TELFER

VOTRE LIEN AVEC CE QUI COMPTE — CONNECTS YOU TO WHAT MATTERS

SOLUTION
2017 Midterm Exam

ADM2352 A&B
Finance Theory

Professor: Dr. Samir Saadi Duration: 180 minutes

INSTRUCTIONS
1. Answer all questions.
2. The **only** aids permitted are financial calculator, scientific calculator and a one-sided, 8.5" x 11" crib sheet.
3. The question paper and crib sheet must be returned at the end of the exam.
4. This **is not** an open book exam.
5. Use of course materials during the exam will result in an exam grade of zero, and a grade of "F" for the course.

NAME: _____

STUDENT #: _____

Statement of Academic Integrity
The School of Management does not condone academic fraud, an act by a student that may result in a false academic evaluation of that student or of another student. Without limiting the generality of this definition, academic fraud occurs when a student commits any of the following offences: plagiarism or cheating of any kind, use of books, notes, mathematical tables, dictionaries or other study aid unless an explicit written note to the contrary appears on the exam, to have in his/her possession cameras, radios (radios with headsets), tape recorders, pagers, cell phones, or any other communication device which has not been previously authorized in writing.

Statement to be signed by the student:
I have read the text on academic integrity and I pledge not to have committed or attempted to commit academic fraud in this examination.

Signed:_____

Note: an examination copy or booklet without that signed statement will not be graded and will receive a final exam grade of zero.

Multiple Choice Questions (1.5 mark each, total 30 marks)

Clearly circle the **best** response to each of the following questions.

1) A drawback to the historical approach of estimating an asset's expected return is:
a) the risk of the firm may have changed over time.
b) history always repeats itself.
c) that the range of potential outcomes is often very broad.
d) all of the above are drawbacks to the historical approach.
ANSWER: a)

2) What is one of the most important lessons from capital market history?
a) Risk does not matter.
b) There is a positive relationship between risk and return.
c) You are always better off investing in stock.
d) T-bills are the highest yielding investment.
ANSWER: b)

3) Based upon the following levels of risk, which stock should have the highest price if each stock is expected to produce the same level of cash over the future life of each asset?

	Systematic risk units	Unsystematic risk units
Stock A	10	3
Stock B	12	5
Stock C	5	300

a) Stock A
b) Stock B
c) Stock C
d) There is not enough information to decide
ANSWER: c)

Least systematic risk ====> lowest discount rate ====> highest price, hence Stock C

4) A particular asset has a beta of 1.2 and an expected return of 10%. The expected return on the market portfolio is 13% and the risk-free rate is 5%. Which of the following statement is correct?
a) This asset lies on the security market line.
b) This asset lies above the security market line.
c) This asset lies below the security market line.
d) Cannot tell from the given information.
ANSWER: c)
Equilibrium return = 5% + 1.2 (13%-5%) = 14.6%

5) An investor put 40% of her money in Stock A and 60% in Stock B. Stock A has a beta of 1.2 and Stock B has a beta of 1.6. If the risk-free rate is 5% and the expected return on the market is 12%, what's the investor's expected return?

a) 22.28%
b) 14.80%
c) -14.80%
d) 15.08%

ANSWER: d)

Expected return (stock A) = 5% + 1.2(12%-5%) = 13.4%
Expected return (stock B) = 5% + 1.6(12%-5%) = 16.2%
Portfolio expected return = .4(13.4%) + .6(16.2%) = 15.08%

6) Asset 1 has a beta of 1.2 and Asset 2 has a beta of 0.6. Which of the following statements is correct?

a) Asset 1 is more volatile than Asset 2.
b) Asset 1 has a higher expected return than Asset 2.
c) In a simple regression with individual asset's return as the dependent variable and the market's return as the independent variable, the R-squared value is higher for Asset 1 than it is for Asset 2.
d) All of the above statements are correct.

ANSWER: b)

7) Which statement is FALSE regarding risk and return?

a) For broad asset classes, the relationship between risk and return is nearly linear.
b) Adding multiple stocks to a portfolio can reduce non-systematic risk.
c) There is a nearly linear relationship between risk and return for individual stocks.
d) Because investors can easily eliminate risk through diversification, investors should only be rewarded for non-diversifiable risk.

