Stockholm University
Department of Economics

Course name:	**Financial Economics**
Course code:	**EC2206**
Examiner:	**Roine Vestman**
Number of credits:	**7.5 credits**
Date of exam:	**29 October 2018**
Examination time:	**4 hours (15:00-19:00)**

Write your identification number on each answer sheet (the number stated in the upper right hand corner on your exam cover).

Explain notions/concepts and symbols. If you think that a question is vaguely formulated, specify the conditions used for solving it. Only legible exams will be marked. A pocket calculator is allowed as long as it is not programmable.

The exam consists of 5 questions. There are 100 points in total, including the credit question. The credit question is meant for students who did not hand in the problem set and for students who received less than 10 points and wish to improve. For students who handed in the problem set, the credit question only counts if it improves the total score. For the grade E a total of 45 points are required, for D 50 points, C 60 points, B 75 points and A 85 points.

Your results will be made available on your Ladok account (www.student.ladok.se) on within 15 working days from the date of the examination.

Good luck!

Exam October 29, 2018 (Financial Economics, EC2206)

See formula sheet at the back. A pocket calculator is allowed as long as it is not connected to the internet or is programmable. Upon request, the memory of the calculator should be erased.

Question 1: Smaller questions (25 points)

These questions (a. to e.) can be answered independently.

a. Consider two random variables, x and y. Show that $var(x + y) = var(x) + var(y) + 2 \cdot cov(x, y)$, starting from the definition of variance in the formula sheet. (5 points)

b. Torbjörn Hamnmark from AP3 gave a guest lecture. Describe some important differences between public and private assets and explain why AP3 is moving into private assets. (5 points)

c. Eugene Fama formulated the joint hypothesis problem in the 1970s. Please explain it. (5 points)

d. State the assumptions of CAPM. (5 points)

e. In empirical sciences it is common to test a null hypothesis such as $H_0 : \alpha = 0$ where α can be, among other things, the effect of some medical treatment or the effect of some action.

   i. In this kind of hypothesis testing, what does a "false positive result" mean? (2 points)

   ii. Suppose that a researcher tests the null hypothesis multiple times, that is, $H_0 : \alpha_1 = 0$, $H_0 : \alpha_2 = 0$,...,$H_0 : \alpha_N = 0$. How does this affect the likelihood of obtaining a false positive result? You may find it helpful to draw analogies to the "lucky event issue" or to other empirical sciences. (2 points)

   iii. What kind of bearing does the insight from part (ii.) have on evaluations of actively managed mutual funds? (1 points)

Question 2: Bond pricing (20 points)

Consider a two-period corporate bond with the following characteristics. The bond was issued at $t = 0$ with face value $FV = 100$ at $t = 2$. In period $t = 1$ and $t = 2$ coupons of 5 are paid out ($c = 5$). We are in $t = 1$ and the bond issuer has just paid the first coupon. The price of the bond is 101.942.

a. Compute the yield to maturity on the bond (5 points)

b. Suppose that the bond is callable at 101. The bond issuer is informed by an investment bank that it can issue a new one-period zero coupon bond worth 101 today for a face value of 104.030 in $t = 2$.

 i. What is the yield to maturity on this hypothetical bond? (5 points)
 ii. Should the bond issuer exercise the call option and finance it through the new bond, yes or no? Assume no transaction costs. Please provide calculations that motivate your answer. (5 points)
 iii. Assume that the investment bank charges a fee, F, to be paid in $t = 1$ by the bond issuer. What is the value of F such that the bond issuer is indifferent between exercising and not exercising the call option? Provide motivating calculations. (5 points)

Question 3: The single-index model and arbitrage pricing theory (25 points)

You observe some market data in the following table:

Time (t)	(1) R_1	(2) R_M	(3) $\hat{\varepsilon}_1$	(4) $\hat{\varepsilon}_2$
1	-0.129	-0.070	-0.059	-0.059
2	-0.008	-0.050	0.043	0.043
3	0.153	0.100	0.052	0.052
4	0.164	0.200	-0.036	-0.036

where $R_1 = r_1 - r_f$ is the excess return on security 1 and $R_M = r_M - r_f$ is the excess return on the market portfolio. Column (3) reports estimated residuals from the regression:

