hw5-2-7

Cohort 2 - Group 7 (Huanyu Liu, Hyeuk Jung, Jiaqi Li, Xichen Luo)

Arithmetic average returns

1. Daily returns
   The average arithmetic daily returns is the arithmetic average of daily returns from 1/3/1972 through 12/30/2017, noted as
   $$\bar{R}_{daily} = \frac{\sum R_{daily}}{\text{Total number of business days}}$$
   Annualize the return:
   $$a.\bar{R}_{daily} = \bar{R}_{daily} \times 365 = 0.1665$$

2. Monthly returns
   The average arithmetic monthly returns is the arithmetic average of monthly returns from 1/3/1972 through 12/30/2017
   Calculate monthly returns for each month:
   $$\bar{R}'_{monthly} = \sum R_{\text{daily in a month}}$$
   Arithmetic average of monthly returns:
   $$\bar{R}_{monthly} = \frac{\sum \bar{R}'_{monthly}}{\text{Total amount of months}}$$
   Annualize the return:
   $$a.\bar{R}_{monthly} = \bar{R}_{monthly} \times 12 = 0.1151$$

3. Yearly returns
   The average arithmetic yearly returns is the arithmetic average of yearly returns from 1/3/1972 through 12/30/2017
   Calculate returns for each year:
   $$\bar{R}'_{yearly} = \sum R_{\text{daily in a year}}$$
   Arithmetic average of yearly returns:
   $$\bar{R}_{yearly} = \frac{\sum \bar{R}'_{yearly}}{\text{Total amount of years}}$$
   Annualize the return:
   $$a.\bar{R}_{yearly} = \bar{R}_{yearly} = 0.1151$$

4. 5-year returns
   The average arithmetic 5-year returns is the arithmetic average of 5-year returns from 1/3/1972 through 12/30/2016
   Calculate returns for each 5 years:
   $$\bar{R}'_{5yr} = \sum R_{\text{daily in 5 years}}$$
   Arithmetic average of 5-year returns:
   $$\bar{R}_{5yr} = \frac{\sum \bar{R}'_{5yr}}{\text{Total amount of 5 years}}$$
   Annualize the return:
   $$a.\bar{R}_{5yr} = \bar{R}_{5yr} \div 5 = 0.1132$$

Geometric average returns

1. Daily returns
   Calculate the geometric daily returns:
   $$\bar{R}_{daily} = \sqrt[t]{(R_1 + 1)(R_2 + 1)...(R_t + 1)} - 1$$

   where
   $$t = \text{the total amount of business days from } 1/3/1972 \text{ through } 12/30/2017$$

   Annualize the return:
   $$a.\bar{R}_{daily} = (1 + \bar{R}_{daily})^{365} - 1 = 0.1571$$

2. Monthly returns
   Calculate the geometric monthly returns:
   $$\bar{R}_{monthly} = (R_1 + 1)(R_2 + 1)...(R_t + 1) - 1$$

   where
   $$t = \text{the total amount of business days in a month}$$

   Calculate the geometric average of monthly returns from 1/3/1972 through 12/30/2017:
   $$\bar{R}_{monthly} = \sqrt[k]{(\bar{R}_{monthly_1} + 1)(\bar{R}_{monthly_2} + 1)...(\bar{R}_{monthly_k} + 1)} - 1$$

   where
   $$k = \text{the total amount of months from } 1/3/1972 \text{ through } 12/30/2017$$

   Annualize the return:
   $$a.\bar{R}_{monthly} = (1 + \bar{R}_{monthly})^{12} - 1 = 0.1061$$

3. Yearly returns
   Calculate the geometric yearly returns:
   $$\bar{R}_{yearly} = (R_1 + 1)(R_2 + 1)...(R_t + 1) - 1$$

   where
   $$t = \text{the total amount of business days in a year}$$

   Calculate the geometric average of yearly returns from 1/3/1972 through 12/30/2017:
   $$\bar{R}_{yearly} = \sqrt[i]{(\bar{R}_{yearly_1} + 1)(\bar{R}_{yearly_2} + 1)...(\bar{R}_{yearly_i} + 1)} - 1$$

   where
   $$i = \text{the total amount of years from } 1/3/1972 \text{ through } 12/30/2017$$

   Annualize the return:
   $$a.\bar{R}_{yearly} = \bar{R}_{yearly} = 0.1061$$

4. 5-year returns
   Calculate the geometric 5 years returns:
   $$\bar{R}_{5yr} = (R_1 + 1)(R_2 + 1)...(R_t + 1) - 1$$

   where
   $$t = \text{the total amount of business days in 5 years}$$

   Calculate the geometric average of 5-year returns from 1/3/1972 through 12/30/2016:
   $$\bar{R}_{5yr} = \sqrt[j]{(\bar{R}_{5yr_1} + 1)(\bar{R}_{5yr_2} + 1)...(\bar{R}_{5yr_j} + 1)} - 1$$

   where
   $$j = \text{the total amount of 5 years from } 1/3/1972 \text{ through } 12/30/2016$$

   Annualize the return:
   $$a.\bar{R}_{5yr} = \sqrt[5]{1 + \bar{R}_{5yr}} - 1 = 0.1037$$