ANSWER: c)

8) Inflation, recession, and higher interest rates are economic events that are characterized as:

a) Company-specific risk.
b) Market risk.
c) Systematic risk that can be diversified away.
d) Diversifiable risk

ANSWER: b)

9) Which statement is TRUE regarding diversification?

a) The greater the systematic risk, the greater the return required by the investor.
b) The greater the diversifiable risk, the greater the return required by the investor.
c) We are able to remove all systematic risk if enough stocks are added to a portfolio.
d) Systematic risk is diversifiable.

ANSWER: a)

10) If the standard deviation of a diversified portfolio is 20% and if the stocks in that portfolio are positively correlated, then what would we expect the average standard deviation of stocks in that portfolio to be?

a) less than 20%
b) 20%
c) greater than 20%
d) you would need to know the percentage of each stock invested in that portfolio to determine the answer

ANSWER: c)

11) Which of the following statements is FALSE?

a) Beta measures the sensitivity of a security to market-wide risk factors.
b) Volatility measures total risk, while beta measures only systematic risk.
c) The beta is the expected percentage change in the excess return of the market portfolio for a 1% change in the excess return of a security.
d) Utilities tend to be stable and highly regulated, and thus are insensitive to fluctuations in the overall market.

ANSWER: c)

Explanation: The beta is the expected percentage change in the excess return of a security for a 1% change in the excess return of the market portfolio.

12) The slope of the Security Market Line (SML) is:

a) the return on the market.
b) beta.
c) the market risk premium.
d) the risk-free rate.

ANSWER: c)

13) An investor has $10,000 invested in Treasury securities (i.e. a risk free asset) and $15,000 invested in stock UV. UV has a beta of 1.2. What is the beta of the portfolio?

a) 0.00
b) 0.72
c) 1.20
d) None of the above

ANSWER: b)

*($10,000/$25,000 * 0) + ($15,000/$25,000 * 1.2) = 0.72*

14) Which type of risk affects just a few securities at a time?

a) return risk
b) variance risk
c) unsystematic risk
d) systematic risk

ANSWER: c)

15) An advantage of the probabilistic approach to estimating an asset's returns is:

a) history always repeats itself.
b) it does not require one to assume that the future will look like the past.
c) recent history is more important than future risk.
d) exact probabilities are easy to estimate.

ANSWER: b)

16) The stock of Alpha Company has an expected return of 0.10 and a standard deviation of 0.25. The stock of Gamma Company has an expected return of 0.16 and a standard deviation of 0.40. The correlation coefficient between the two stocks' returns is 0.2. If a portfolio consists of 40% of Alpha Company and 60% of Gamma Company, what's the expected return of the portfolio?

a) 0.126
b) 0.136
c) 0.160
d) None of the above

ANSWER: b)

Portfolio expected return = .4(0.10) + .6(0.16) = 0.136

17) Which of the following statements is FALSE?

a) It is not actually necessary to identify the efficient portfolio itself. All that is required is to identify a collection of portfolios from which the efficient portfolio can be constructed.
b) Although we might not be able to identify the efficient portfolio itself, we know some characteristics of the efficient portfolio.
c) An efficient portfolio can be constructed from other diversified portfolios.
d) An efficient portfolio need not be well diversified.

ANSWER: d)

Explanation: An efficient portfolio needs to be well diversified.

18) According to the CAPM (capital asset pricing model), what is the single factor that explains differences in returns across securities?

a) the expected risk premium on the market portfolio
b) the beta of a security
c) the expected return on the market portfolio
d) the volatility of a security

ANSWER: b)

19) Suppose Sarah can borrow and lend at the risk free-rate of 3%. Which of the following four risky portfolios should she hold in combination with a position in the risk-free asset?

a) portfolio with a standard deviation of 15% and an expected return of 12%
b) portfolio with a standard deviation of 19% and an expected return of 15%
c) portfolio with a standard deviation of 12% and an expected return of 9%
d) she should be indifferent in holding any of the three portfolios

ANSWER: b)

The best portfolio is the one with the highest Sharp ratio.

