \frac{1}{(1+r)^t}}{r})$: $C = \frac{(FV \cdot r)}{(1+r)^t - 1}$

cash flow perpetuity: $PV = \frac{C}{r}$ growing perpetuity: $PV = \frac{C_1}{r-g}$

r: real rate
h: inflation

growing annuity: $PV = \frac{C_1}{r-g} \cdot (1 - (\frac{1+g}{1+r})^t)$ Effective annual rate (EAR) = $[1 + \frac{APR}{m}]^m - 1$

$APR = m[(1 + EAR)^{\frac{1}{m}} - 1]$: continuous compounding (EAR) = $e^q - 1$: nominal rate (R) = (r + h)

Annuity Present value Factor = $\frac{1 - \frac{1}{(1+r)^t}}{r}$: Present value Factor = $\frac{1}{(1+r)^t}$

PV annuity due = $PMT \cdot (1+r) \cdot \frac{1 - (1+r)^{-n}}{r}$: PV_{coupons} PV annuity = $PMT \frac{1 - (1+r)^{-t}}{r}$: $N = \frac{\log(\frac{PMT}{PMT - P \cdot r})}{\log(1+r)}$

annual investment payments
coupon payments } $\frac{\text{coupon rate}}{\text{pro anno}}$ × face value : $PV_{\text{face value}} = \frac{FV}{(1+r)^n}$: Bond value = PV_{coupons} + PV face value

Present value of a Bond face value
Lump sum } $= \frac{FV}{(1+YTM)^t}$: Bond annuity PV = CR · FV · $\frac{1 - \frac{1}{(1+YTM)^t}}{YTM}$

Future value factor = $(1+r)^t$: FV annuity = $\frac{(1+r)^t - 1}{r} \cdot C$

Bond value = $C \times [\frac{1 - \frac{1}{(1+r)^t}}{r}] + \frac{F}{(1+r)^t}$

bond PV 0 − coupon : $\frac{F}{(1+r)^t}$

Last year does not compound

Cash flow

PV top down FV bottom up

$C = [PV - \frac{F}{(1+R)^t}] \times \frac{r}{(1 - \frac{1}{(1+r)^t})}$

Calculator:

FV = PV, I/Y, N, CPT FV

PV = N, I/Y, FV, −11− PV

I/Y = N, −PV, FV, −11− I/Y

Multiple cash flow:

PV = N=1, I/Y, FV, −11− PV, STO, N=2, FV ..

Annuity present value

PV = N, I/Y, PMT, −11− PV

annuity payments

PMT = N, I/Y, PV −11− PMT = − (cash flow)

N = I/Y, − PMT, PV, −11− N

I/Y = N, PMT, −PV, −11− I/Y

FVA = −PMT, N, I/Y, −11− FV

when computing differences in compounding methods-

set PV = 1 to find the factor

YTM = required return

Fisher equation:

$(1+R) = (1+r) \times (1+h)$
$h = \frac{1+R}{1+r} - 1$
$r = \frac{(1+R)}{(1+h)} - 1$ } R = total return, h = inflation, r = real return

Bond Yield ↑ = Bond price ↓

market interest rate ↑ = Present value of cash flow ↓

coupon rate ↑ = interest rate risk ↓

time to maturity ↑ = interest rate risk ↑

YTM > Coupon rate = Discount