

Faculty of Economics and Business Administration

Exam: Investments

Code: E\_EBE3\_INVES

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Co-reader: Dr. Leonard Wolk

Date: June 1, 2017

Time: 12:00

Duration: 2 hours and 45 minutes

Calculator allowed: Yes

Graphical calculator  
allowed: Yes

Number of questions: 20 multiple choice questions and 3 open-ended

Type of questions: Open/ multiple choice

Answer in: English

Remarks: Be concise and complete in your answers (including calculations). Always explain the answers to the open questions, even if not explicitly called for. Use your time efficiently, using the maximum number of points per question as a guideline.

Credit score: 3 points for the multiple-choice part and 4 for the open-ended part.

Grades: The grades will be made public on: June 14

Inspection: Thursday, June 15 2017 at 9.00. Room: TBA.

Number of pages: (10 (including front page))

**Good luck!**

**PART 1 (MULTIPLE CHOICE QUESTIONS; 20 questions providing 3 points at maximum)**

**Read the questions and answers carefully and write down your answer on your answer sheet. Your final score is determined as (number of correct answers - 3)\*3/17. Negative scores for this part of the exam are set to zero.**

1. If a distribution has "fat tails" it exhibits
  - A. positive skewness
  - B. negative skewness
  - C. a kurtosis of zero
  - D. high kurtosis
  - E. positive skewness and negative kurtosis
  
2. You invest €234 in a risky asset with an expected rate of return of 0.11 and a standard deviation of 0.20 and a (risk-free) Treasury Bill with a rate of return of 0.03. What percentages of your money must be invested in the risk-free asset and the risky asset, respectively, to form a portfolio with a standard deviation of 0.08?
  - A. 30% and 70%
  - B. 50% and 50%
  - C. 60% and 40%
  - D. 40% and 60%
  - E. Cannot be determined.
  
3. The unsystematic risk of a specific security
  - A. is likely to be higher in an increasing market
  - B. results from factors unique to the firm
  - C. depends on market volatility
  - D. cannot be diversified away
  - E. is uncorrelated with the company CEO's grade in the course "Investments"
  
4. Which of the following measures of risk best highlights the potential loss from extreme negative returns?
  - A. Standard deviation
  - B. Variance
  - C. Fama-French alpha
  - D. Value at Risk (VaR)
  - E. Sharpe measure

5. The single-index model

- A. greatly reduces the number of required calculations, relative to those required by the Markowitz model.
- B. reduces our understanding of systematic versus nonsystematic risk.
- C. greatly increases the number of required calculations, relative to those required by the Markowitz model.
- D. cannot be applied in practice.
- E. is inconsistent with the CAPM.

6. The capital asset pricing model DOES NOT assume

- A. all investors are price takers.
- B. all investors have the same holding period.
- C. investors have heterogeneous information about expected returns.
- D. all investors are mean-variance efficient.
- E. Investments are limited to those that are publicly traded.

7. Consider the single factor APT. Portfolios A and B have expected returns of 14% and 18%, respectively. The risk-free rate of return is 7%. Portfolio A has a beta of 0.7. If arbitrage opportunities are ruled out, portfolio B must have a beta of \_\_\_\_\_.

- A. 0.45
- B. 1.00
- C. 1.10
- D. 1.22
- E. 1.33

8. Standard deviation and beta both measure risk, but they are different in that

- A. beta measures both systematic and unsystematic risk.
- B. beta measures only systematic risk while standard deviation is a measure of total risk.
- C. beta measures only unsystematic risk while standard deviation is a measure of total risk.
- D. beta measures both systematic and unsystematic risk while standard deviation measures only systematic risk.
- E. beta measures total risk while standard deviation measures only nonsystematic risk.

9. There is a news report that a devastating tsunami has just hit the Philippines. In an efficient market one would expect the price of government bonds issued by the Philippines to

- A. drop immediately.
- B. remain unchanged.
- C. increase immediately.
- D. gradually decline for the next several weeks.
- E. gradually increase for the next several weeks.

