STAT GU4261/GR5261 Statistical Methods in Finance

Spring 2018

Homeowork 3 Suggested Solution

Due date: 15 Feb 2017 (Thu)

Exercise 17.10.1 in textbook:
$\mu_P = \mu_f + \beta_p(\mu_M - \mu_f)$ gives $\beta_p = \frac{21}{11}$.

Exercise 17.10.2 in textbook:

1. $0.03w + 0.14(1 - w) = 0.11$ gives $w = \frac{3}{11}$. That is, invest $\frac{3}{11}$ of your money to risk-free asset and the rest to the market portfolio.
2. $\sigma = \frac{8}{11}\sigma_M = \frac{24}{275}$.

Exercise 17.10.3 in textbook:

(a) $\sigma_P = w\sigma_M$ implies $w = \frac{5}{12}$. Hence $\mu_P = \frac{7}{12}(0.023) + \frac{5}{12}(0.1) = \frac{661}{12000}$.

(b) $\beta_A = \frac{0.004}{0.12^2} = \frac{5}{18}$.

(c) β of the portfolio is $(1.5 + 1.8)/2 = 1.65$, so the expected return is

$$\mu_f + \beta(\mu_M - \mu_f) = 0.023 + 1.65 \times (0.1 - 0.023) = 0.15.$$

The σ_ϵ for the portfolio is $\sigma_\epsilon = \sqrt{\frac{1}{2^2}(0.08^2 + 0.10^2)} = 0.064$, therefore the standard deviation of the return of the portfolio is

$$\sqrt{\beta^2\sigma_M^2 + \sigma_\epsilon^2} = \sqrt{1.65^2 \times 0.12^2 + 0.064^2} = 0.208.$$

Exercise 17.10.7 in textbook:

(a) $\beta_p = \frac{1}{3}\sum_{j=1}^{3}\beta_j = \frac{1}{3}(0.9 + 1.1 + 0.6) = \frac{26}{3}$.

(b) Assume $R_j - \mu_f = \beta_j(R_M - \mu_f) + \varepsilon_j$ for $j = 1, 2, 3$. Taking variance on both sides, we have

$$Var(R_p - \mu_f) = \beta_p^2 Var(R_M - \mu_f) + \frac{1}{9}\sum_{j=1}^{3}\sigma_{\varepsilon_j}^2 = (\frac{26}{3})^2(0.014) + \frac{1}{9}(0.01 + 0.015 + 0.011) = \frac{19}{18}.$$

(c) Note that μ_f is constant, therefore

$$Var(R_1 - \mu_f) = \beta_1^2 Var(R_M - \mu_f) + \sigma_{\varepsilon_1}^2 = (0.9)^2(0.014) + 0.01 = 0.01134 + 0.01.$$

Hence the proportion due to market risk is $\frac{0.01134}{0.01134+0.01} = 53\%$.

Exercise 17.10.10 in textbook:

(a) Under CAPM assumptions, the market portfolio is the tangency portfolio. Hence, we solve

$$\begin{aligned} \mu_P &= wr_f + (1-w)\mu_M \\ 0.11 &= 0.07w + 0.14(1-w). \end{aligned}$$

We get $w = \frac{3}{7}$.

(b) $\sigma_P = (1-w)\sigma_M = \frac{12}{175}$.

Exercise 17.10.11 in textbook:

(a) $\beta_P = \sum_{j=1}^{3} w_j \beta_j = 0.7$. (here $w_j = \frac{1}{3}$ for all j)

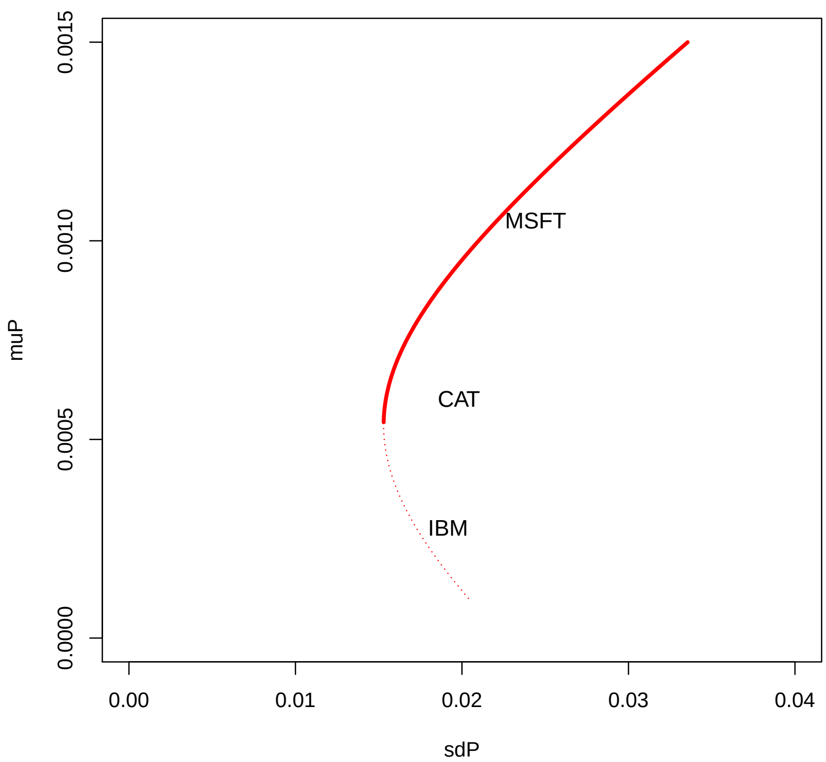
(b) $\sigma_P^2 = \beta_P^2 \sigma_M^2 + \sum_{j=1}^{3} w_j^2 \sigma_{\varepsilon_j}^2 = \frac{169}{11250}$.