$$R_{1,t} = \alpha_1 + \beta_1 R_{M,t} + \varepsilon_{1,t} \tag{1}$$

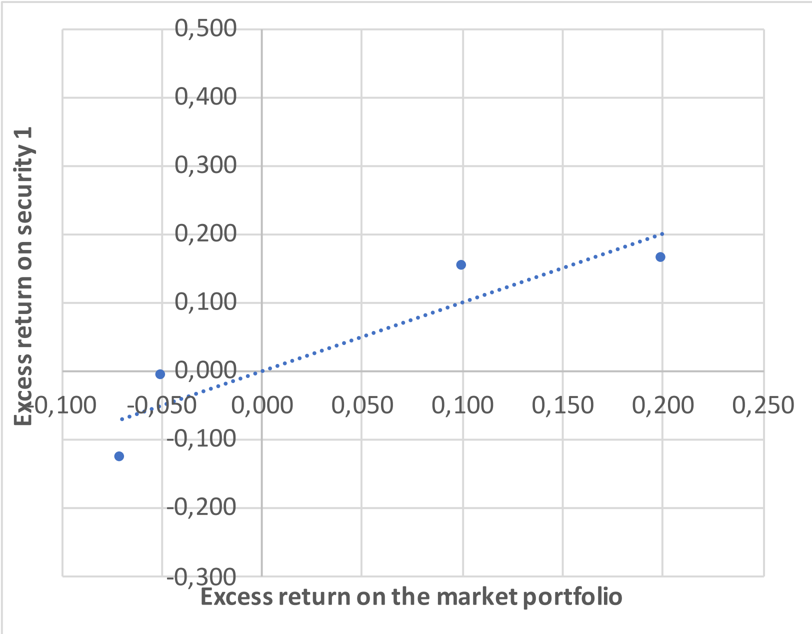
Figure 1 provides a scatter plot of the returns in columns (1) and (2) together with the fitted line from the regression.

Throughout, assume that you can take long and short positions as you wish in any asset, including in the risk-free asset (at the rate r_f).

a. The estimator for β_1 is $\frac{cov(R_1,R_M)}{var(R_M)}$. Use the data in columns (1) and (2), to verify that the point estimate of the slope coefficient ($\hat{\beta}_1$) is approximately 1. To speed up calculations, use $E[R_M] = E[R_1] = 0.045$. *Hint:* Separately calculate $cov(R_1, R_M)$ and $var(R_M)$. (8 points)

b. Use the estimated residuals in column (3) of the table to compute the mean squared error, MSE, in the regression. (5 points)

Figure 1: Security 1 and the market portfolio



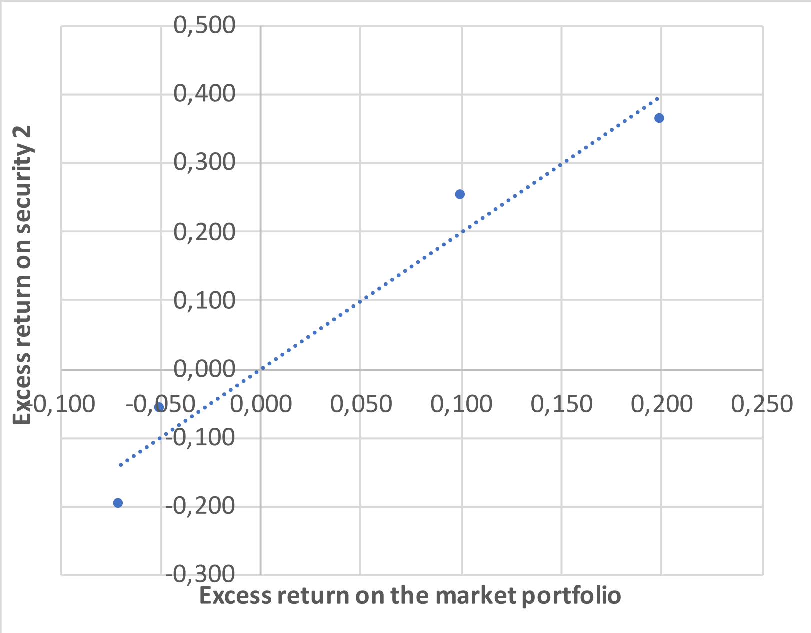
c. The point estimate of the intercept ($\hat{\alpha}_1$) in the regression is zero. What would it need to be in order to justify an overweight of 10% in an active portfolio and thus holding 90% in the market portfolio? Use the Treynor-Black model and information from (a) and (b) as inputs. Let the market price of risk, $\frac{E[R_M]}{var(R_M)}$, be equal to 2.738. (In addition, ignore uncertainty in the estimate of the intercept.) (5 points)

d. Suppose that the assumptions of arbitrage pricing theory holds. Figure 2 depicts a scatter plot with excess returns of security 2 against the same market excess returns. A regression analogous to equation (1) produces a point estimate of the intercept ($\hat{\alpha}_2$) of zero and a point estimate of the slope coefficient ($\hat{\beta}_2$) of 2. Column (4) of the table provides the estimated residuals ($\hat{\varepsilon}_2$).