10. Consider the regression equation:  $r_{it} - r_{ft} = g_0 + g_1 b_i + g_2 s^2(e_i) + e_{it}$  where:  $r_{it} - r_{ft}$  = the average difference between the monthly return on stock  $i$  and the monthly risk-free rate;  $b_i$  = the beta of stock  $i$ ;  $s^2(e_i)$  = a measure of the nonsystematic variance of the stock  $i$ . If you estimated this regression equation and the CAPM was valid, you would expect the estimated coefficient  $g_0$  has to be

- A. 0
- B. 1
- C. equal to the risk-free rate of return
- D. equal to the average difference between the monthly return on the market portfolio and the monthly risk-free rate
- E. 3.14159265359

11. You invest 55% of your money in security A with a beta of 1.4 and the rest of your money in security B with a beta of 0.9. The beta of the resulting portfolio is

- A. 1.466
- B. 1.157
- C. 0.968
- D. 1.082
- E. 1.175

12. A coupon bond pays annual interest, has a par value of €1,000, matures in 4 years, has a coupon rate of 8.25%, and has a yield to maturity of 8.64%. The current yield is defined as the bond's annual coupon payment divided by the bond price and is equal to

- A. 8.65%
- B. 8.45%
- C. 7.95%
- D. 8.36%
- E. None of these is correct.

13. Consider the following forward rates obtained from risk-free government bonds:

<u>Year</u>	<u>1-Year Forward Rate</u>
1	5.8%
2	6.4%
3	7.1%
4	7.3%
5	7.4%

What would the yield to maturity be on a four-year risk-free zero coupon bond purchased today?

- A. 5.80%
- B. 7.30%
- C. 6.65%
- D. 7.25%
- E. None of these is correct.

14. Holding other factors constant, the interest-rate risk of a coupon bond is higher when the bond's:

- A. term-to-maturity is lower.
- B. coupon rate is lower.
- C. yield to maturity is higher.
- D. term-to-maturity is lower and yield to maturity is higher.
- E. None of these is correct.

15. Identify the bond that has the longest duration (NOTE: no calculations necessary).

- A. 20-year maturity with an 8% coupon.
- B. 20-year maturity with a 12% coupon.
- C. 20-year maturity with a 0% coupon.
- D. 10-year maturity with a 15% coupon.
- E. 12-year maturity with a 12% coupon.

16. An American put option can be exercised

- A. any time on or before the expiration date.
- B. only on the expiration date.
- C. any time in the indefinite future.
- D. only after dividends are paid.
- E. only on the last date of each month up to the expiration date.

17. The gamma of an option is

- A. the volatility level for the stock that the option price implies.
- B. the continued updating of the hedge ratio as time passes.
- C. the percentage change in the stock call option price divided by the percentage change in the stock price.
- D. the sensitivity of the delta to the stock price.
- E. the volatility level for the stock that the option price implies and the percentage change in the stock call option price divided by the percentage change in the stock price.

18. Portfolio A consists of 600 shares of stock and 300 calls on that stock. Portfolio B consists of 685 shares of the same stock. The call delta is 0.3. Which portfolio has a higher monetary exposure to a change in the stock price?

- A. Portfolio B.
- B. Portfolio A.
- C. The two portfolios have the same exposure.
- D. A if the stock price increases and B if it decreases.
- E. B if the stock price decreases and A if it increases.

19. Other things equal, the price of a call option on common stock is negatively related to the following factor

- A. the stock price.
- B. the time to expiration.
- C. the stock volatility.
- D. the exercise price.
- E. none of the above is correct.

20. A speculative trader who has a \_\_\_\_\_ position in wheat futures believes the price of wheat will \_\_\_\_\_ in the future.

- A. long; increase
- B. long; decrease
- C. short; increase
- D. long; stay the same
- E. short; stay the same

## PART 2 (OPEN QUESTIONS; 3 questions providing 4 points at maximum)

Read the questions and answers carefully and write down your answer on your answer sheet.

### Question 1: Portfolio Construction and Asset Pricing (1.6 points)

#### Part a. (0.3 points)

Both the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) derive a capital market equilibrium, albeit under different assumptions. Discuss the main differences between the two theories.

#### Part b. (0.3 points)

There are three forms of market efficiency – weak, semi-strong, and strong. What is meant by these three forms? Discuss one possible way to empirically test one form of the efficient market hypothesis (Note: there are many possible ways to test each form of market efficiency, please outline just one test for one of the forms).

