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IM 3rd MBA

INVESTMENT MANAGEMENT FORMULA'S.

Index calculation: (Assuming Base value = 100)

$$\text{Price Weighted Index (PWI)} = \frac{\text{Sum of prices in current period}}{\text{Sum of prices in Base period}} \times 10$$

$$\text{Equal weighted Index (EWI)} = \frac{\text{Sum of price relative}}{\text{Equal total Investment}} \times 100$$

$$\text{Value weighted Index (VWI)} = \frac{\text{Sum of market capitalisation in } \cancel{\text{Base}} \text{ current period}}{\text{Sum of market capitalisation in Base period}} \times 10$$

Risk and Return:

When only price is given to calculate return.

$$\frac{\text{Today's price} - \text{Yesterday's price}}{\text{Yesterday's price}} \times 100.$$

Average return $\bar{R}_i = \frac{\Sigma R}{n}$ Expected return $(\mathcal{E}(r)) = (P_i)(r_i$

$P_i \rightarrow$ Probability $r_i \rightarrow$ Return of the stock

Standard deviation: Variability in return and indicate total risk.

If the probability is given $\sigma = \sqrt{\Sigma P(r_i - \mathcal{E}(r))^2}$

When only return is given $\sigma = \sqrt{\frac{\Sigma(R_i - \bar{R}_i)^2}{n-1}}$

$n \rightarrow$ only two observations

$n-1 \rightarrow$ More than two observations

Beta: Volatility of stock with respect to market Index. indicates systematic risk.

S1

Simple linear regression is used to calculate Beta.

Slope or charateristic regression line $R_i = \alpha + \beta R_m$

For X, Y   X → Index return   Y → Stock return.

$$\beta = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

For R_i, R_m R_i → Stock return R_m → Index return

$$\beta = \frac{\sum(R_i - \bar{R_i})(R_m - \bar{R_m})}{\sum(R_m - \bar{R_m})^2}$$

$$\alpha = \bar{Y} - \beta\bar{X} \qquad \alpha = \bar{R_i} - \beta\bar{R_m}$$

Alternative formulas for Beta

σ_m^2 → Market variance.

$$\beta = \frac{COV_{(i,m)}}{\sigma_m^2}$$

→ This formula can be used when Probability, return on stock an market is given

$$\beta = r\frac{\sigma_p}{\sigma_m}$$

→ Use this formula when the Correlation, σ_p and σ_m is given

σ_p → Std. deviation of Portfolio or std. deviation of individual stock(o

<u>Correlation</u>: $$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{\sum Y^2 - (\sum Y)^2}}$$

$$r_{12} = \frac{Cov_{12}}{\sigma_1\sigma_2}$$

When Probability is given $COV_{12} = \sum P(R_1 - \bar{R_1})(R_2 - \bar{R_2})$

If only return is given $COV_{12} = \frac{\sum(R_1 - \bar{R_1})(R_2 - \bar{R_2})}{n-1}$

$$COV_{12} = r_{12} \times \sigma_1\sigma_2$$

Portfolio risk

Two asset case:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\underbrace{(r_{12}\sigma_1\sigma_2)}_{COV_{12}}}$$

Three asset case:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + w_3^2\sigma_3^2 + 2w_1w_2COV_{12} + 2w_2w_3COV_{23} + 2w_1w_3COV_1}$$

Minimum risk portfolio

If $r = -1$ $\qquad W_A = \dfrac{\sigma_B}{\sigma_A+\sigma_B} \qquad W_B = 1 - W_A$.

If $r = +ve$ $\qquad W_A = \dfrac{\sigma_B^2 - \sigma_A\sigma_B r_{AB}}{\sigma_A^2 + \sigma_B^2 - 2\sigma_A\sigma_B r_{AB}}$.

Capital Asset Pricing Model (CAPM)

Capital market line (CML) $R_i = R_f + \left[\dfrac{R_m - R_f}{\sigma_m}\right]\sigma_p$

$R_m \rightarrow$ Market return $\quad R_f \rightarrow$ Risk free return.

$\sigma_M \rightarrow$ Market std. deviation $\quad \sigma_p$ or $\sigma_i \rightarrow$ Std. deviation of stock or Portfolio

Security market line (SML) $R_i = R_f + \beta(R_m - R_f)$

Single Index Model

Total Risk = Systematic risk + Unsystematic risk.

Systematic risk = $\beta_i^2\sigma_M^2$.

Unsystematic risk = Total variance − Systematic risk

$\sigma_{ei}^2 = \sigma_i^2 -$ Systematic risk.

Sharpe's optimal portfolio

Excess return to beta = $\dfrac{R_i - R_f}{\beta_i}$

$$C_i = \frac{\sigma_m^2 \sum \frac{(R_i - R_f)\beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum \frac{\beta_i^2}{\sigma_{ei}^2}}$$

$\sigma_m^2 \rightarrow$ Market variance

$\sigma_{ei}^2 \rightarrow$ Unsystematic risk.

