vrije Universiteit *amsterdam*

Faculty of Economics and Business Administration

Exam: Investments 3.4

Code: E_BE3_INV

Examinator: Dr. Teodor Dyakov
Co-reader: Dr. Anne Opschoor

Date: May 18, 2015

Time: 8.45

Duration: 2 hours and 45 minutes

Calculator allowed: Yes

Graphical calculator
allowed: Yes

Number of questions: 20 multiple choice and 4 open-ended

Type of questions: Open/ multiple choice

Answer in: English

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

Credit score: The maximum possible scores for each part and question are indicated. In total, you can earn 100 points. Your final exam grade is determined by dividing the number of points by 10.

Grades: The grades will be made public on: June 1, 2015

Inspection: Tuesday, June 2, 2015 at 13.00. Room – to be announced on blackboard.

Number of pages: 13 (including front page)

Good luck!

PART 1 (MULTIPLE CHOICE; 40 points at maximum)

Read the questions and answers carefully and write down your answer on your answer sheet. Your final score is determined as (# correct answers - 2) * 40/18. Negative scores for this part of the exam are set to zero.

1. Which of the following statements is (are) true regarding the variance of a portfolio of two risky securities?
A. The higher the coefficient of correlation between securities, the greater the reduction in the portfolio variance.
B. There is a linear relationship between the securities' coefficient of correlation and the portfolio variance.
C. The degree to which the portfolio variance is reduced depends on the degree of correlation between securities.
D. A and B.
E. A and C.

2. An investor who wishes to form a portfolio that lies to the right of the optimal risky portfolio on the Capital Allocation Line must:
A. lend some of her money at the risk-free rate and invest the remainder in the optimal risky portfolio.
B. borrow some money at the risk-free rate and invest in the optimal risky portfolio.
C. invest only in risky securities.
D. such a portfolio cannot be formed.
E. B and C

3. Suppose you held a well-diversified portfolio with a very large number of securities, and that the single index model holds. If the σ of your portfolio was 0.20 and σM was 0.16, the β of the portfolio would be approximately _____.
A. 0.64
B. 0.80
C. 1.25
D. 1.56
E. none of the above

4. An important difference between CAPM and APT is
A. CAPM depends on risk-return dominance; APT depends on a no arbitrage condition.
B. CAPM assumes many small changes are required to bring the market back to equilibrium; APT assumes a few large changes are required to bring the market back to equilibrium.
C. implications for prices derived from CAPM arguments are stronger than prices derived from APT arguments.
D. all of the above are true.
E. both A and B are true.

5. The risk-free rate is 7 percent. The expected market rate of return is 15 percent. If you expect a stock with a beta of 1.3 to offer a rate of return of 12 percent, you should
A. buy the stock because it is overpriced.
B. sell short the stock because it is overpriced.
C. sell the stock short because it is underpriced.
D. buy the stock because it is underpriced.
E. none of the above, as the stock is fairly priced.

6. A finding that _____ would provide evidence against the semistrong form of the efficient market theory.
A. low P/E stocks tend to have positive abnormal returns
B. trend analysis is worthless in determining stock prices
C. one can consistently outperform the market by adopting a contrarian strategy based on price reversals
D. A and B
E. A and C

7. Consider the regression equation:
$r_i - r_f = g_0 + g_1 b_i + g_2 s^2(e_i) + e_{it}$
where:
$r_i - r_t$ = 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_1 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. equal to the average monthly return on the market portfolio.

8. Each of two stocks, A and B, are expected to pay a dividend of $5 in the upcoming year. The expected growth rate of dividends is 10% for both stocks. You require a rate of return of 11% on stock A and a return of 20% on stock B. The intrinsic value of stock A _____.
A. will be greater than the intrinsic value of stock B
B. will be the same as the intrinsic value of stock B
C. will be less than the intrinsic value of stock B
D. cannot be calculated without knowing the market rate of return.
E. none of the above is true.

