Portfolio Management 2013 Final Exam 0 "Mid-term"
Wednesday, April 10th, 2013 **Extras: Calculator**
Exam time: 4 hours
Maximum score is 50 points. Minimum required to pass exam is 25p. Avoid essay question answers>one page. For speeding up exam correction: Please structure your answers - do not ramble. Underlining the key terms in your answers is a good idea.

1. Define briefly following terms (+2p/sub-question, 10p max.)

a) Information ratio.
b) Performance attribution analysis.
c) Abnormal return.
d) Disposition effect.
e) The Black-Litterman model (of active investing). **(total 10p)**

2. a) Explain (briefly) what the Capital Asset Pricing Model predicts about the expected returns on different assets? **(5p)**
b) Explain (briefly) how liquidity and human capital risk might explain why the CAPM appears to work poorly in practice. **(5+5p)** **(total 15p)**

3. Discuss briefly arguments for and arguments against international investing (as compared to local investing). (**2p** per unique argument, **max 10p**)

Please turn page!

4. You are a portfolio manager at Polar Bear Frozen Asset Management and consult a client whose constant relative risk aversion coefficient has been determined as A=6. You decide to apply the (Treynor-Black) single index model consisting of a broad stock index mutual fund "S" as the risky benchmark asset along with the risk free asset. The expected stock index return is 11% p.a. and volatility 15% p.a. The risk free rate is 2% p.a. **(a) = 1.5p + b) 6.5p + c) 7p = total 15p).**

a1) Suggest an allocation (=weight in equity and weight in risk free asset) for your client with A=6 from the single index model. **(0.5p)**

a2) What Sharpe ratio is offered to your client with optimal allocation? **(0.5p)**

a3) What is the expected return and volatility of your clients portfolio? **(0.5p)**

b) Your client then asks: What about adding "long bonds" ("B") for diversification?

You say "OK, no problem" and establish that the expected return on long bonds is 4.2% p.a. with volatility 5.5% p.a. The long bond beta against the stock index is 0.2.

Calculate:

b1) the correlation coefficient between stock and long bond returns, i.e. corr(r_S,r_B). **(0.5p)**
b2) the optimally diversified combination of stocks and bonds. **(2p)**
b3) the expected Sharpe ratio of the optimally diversified combination of stocks and bonds. (you'll need the optimal portfolio's expected return and volatility). **(1p)**
b4) your revised optimal portfolio recommendation for your client with A=6. **(3p)**

c) Your client then asks: "I've heard these so called Hedge Funds (HF) are supposed to offer diversification benefits, why don't we consider them too? "No problem, sir, I'll be back in a sec!" Further research locates a hedge fund investment with an expected return of 4% p.a. and volatility 10% p.a. Its beta against the stock index is only 0.10.
Calculate:

c1) the correlation coefficient between stock and hedge fund returns, i.e. corr(r_S,r_{HF}) as well as the correlation coefficient between long bond and hedge fund returns, corr(r_B,r_{HF})! (note: cov(a*x,b*y)=a*b*cov(x,y) where x and y are random variables and a and b constants. **(1p)**
c2) the optimally diversified combination of stocks, long bonds and hedge funds. **(2p)**
c3) the expected Sharpe ratio of the optimally diversified combination of stocks, long bonds and hedge funds. **(1p)**
c4) your revised optimal portfolio recommendation for your client with A=6. **(3p)**

**** End of exam *** (formulas follow)*

Formulas:

$$U(E(R_p),\sigma_p^2) = E(R_p) - 0.5A\sigma_p^2$$

$$w_{\text{Risky}}^* = \frac{E(R_S) - R_f}{A\sigma_S^2}$$

$$w_S^* = \frac{\sigma_B^2 - \sigma_{BS}}{\sigma_S^2 + \sigma_B^2 - 2\sigma_{BS}} + \frac{E(R_S) - E(R_B)}{A\cdot(\sigma_S^2 + \sigma_B^2 - 2\sigma_{BS})}$$ (no risk free asset special case)

$$w_S^* = \frac{\left(E(R_S) - R_f\right)\sigma_B^2 - \left(E(R_B) - R_f\right)\sigma_{B,S}}{\left(E(R_S) - R_f\right)\sigma_B^2 + \left(E(R_B) - R_f\right)\sigma_S^2 - \left[\left(E(R_S) - R_f\right) + \left(E(R_B) - R_f\right)\right]\sigma_{B,S}}$$

$$w_X^* = \frac{\alpha_X \sigma_M^2}{\alpha_X \sigma_M^2 (1 - \beta_X) + [E(R_M) - R_f]\sigma_{X\varepsilon}^2}$$ or alternatively

$$w_X^* = \frac{w_X^0}{1 + (1 - \beta_X) w_X^0} \quad \text{where} \quad w_X^0 = \frac{\left(\dfrac{\alpha_X}{\sigma_{X\varepsilon}^2}\right)}{\left(\dfrac{E(R_M) - R_f}{\sigma_M^2}\right)}.$$

(with several (N) active assets $X1, X2, \ldots$ (i=1..N) use $(\alpha_{xi}/\sigma_{xie}^2)$:s as weights to form a single active portfolio and use above formula.)

$$w_M^* = \beta_p^* = \frac{E(R_M) - R_f + a + b\alpha_M}{A(1 - \rho^2)\sigma_M^2}$$

p=any risky portfolio, M = market index (benchmark), S = Stocks, B=Bonds, f = *riskfree.*

Single-factor (index) market model

$$R_{X,t} - R_{f,t} = \alpha_X + \beta_X \cdot \left(R_{M,t} - R_{f,t}\right) + e_{X,t}$$

Systematic risk Unsystematic risk

α_x = abnormal return that the active security x may have.
e_{xt} is assumed to have mean zero and variance of σ_{xe}^2.

$$E[R_X] = \alpha_X + R_f + \beta_X\left(E[R_M] - R_f\right) \qquad \sigma_X^2 = \beta_X^2 \sigma_M^2 + \sigma_{X,e}^2$$

$$\text{cov}(r_X, r_M) = \beta_X^2 \sigma_M^2 \qquad \text{cov}(r_X, r_Y) = \beta_X \beta_Y \sigma_M^2$$ (Y=another active security).