(c) Let's calculate the proportion of squared risk that is due to the market:

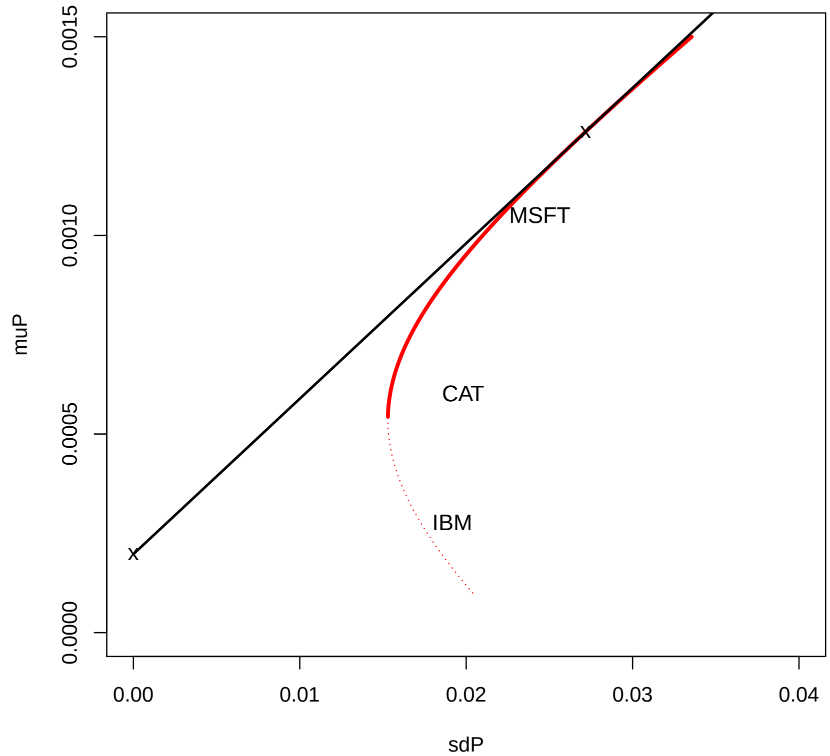
$$\frac{\beta_1^2 \sigma_M^2}{\sigma_1^2} = \frac{0.7^2(0.02)}{0.7^2(0.02)+0.01} = \frac{49}{99}.$$

Other questions:

(1) (a)



(b)



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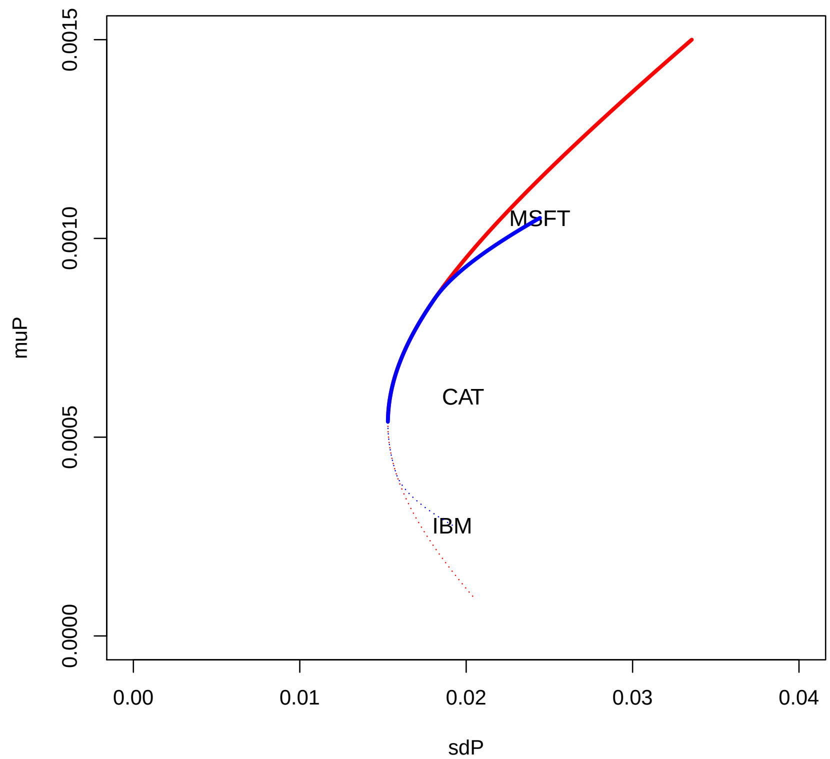

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