9. Midwest Airline is expected to pay a dividend of $7 in the coming year. Dividends are expected to grow at the rate of 15% per year. The risk-free rate of return is 6% and the expected return on the market portfolio is 14%. The stock of Midwest Airline has a beta of 3.00. The return you should require on the stock is _____.
A. 10%
B. 18%
C. 30%
D. 42%
E. none of the above

10. Suppose two portfolios have the same average return, the same standard deviation of returns, but portfolio A has a higher beta than portfolio B. According to the Sharpe measure, the performance of portfolio A _____.
A. is better than the performance of portfolio B
B. is the same as the performance of portfolio B
C. is poorer than the performance of portfolio B
D. cannot be measured as there is no data on the alpha of the portfolio
E. none of the above is true.

11. A Treasury bond due in one year has a yield of 5.7%; a Treasury bond due in 5 years has a yield of 6.2%. A bond issued by Ford Motor Company due in 5 years has a yield of 7.5%; a bond issued by Shell Oil due in one year has a yield of 6.5%. The default risk premiums on the bonds issued by Shell and Ford, respectively, are
A. 1.0% and 1.2%
B. 0.7% and 1.5%
C. 1.2% and 1.0%
D. 0.8% and 1.3%
E. none of the above

12. You have just purchased a 10-year zero-coupon bond with a yield to maturity of 10% and a par value of $1,000. What would your rate of return at the end of the year be if you sell the bond? Assume the yield to maturity on the bond is 11% at the time you sell.
A. 10.00%
B. 20.42%
C. 13.8%
D. 1.4%
E. none of the above

13. Suppose that all investors expect that interest rates for the 4 years will be as follows:

Year	Forward Interest Rate
0	(today)5%
1	7%
2	9%
3	10%

What is the price of 3-year zero coupon bond with a par value of $1,000?
A. $863.83
B. $816.58
C. $772.18
D. $765.55
E. none of the above

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. A and C
E. none of the above.

15. Some of the problems with immunization are
A. duration assumes that the yield curve is flat.
B. duration assumes that if shifts in the yield curve occur, these shifts are parallel.
C. immunization is valid for one interest rate change only.
D. durations and horizon dates change by the same amounts with the passage of time.
E. A, B, and C.

16. A covered call position is

A. the simultaneous purchase of the call and the underlying asset.

B. the purchase of a share of stock with a simultaneous sale of a put on that stock.

C. the short sale of a share of stock with a simultaneous sale of a call on that stock.

D. the purchase of a share of stock with a simultaneous sale of a call on that stock.

E. the simultaneous purchase of a call and sale of a put on the same stock.

17. The Black-Scholes formula assumes that

I) the risk-free interest rate is constant over the life of the option.

II) the stock price volatility is constant over the life of the option.

III) the expected rate of return on the stock is constant over the life of the option.

IV) there will be no sudden extreme jumps in stock prices.

A. I and II

B. I and III

C. II and II

D. I, II and IV

E. I, II, III, and IV

18. Other things equal, the price of a stock call option is negatively correlated with the following factors

A. the stock price.

B. the time to expiration.

C. the stock volatility.

D. the exercise price.

E. A, B, and C.

19. If interest rate parity holds, then

A. covered interest arbitrage opportunities will exist

B. covered interest arbitrage opportunities will not exist

C. the average grade on Investments 3.4 will be above 8.5

D. arbitrageurs will be able to make risk-free profits

E. B and D

20. Suppose that the risk-free rates in the United States and in the United Kingdom are 4% and 6%, respectively. The spot exchange rate between the dollar and the pound is $1.60/BP. What should the futures price of the pound for a one-year contract be to prevent arbitrage opportunities, ignoring transactions costs.

