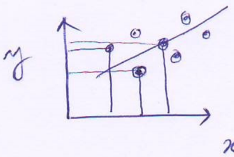

$\hat{y} = \hat{\alpha} + \hat{\beta} x$ (Y is dependent, x " independent)

$\hat{y}$ represents values on the line

Error = $y - \hat{y}$ (Actual − fitted)

$\Sigma (\text{Error})^2 = \Sigma (y - \hat{y})^2 = \Sigma (y - \hat{\alpha} - \hat{\beta} x)^2$

Minimize $(\text{error})^2$ w.r.t. parameters (α, β)

$$\frac{\partial (\text{Error})^2}{\partial \alpha} = 0 = -2 \Sigma (y_i - \hat{\alpha} - \hat{\beta} x_i) \rightarrow (1)$$

$$\frac{\partial (\text{Error})^2}{\partial \beta} = 0 = -2 \Sigma x_i (y_i - \hat{\alpha} - \hat{\beta} x_i) \rightarrow (2)$$

Solving (1) and (2) $\Rightarrow$

$$\hat{\beta} = \frac{\Sigma x_i' y_i'}{\Sigma x_i'^2} \qquad x_i' = x_i - \bar{x}, \quad y_i' = y_i - \bar{y}$$

$$\hat{\alpha} = \bar{y} - \hat{\beta} \bar{x} \qquad \bar{x} = \text{Mean of } x, \quad \bar{y} = \text{Mean of } y.$$

$$\left\{ \hat{\beta} = \frac{\text{cov}(x, y)}{\text{var}(x)} \right\} \rightarrow \text{risk factor in CAPM}$$