C_i = Cut off Point.

$$X_i = \frac{Z_i}{\sum Z_i} \qquad \underbrace{Z_i = \frac{\beta_i}{\sigma_{ei}^2}}\left[\frac{R_i - R_f}{\beta_i} - C^*\right]$$

$\hookrightarrow$ To find out proportion of Investment

Arbitrage pricing Model:

$$R_i = R_f + (b_{i1}\lambda_1 + b_{i2}\lambda_2 + \lambda_3 b_{i3} + \ldots)(R_m - R_f)$$

$b_{i1}, b_{i2}, b_{i3} \longrightarrow$ Market risk factor with respect to sensitivity factors like inflation, interest and Industrial production etc.

$\lambda_1, \lambda_2, \lambda_3 \longrightarrow$ Sensitivity index with respect to inflation, interest and IP etc.

Portfolio Evaluation

Sharpe's performance Index $S_t = \frac{R_p - R_f}{\sigma_p}$

Treynor's performance Index $T_n = \frac{R_p - R_f}{\beta_p}$

Jensen's performance Index $R_p = \alpha_p + R_f + \beta(R_m - R_f)$

$$\alpha_p = R_p - [R_f + \beta_p(R_m - R_f)]$$

$R_p \rightarrow$ Portfolio return

$R_f \rightarrow$ Risk-free return

$\beta_p \rightarrow$ Portfolio Beta

$R_m \rightarrow$ Market return

$\alpha_p \rightarrow$ Forecasting ability of the manager.

Bond Valuation

Present value of a bond (PV) = $C \times PVIFA_{(r,n)} + M \times PVIF_{(r,n)}$

With semi-annual Interest rate $= C/2 \times PVIFA_{(r/2,\, n2)} + M \times PVIF_{(r/2,\, 2n)}$

Current yield = $\dfrac{\text{Annual Interest}}{\text{Market price}}$

Yield to Maturity (YTM) = $\dfrac{C + (M-P)/n}{0.4M + 0.6P}$

$C \rightarrow$ Coupon rate $\quad M \rightarrow$ Maturity value or Face value

$P \rightarrow$ Market price of the bond $\quad n \rightarrow$ Years to maturity

$r \rightarrow$ required rate of return or yield.

Realised yield to maturity = Present market Price $(1+r)^n$ = Future value.

Trail & error method (YTM)

$$IRR \rightarrow LDF + \left[\Delta DF \frac{PVLDF - CI}{PVLDF - PVHDF}\right]$$

Bond duration:

Steps: Year, Cash flow, PVIF, Cashflow x PVIF, Proportion, Proportion x t

Modified duration $D^* = \dfrac{D}{1+y}$ $\quad D \rightarrow$ Duration, $Y \rightarrow$ yield

Change in price $\Delta P = -D^* \Delta y$

Yield to call (YTC) = $\dfrac{C + (M^* - P)/n^*}{0.4M + 0.6P}$

$M^* \rightarrow$ call price

$n^* \rightarrow$ Number of years until the assumed call date.

Valuation of shares : Dividend Discount Models.

Single period valuation

$$P_0 = \frac{D_1}{1+r} + \frac{P_1}{1+r}$$

$P_0 \rightarrow$ Current price of the equity share

$D_1 \rightarrow$ Dividend expected after a year.

$P_1 \rightarrow$ Price of the share expected a year hence

$r \rightarrow$ required rate of return

Constant growth Model

$$P_0 = \frac{D_1}{r-g}$$

$$r = \frac{D_1}{P_0} + g \qquad g = r - \frac{D_1}{P_0}$$

Zero growth model $P_0 = \frac{D}{r}$

Multi-period valuation Model:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \dots \frac{D_n}{(1+r)^n} + \frac{P_n}{(1+r)^n}.$$

Two-stage growth Model:

$$P_0 = D_1 \left[\frac{1 - \left[\frac{1+g_1}{1+r}\right]^n}{r - g_1} \right] + \left[\frac{D_1 (1+g_1)^{n-1} (1+g_2)}{r - g_2} \right] \left[\frac{1}{(1+r)^n} \right]$$

$g_1 \rightarrow$ Above-normal growth rate applicable in the first stage

$g_2 \rightarrow$ growth rate applicable in the second stage.

Technical Analysis

$$RSI = 100 - \left[\frac{100}{1+R_s} \right]$$

$$R_s = \frac{\text{Avg. gain Per day}}{\text{Avg. loss per day}}$$

Important points to remember.

When dividend is given in % consider face value Rs.10
For eg: 10% of dividend, Hence dividend is Rs. 1.

If stock return (Y), Index return (X) → use XY formu to calculate Beta.
If stock return (R_i), Index return (R_m) → use R_i, R_m formula to calculate Beta. Otherwise you can choo anyone of these formula.

When probability, stock return and market return is given use $\beta = \frac{Cov_{i,m}}{\sigma^2_m}$

If correlation, standard deviation of stock & market is given use $\beta = r \frac{\sigma_p}{\sigma_m}$.

When they ask you to use CAPM use SML formula
If standard deviation of market and portfolio is given use CML Formula.

When actual return or expected return is higher than estimated return or calculated return it is called under priced.
When actual return is lower than estimated return it is called over priced.
AR > ER → UP, AR < ER → OP.

If the market price of the bond is lower than Present value or intrinsic value of the bond then it is underpriced, otherwise overpriced.