A. $1.60/BP

B. $1.70/BP

C. $1.66/BP

D. $1.63/BP

E. $1.57/BP

PART 2 (OPEN QUESTIONS; 60 points at maximum)

Question 1: Equilibrium Pricing Models (15 points)

Part a. (4 points)

What are the equilibrium implications of the CAPM? When answering this question focus on the following:
    i.   Give a graphical illustration of the Capital Market Line and explain it.
    ii.   State the Mutual Fund Theorem
    iii.   Give an expression for the risk premium of the market portfolio
    iv.   Given an expression for the risk premium of individual assets (the expected return-beta relationship)

Part b. (4 points)

Consider the Fama-French 3-factor model:

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

where r_i is the return of a stock i, r_m is the market return, SMB is a factor that proxies for size, and HML – for value. The variances of the three factors are respectively σ_m^2, σ_{smb}^2, and σ_{hml}^2. The variance of the idiosyncratic source of risk is σ_ϵ^2 and it is the same for all stocks i.
Assume that the idiosyncratic sources of risk are uncorrelated, and that the three factors are uncorrelated as well.

    i.   Give an expression for the systematic risk of stock i in terms of the variances of the three factors.

    ii.   Construct an equally weighted portfolio of 10 stocks. What is its non-systematic risk component? Compare it to the non-systematic risk component of the individual stocks.

    iii.   Consider three stocks, i={1,2,3}. Construct a portfolio out of the three stocks that has zero exposure to the size factor, and an exposure of 1.5 to the value factor. Provide the system of equations to be used to solve for the weights. You do not need to find the explicit solution for the weights.

Part c. (4 points)

Assume that the CAPM holds. The risk-free rate is 2% and the market return is 8%. Consider the following information for two stocks A and B. Beta refers to the market beta, P/E – to price-earnings ratio, and b denotes the retention ratio:

Stocks	beta	P/E	b
A	1.5	14.29	0.7
B	0.9	13.51	0.5

    i.   Compute the return on equity (ROE) of the two stocks, assuming a constant growth model with endogenous earnings growth (round at the third decimal).

    ii.   Estimate the growth rate for both firms (round at the third decimal).

    iii.   What would the effect on the P/E ratio be if you change the retention ratio of stock B, keeping ROE constant? Why?

Part d. (3 points)

Consider the multifactor APT with two factors. The risk premiums on the factor 1 and factor 2 portfolios are 5% and 6%, respectively. Stock A has a beta of 1.2 on factor 1, and a beta of 0.7 on factor 2. The expected return on stock A is 17%.

If no arbitrage opportunities exist, what should the risk-free rate of return be?

Question 2: Portfolio Construction and Performance Measurement (15 points)

Part a. (6 points)

Consider a portfolio P that consists of a risky asset A and a risk-free asset with weights ω and (1-ω) respectively. Denote by r_A the return of the risky asset, and by r_f – the risk-free return. The standard deviation of the risky asset is σ_A.

    i.   Give an analytic expression of the return of the portfolio (r_P) and its variance (σ_P^2). What is the expected return of the portfolio $E[r_P]$?

    ii.   Consider an investor who has the following utility function:
$$U = E[r_P] - \frac{1}{2}A\sigma_P^2$$
where A is the level of risk aversion of the investor. Obtain analytically the optimal weights in the risky asset ω if the investor solves the following problem:
$$max_w U = E[r_P] - \frac{1}{2}A\sigma_P^2$$

    iii.   Which value of A makes the investor indifferent between investing in the risky portfolio P and the risk-free asset? Give an analytic expression.

Part b. (5 points)

You want to evaluate three mutual funds, based on the information below. The market return is 8% and the risk free rate is 2%.

Fund	Average Return	Standard Deviation	Beta
A	9	9	0.7
B	12	16	1.3
C	14	20	1.8

    i.   Provide the formulas for the Sharpe Ratio, Treynor measure, and Jensen's alpha.

    ii.   As an investor, would you prefer your fund to have higher or lower scores on these three measures? Why?

    iii.   Calculate the Sharpe Ratio, Treynor measure, and Jensen's alpha. Based on your analysis, which fund performs best?

Part c. (4 points)

You have a time series of realized returns of a mutual fund, a stock and a bond index, and treasuries. You want to perform style analysis of the mutual fund. Give an equation that would allow you to do that and explain its components. Explain how you would estimate its coefficients.