   i. If you are starting out with holding 100% in the market portfolio, would you prefer to just stay with that or would you prefer to take an active position by adding an over- or under-weight of either security 1 or security 2, or both securities? (2 points)

   ii. Assume that you are restricted to two alternatives. You can either hold the risk-free asset and security 1 in some combination, or hold the risk-free asset and security 2 in some combination. Do you prefer one of the alternatives or are you indifferent between them? Make sure to use quantitative arguments. (5 points)

Figure 2: Security 2 and the market portfolio



Question 4: Financial Crises (20 points)

This is an essay question. Nevertheless, please be brief and to the point. **Your total answer should not exceed 2 pages.**

a. Describe how traditional securitization of mortgage backed securities worked in, say, the 1990s. (Who were the main players? What kind of mortgages were securitized? Illustrate with a value chain.) Then contrast to how securitization evolved in the early 2000s in the boom phase of the financial crisis. Describe the main differences and the appearing moral hazards. (10 points)

b. Why are central banks the natural lender of last resort? Under which three conditions can it lend to a financial entity? (5 points)

c. In chapter 20 of Mankiw's text book, six common features of a financial crisis are listed. Describe these features very briefly without necessarily making references to any specific crisis. (5 points)

Question 5: Questions for credit score (10 points)

Credit question. These questions should only be answered by students who either did not hand in the problem set or by students who received a score below 10 on

the problem set and wish to try to improve. In the latter case, the best of the two scores will be counted.

a. Consider two random variables, x and y, and a number, a. Show that $cov(a \cdot x, y) = a \cdot cov(x, y)$, starting from the definition of a covariance in the formula sheet. (5 points)

b. Consider two random variables x and y. Let $var(x) = var(y) = \sigma^2$. Derive the upper and lower bound on $var(x + y)$. (5 points)

Formula sheet – Financial Economics (EC2206)

- The variance of a random variable x: $var(x) = E[(x - E[x])^2]$
- The covariance of two random variables x and y: $cov(x, y) = E[(x - E[x])(y - E[y])]$
- The variance of the sum of two random variables: $var(x + y) = var(x) + var(y) + 2 \cdot cov(x, y)$
- Covariances are additive: cov(x,z)+cov(y,z)=cov(x+y,z)
- The Sharpe ratio of a security: $\frac{E[r-r_f]}{std(r)}$
- For two risky assets with excess returns R_E and R_D, the optimal risky portfolio P is given by:

$$\begin{aligned} w_D &= \frac{E[R_D]\sigma_E^2 - E[R_E]cov(R_D, R_E)}{E[R_D]\sigma_E^2 + E[R_E]\sigma_D^2 - [E[R_D] + E[R_E]]cov(R_D, R_E)} \\ w_E &= 1 - w_D \end{aligned}$$

- The single-index model and the information ratio:
  - If $\beta_A = 1$ the weight in the active portfolio equals $w_A^0 = \frac{\alpha_A/\sigma_{e,A}^2}{E[R_M]/\sigma_M^2}$.
  - Otherwise $w_A^* = \frac{w_A^0}{1+(1-\beta_A)w_A^0}$.
  - The weight of each security in the active portfolio is $\frac{\alpha_i/\sigma_{e_i}^2}{\Sigma\alpha_i/\sigma_{e_i}^2}$.
  - The Sharpe ratio of the risky portfolio equals: $S_P = \sqrt{S_M^2 + [\frac{\alpha_A}{\sigma e,A}]^2}$.
- The equation $x^2 + px + q = 0$ has solutions $x = -\frac{p}{2} \pm \sqrt{(\frac{p}{2})^2 - q}$
- Bond pricing:
  - Given a market rate r, the value of a perpetuity that pays a coupon c forever is: $\frac{c}{r}$
  - The value of an annuity with coupons c and duration T is: $\frac{c}{r}\left[1 - \frac{1}{(1+r)^T}\right]$