Vrije Universiteit Amsterdam
Faculty of Economics and Business Administration

Programs:	M.Sc. Finance, M.Sc. Quantitative Finance
Exam:	Investments 4.1
Course code:	60412040
Date:	Dec 14, 2006
Time:	8:45 – 11:30
Duration:	2 hours, 45 minutes
Parts:	The exam has 4 questions with 5 subquestions.
Grading:	Each of the four questions in the exam yields you a maximum of 10 points. All subquestions are **equally weighted per question**. Your total score cannot exceed 40 points. The grade for this written exam is obtained by dividing the points scored by 4. Perhaps redundantly: the written exam makes up 70% of your final grade. The remaining 30% is scored by the cases. The exam can be re-taken. The cases cannot.
Results:	Results will be made known as soon as possible, but at the latest Monday, Jan 8, 2006.
Inspection:	You can inspect your marked exam papers Wednesday, January 10, 9:00am. The room will be announced via the monitor system.
Remark:	Provide complete answers (including computations where appropriate). Always provide motivation/explanation of your answer, even if this is not mentioned explicitly in the question. A short 'yes' or 'no' will never do as an answer. But also be concise/crisp in your answer, or it will take you too much time to write it down. Use your time efficiently.

Scan for the (in your opinion) easier questions first. Good luck!

This document has 5 pages (this page included)

If $X \sim N(m,s^2)$, then $E[\exp(X)] = E[e^X] = \exp(m + 0.5s^2)$.

If $X \sim N(0,s^2)$, then $E[X^3] = 0$. [new]

If $X \sim N(\mu, V)$, then $w'X \sim N(w'\mu, w'Vw)$.

$E[XY] = cov(X,Y) + E[X]E[Y]$, $cov(X,Y) = E[XY] - E[X]E[Y]$,
$E[X^2] = var(X) + E[X]^2$, $var(X) = E[X^2] - E[X]^2$,

$X = \exp(\ln(X))$; $\exp(X)\exp(Y) = \exp(X+Y)$; $\ln(X^a) = a\ln(X)$

$$\frac{\partial \exp(x)}{\partial x} = \exp(x); \quad \frac{\partial x^a}{\partial x} = a \cdot x^{a-1}; \quad \frac{\partial a^x}{\partial x} = a^x \cdot \ln(a);$$

[new, but known]

$$\frac{\partial \ln(x)}{\partial x} = x^{-1}; \quad \frac{\partial (c \cdot x + b)^a}{\partial x} = c \cdot a \cdot (c \cdot x + b)^{a-1}$$

Question 1.

Haugen and Baker (1996) show the following Fama-French regressions for their High Return Portfolio (H) en Low return portfolio (L).

They write: "As with the deciles, we regress the excess returns on H and L on the market's excess return, SML, and HML over the period 1979 through 1993. The regression yields the following results:"

$$r_{j,t} - r_{f,t} = a + s\ SML_t + h\ HML_t + m\ MKTPREM_t + e_t$$

Portfolio	A	T-stat	s	T-stat	h	T-stat	M	T-stat	R^2
H	.0041	3.923	-.0508	-2.608	-.0546	-1.728	.9558	39.35	.921
L	-.0060	-5.006	.0508	2.283	.2129	5.914	1.111	40.13	.910

Part a.
How do they come up with their H and L portfolios?

Part b.
Where do the SML and HML symbols stand for? How are they computed.

Part c.
Interpret each element of the above regression results.

Part d.
How much alpha do they expect to generate on an annualized basis (in percentages)?

Part e.
How would you isolate the alpha from the systematic risk exposures? I.e., how would you implement a pure alpha strategy?

Question 2.

Part a.
Briefly explain the bootstrap procedure from the paper of Kosowski, Timmermann, White, and Werners (2006) discussed in class to test for mutual fund return persistence.

Part b.
If the Stochastic Discount Factor (SDF) is linear in the market return R_m, show that the CAPM holds.