Question 3: Fixed Income (15 points)

Part a. (6 points)

Consider the data on the following three coupon bonds:

	Maturity	Coupon	Yield	Face Value
Bond A	2	0.06	0.02	100
Bond B	3	0.05	0.03	100
Bond C	4	0.03	0.04	100

   i.   Compute the prices, duration and the modified duration of the three bonds.

   ii.   You have a portfolio consisting of a long position in 5 bonds of type B, 4 bonds of type C, and a short position in 2 bonds of type A. 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 b. (2 points)

If you are buying a coupon bond between interest paying dates, is the amount you would pay to your broker for the bond more or less than the amount quoted in the financial quotation pages? Discuss the differences and how these differences arise.

Part c. (4 points)

The zero rates for maturities of 1, 2, and 3 years are given by z1, z2, and z3. Obtain (analytically) the corresponding one-year forward rates for t=1, 2, 3 (f1, f2, f3) in terms of the zero rates. Express the price of a 3-year coupon bond with annual coupon payments of C and face value of 100 using the forward rates.

Part d. (3 points)

Discuss the theories of the term structure of interest rates. Include in your discussion the differences in the theories, and the advantages/disadvantages of each.

Question 4: Option Pricing (15 points)

Part a. (2 points)

What is an option hedge ratio? How does the hedge ratio for a call differ from that of a put (or are the

Part b. (7 points)

You are evaluating a stock that is currently selling for $30 per share. Over the investment period of 1 year you think that the stock price might get as low as $25 or as high as $40. There is a call option available on the stock with an exercise price of $35. The annual interest rate is 6%. Answer the following questions about hedging your position in the stock. Assume that you will buy one share.

  i. What is the hedge ratio?

  ii. How much would you borrow to purchase the stock? (Hint: make sure the value of your stock portfolio at the end of the holding period is non-negative)

  iii. What is the amount of your net investment in the stock?

  iv. What is the value of the stock at year end, the repayment of the loan, and the total value of your portfolio (all calculated as of the end of the holdings period) under the two scenarios (low and high stock price)? How many call options will you combine with the stock to construct the perfect hedge? Will you buy the calls or sell the calls?

  v. Show the option values (i.e. the value of your call position) under the two scenarios (low and high stock price).

  vi. Show the net payoff to your stock, call, and total portfolio under the two scenarios (low and high stock price).

  vii. What must the price of one call option be?

Part c. (6 points)

The payoff of a collar strategy is given below.
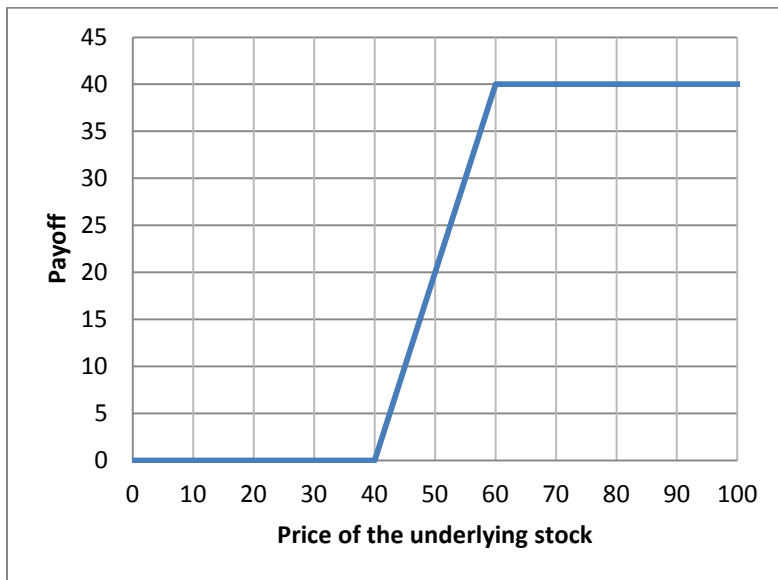
Replicate the payoff using:

    i.   A combination of call options

    ii.   A combination of a cash account and put options