#### Part c. (0.6 points)

Motivated by the ICAPM and the observation that small stocks typically have higher returns than large stocks, you apply a multifactor model where you consider SMB (the return of small minus large stocks) as systematic source of risk that describes investors' investment opportunity set. You therefore consider the following asset pricing model:

$$r_i = \alpha_i + \beta_i * r_m + \gamma_i * SMB + \epsilon_i$$

Where  $r_i$  is the excess return of stock  $i$ ,  $r_m$  is the excess return on the market. The variances of the two factors are  $\sigma_m$  and  $\sigma_{smb}$ . The variance of the idiosyncratic risk is  $\sigma_\epsilon$  for all stocks  $i$  (i.e. it is the same). Assume that the idiosyncratic risks are uncorrelated, and that the two factors are uncorrelated as well. Now consider two stocks  $i = \{1,2\}$ .

- i) Is the systematic risk of each of the two stocks dependent on the covariance between the systematic sources of risk with the idiosyncratic volatilities?

- ii) Construct an equally-weighted portfolio of the two stocks. What is the non-systematic risk component? Compare it to the non-systematic component of each stock.
- iii) Construct a portfolio out of the two stocks that has exposure of 1.5 to the SMB factor. Give an analytical expression of its weights.
- iv) If your asset pricing is the true model in the economy, would it apply to both individual assets and well-diversified portfolios and why?

**Part d. (0.4 points)**

You want to evaluate three mutual funds. The market return is 6% and the risk free rate is 1%.

Below is the data for the three funds.

Fund	Average Return	Standard Deviation	Beta
<b>A</b>	4%	6%	1.1
<b>B</b>	5%	8%	1
<b>C</b>	6%	10%	0.8

- i) Provide the formula for Sharpe Ratio and calculate the Sharpe Ratios for the 3 funds. Based on your analysis so far, which fund performs best?
- ii) Provide the formulas for Jensen's alpha and Treynor's measure and calculate the two measures for each fund. Based on your analysis, which fund performs best?
- iii) Are there any differences in results between points i) and ii) ? What accounts for the differences (or lack of differences)?



## Question 2: Fixed Income Securities (1.2 points)

### Part a. (0.3 points)

You purchased an annual coupon-paying bond *one year ago* with 6 years remaining to maturity at the time of purchase. The coupon interest rate is 10% and par value is €1,000. At the time you purchased the bond, the yield to maturity was 8%. If you sell the bond after receiving the first interest payment and the bond's yield to maturity has changed to 7%, what would be your annual total rate of return on holding the bond for that year?

### Part b. (0.6 points)

Consider the data on the following three annual-paying coupon bonds:

Bond	Maturity	Coupon	Yield	Face Value
A	2	0.07	0.04	1000
B	3	0.05	0.03	1000
C	4	0.05	0.05	1000

- i) Compute the prices, duration and the modified duration of the three bonds.
- ii) You have a portfolio consisting of a long position in 3 bonds of type A, long position of 4 bonds of type B, and a long position of 5 bonds of type C. Calculate the duration and the modified duration of the portfolio.
- iii) Using duration approximation, what is the change in the value of the portfolio if the yield curve shifts downwards by 100 basis points? And if it shifts downwards by 10 basis points? In which of the two cases the approximation will be more exact and why?

### Part c. (0.3 points)

The shape of the term structure of interest rates is often explained via the expectations hypothesis. What is the relationship between forward rates and expected future short rates, according to this hypothesis? Given the usual upward sloping shape of the yield curve, can the expectations hypothesis be true in reality? Is there any empirical support for the expectations hypothesis and why?

### Question 3: Derivatives (1.2 points)

#### Part a. (0.3 points)

Discuss marking to market and margin accounts in the futures market. How would the volatility of the underlying affect the margin requirement?

#### Part b. (0.3 points)

What is meant by “implied volatility”? What is the relationship between implied volatility and option premiums?

#### Part c. (0.6 points)

Bitterballen Corporation currently trades at €25 per share. Consider the binomial tree for the evolution of the stock price of Bitterballen Corporation over the period of 12 months, assuming two steps ( $t=0$ ,  $t=1$ ,  $t=2$ ). The annual risk free rate is 3%, and the price of Bitterballen Corporation can increase by 5% or decrease by 2.5% each period.

- i) Draw the binomial tree for ( $t=0$ ,  $t=1$ ,  $t=2$ )
- ii) Calculate the risk-neutral probabilities of an upward movement and that of a downward movement. Do they differ at each node of the tree and why?
- iii) You are worried that the price of Bitterballen Corporation may not increase as much as possible over the next 1 year. Thus, you consider buying a European put option with a strike price of €26 that matures in 1 year. Calculate the option's premium.