Part c.
Assume the SDF M_t is linear in the market return and in the return Z_t on another investment portfolio. Derive the system of equations to solve for the coefficients a,b,c in the representation $M_t = a + b\, R_{m,t} + c\, Z_t$. The system should solve for a,b,c as a function of the riskfree rate and the means, variances and covariances of the above two returns $R_{m,t}$ and Z_t.
[hint: only clearly state the system of equations to solve. Do not actually solve it.]

Part d.
Given an SDF, how would you (roughly) check whether a specific asset is earning abnormal returns.

Part e.
How would you formally test whether these abnormal returns for this specific SDF are *statistically significant*?

Part f. Bonus (2pt) [you need not answer this one, but you may]
If M_t denotes the SDF from period t to period t+1, derive the the SDF from period t to period $t+\ell$ for $\ell > 1$ and show how it relates to non-stochastic discount factors.

Question 3.

Part a.
State the Fundamental Asset Pricing Equation (FAPE) in its two relevant forms [(i) discounted gross returns and (ii) risk premia].

Part b.
Assume the representative agent in the economy has a utility function

(1) $U(C) = (C - d)^{1-\gamma} / (1-\gamma)$.

Derive the coefficient of relative risk aversion and the coefficient of absolute risk aversion for the utility function (1).
[Hint: if you must, you can check the black-box on page 2.]

Part c.
Assume the representative agent in the economy has a utility function

(2) $U(C_{t+1}) = (C_{t+1} - k \cdot C_{t})^{1-\gamma} / (1-\gamma)$,

with k a constant, e.g., k=0.8. Interpret this utility function and explain how it does or does not reflect the notion of habit formation.

Part d.
Assume the representative agent in the economy maximizes the utility function

(2) $$\max_{C_0,\alpha} \mathrm{E}\left[\frac{C_0^{1-\gamma}}{1-\gamma} + \vartheta \frac{(C_1 - k \cdot C_0)^{1-\gamma}}{1-\gamma}\right],$$

subject to

(3) $$C_1 = (W_0 - C_0) \cdot \alpha'(1+R) = (W_0 - C_0)(\alpha_1(1+R_1) + \ldots + \alpha_n(1+R_n)),$$

and

(4) $$\alpha_1 + \ldots + \alpha_n = 1,$$

where α is a vector of weights in each asset category, and $1+R$ is a vector with the (gross) returns on each asset category, and n the number of asset categories. Derive the fundamental asset pricing equation for this economy.
[Hint: do not use the standard expression here of $U'(C_1) / U'(C_0)$, but solve the complete maximization problem by writing down the first order conditions.]

Part e.
For k=0 you recover the standard FAPE as dealt with in class. Explain the effect of k>0 on the equilibrium riskfree rate. Also explain how the utility in (2) may help to solve the equity premium puzzle and the riskfree rate puzzle.

QUESTION 4.

Part a.
Provide the steps in the Fama-McBeth procedure to test the cross-sectional predictions of the CAPM.

Part b.
Briefly explain and discuss the effects on asset allocation of **one** of the following behavioural ‘biases’:

- law of small numbers
- anchoring
- ambiguity aversion
- mental accounting
- narrow framing.

Part c.
Give the three types of correlations/covariances that are relevant in finance for portfolio choice and asset pricing. For each of these correlations, briefly discuss/explain the desirability (or otherwise) of an asset for which this correlation is high.

Part d.
Assume that returns behave as follows,

$$r_t = \mu_t + e_t, \quad e_t \sim N(0,\sigma_t^2), \quad \sigma_t^2 = 0.038 + 0.95 e_{t-1}^2.$$

Also assume that the market price of risk $\lambda = (\mu_t - r) / \sigma_t^2$ is constant (i.e., does not vary over time).
Show whether you will find return predictability if you perform a regression of r_t on r_{t-1} and a constant.
[hint: what is the covariance between r_t and r_{t-1} under a constant market price of risk? For the unconditional expectation we have $\mathrm{E}[\sigma_t^2] = 0.038 / 0.05$.]

Part e.
Explain why possible predictability found in part d (following from the regression results) would or would not imply a violation of the Efficient Markets Hypothesis (EMH).