Historical Volatility

Let $R_n = \frac{S_n - S_{n-1}}{S_{n-1}}$ Daily Return

S_n stock price on day n

Let $\gamma_n = \ln(1 + R_n)$

Notice $1 + R_n = \frac{S_n}{S_{n-1}}$

Notice $\ln(1+R_n) = \ln\left(\frac{S_n}{S_{n-1}}\right)$

$\ln(1+R_n)$?? R_n

(Since $\ln(1+x) \approx x$)

Let $\hat{\mu}_d = \frac{1}{N}\sum_{n=1}^{N} x_n$ Sample Mean

$$\hat{\sigma}_d^2 = \frac{1}{N-1}\sum_{n=1}^{N}[x_n - \hat{\mu}_d]^2$$

Sample Variance

$$\sigma_H = \sqrt{252}\,\hat{\sigma}_d$$

σ_H historical Volatility

252 Trading Days per year

Mathematicians Trading Year

256 days