Uppsala University
Department of Economics
Fredrik Armerin
070 – 251 75 55

Exam number:

Exam in Master / Financial Theory

General instructions

- No technical aids are allowed.
- All calculations should be clearly motivated.
- Do not skip steps in the formal derivations.
- Answer the questions without providing additional / unrelated information. I deduct points for incorrect statements you make.
- If you cannot solve a question without making additional assumptions, state these assumptions clearly and explain in writing why they are necessary.
- The writing time is 5 hours. Write your examination number in the indicated space and on all papers you hand in.
- The total number of points is 50. For grade E is 25 points required, for grade D is 27.5 points required, for grade C is 32.5 points required, for grade B is 37.5 points required and for grade A is 45 points required.

Good luck!

Problem 1

a) Write down Gordon's formula for the stock price P_t as a function of the dividends D_{t+1}, and define the different parts of it. (2 p)

b) A coupon bond is trading at par. What is the relation between the yield to maturity and the coupon rate for this bond? (2 p)

c) How is the excess return HML in the Fama-French model defined?(2 p)

d) Write down the forward rate $f_{1,2}$ as a function of the rates y_1 and y_2. (2 p)

e) What is meant by ”loss aversion”? Be brief in your answer. (2 p)

Problem 2

a) —

b) Show that the duration of a zero coupon bond is equal to its time to maturity. (2 p)

c) Describe using a graph together with a text explaining the graph, the difference between Value-at-Risk and Expected shortfall. (2 p)

d) A market consists of the following assets.

Asset no	Price	No of shares
1	20	250
2	15	200
3	10	700

Determine the market portfolio. (2 p)

e) Two assets have the following standard deviations:

$$\sigma_1 = 0.1 \text{ and } \sigma_2 = 0.2.$$

The correlation between them is

$$\rho = -0.25$$

and short selling is allowed. Determine the weights of the minimum variance portfolio. (2 p)

Problem 3

The minimum variance frontier on a market where short selling is allowed is given by

$$\sigma(\bar{\mu}) = \sqrt{\bar{\mu}^2 - 0.2\bar{\mu} + 0.02}.$$

Furthermore, the market portfolio on this market is known to have variance $\sigma_m^2 = 0.05$.

a) Determine the expected return and standard deviation of the minimum variance portfolio. (3 p)

b) How large is the expected return on the market portfolio? (2 p)

c) How large is the Sharpe ratio if there exists a risk-free rate $r_f = 0.05$? (2 p)

d) Now assume that there does not exist a risk-free asset. What is the expected return and standard deviation of the portfolio on the minimum variance frontier that is uncorrelated with the market portfolio? (3 p)

Problem 4

The following asset data are given:

Asset no i	$\text{Var}[r_i]$	$\text{Cov}[r_i, r_m]$
1	0.28	0.06
2	0.32	0.08
3	0.27	0.04

The market portfolio has mean $E[r_m] = 0.12$ and standard deviation $\text{Std}[r_m] = 0.2$, and the risk-free rate is $r_f = 0.04$.

a) Determine the expected returns of the assets given by CAPM. (3 p)

b) Which of the three assets has the largest idiosyncratic risk? (3 p)

c) Write down the security market line (SML) of this market. (2 p)

d) How large is the beta-value of the portfolio with weights

$$(\pi_1, \pi_2, \pi_3) = (0.4, 0.2, 0.4)?$$

(2 p)

Problem 5

Consider the one period pricing equation

$$P_i = E\left[mY_i\right].$$

We also assume that there exists a risk-free asset with rate of return r_f.

a) Show that

$$1 + r_f = \frac{1}{E[m]}.$$

(2 p)

b) Show that

$$P_i = \frac{E[Y_i]}{1 + r_f} + \mathrm{Cov}[m, Y_i].$$

(2 p)

c) Find a random variable X such that

$$r_i = r_f + \mathrm{Cov}(X, r_i).$$

(4 p)

d) Write down the expression for the stochastic discount factor (SDF) m in the consumption-CAPM model and define its different parts. (2 p)