20) A stock that pays no dividends is currently priced at $40 and is expected to increase in price to $45 by year end. The expected risk premium on the market portfolio is 6% and the risk-free rate is 5%. If you believe in the CAPM and if the stock has a beta of 0.6, the stock is

a) overpriced
b) underpriced
c) appropriately priced
d) Cannot tell from the given information

ANSWER: b)

Required (or equilibrium) rate of return = 5% + 0.6 (6%) = 8.6%
Stock expected return = (45-40)/40 = 12.5%

Bonus MCQ Question (1.5 marks)

21) Based on Saadi, Baker and Dutta's (2011) study, what is the most commonly used approach to measure a firm's cost of equity capital?

a) Weighted average cost of capital (WACC)
b) Earning/price (E/P) ratio
c) Capital asset pricing model (CAPM)
d) Judgement

ANSWER: d)

Problem 1 (10 marks)
Consider a bond that pays $1,000 at the end of the year. Suppose the market interest rate for deposits is 3%, but the market interest rate for borrowing is 3.5%. Compute the highest and lowest price the bond could trade for without creating an arbitrage opportunity (i.e. the no-arbitrage price range).

SOLUTION
The lowest price, P_L = $1000/(1+3.5%) = $966.18
The highest price, P_H = $1000/(1+3%) = $970.87

If the bond price is between $966.18 and $970.87 then there is no arbitrage opportunity. For example, if the current bond price is $980, an arbitrageur could profit by short selling the bond at $980 and investing $970.87 of the proceeds at the 3% rate. The arbitrage profit is $980.87-$970.87 = $9.13. Alternatively, if the current bond price is $960, an arbitrageur could borrow $966.18 at 3.5% and use it to buy the bond at $960. The arbitrage profit is then $966.18-$960 = $6.18

Thus the no-arbitrage price range of the bond is [$966.18, $970.87].

Problem 2 (15 marks)

Suppose the market portfolio is equally likely to increase by 25% or decrease by 5%.

a) Calculate the beta of a firm that goes up on average by 34% when the market goes up and goes down by 22% when the market goes down.

b) Calculate the beta of a firm that goes up on average by 12% when the market goes down and goes down by 16% when the market goes up

c) Calculate the beta of a firm that is expected to go down by 10% or go up by 8% solely due to idiosyncratic risk.

SOLUTION

a) Beta = [34%-(-22%)]/[25%-(-5%)]=1.87

b) Beta = [-16%-12%)]/[25%-(-5%)]=-0.93

c) Because the firm has no systematic risk so Beta is equal to zero.

Problem 3 (10 marks)

Consider two risky securities A and B. The volatilities of A and B are σ_A and σ_B, respectively. Let *X* be the percentage of wealth invested in security A and (*1-X*) be the percentage of wealth invested insecurity B. The correlation between the returns on the two securities is denoted as ρ.

a) Develop the formula of *X**, the minimum variance portfolio composed of securities A and B. Please provide a detailed proof and not just the final formula.

b) Show that if $\rho = -1$, then $X^* = \frac{\sigma_B}{\sigma_A + \sigma_B}$

SOLUTION

a)

$$Var(R) = x^2\sigma_A^2 + (1-x)^2\sigma_B^2 + 2x(1-x)\sigma_A\sigma_B\rho$$

$$= x^2\sigma_A^2 + (1 - 2x + x^2)\sigma_B^2 + 2x\sigma_A\sigma_B\rho - 2x^2\sigma_A\sigma_B\rho$$

$$= x^2\sigma_A^2 + \sigma_B^2 - 2x\sigma_B^2 + x^2\sigma_B^2 + 2x\sigma_A\sigma_B\rho - 2x^2\sigma_A\sigma_B\rho$$

$$\frac{\partial Var(R)}{\partial x} = 0 \Rightarrow 2x\sigma_A^2 - 2\sigma_B^2 + 2x\sigma_B^2 + 2\sigma_A\sigma_B\rho - 4x\sigma_A\sigma_B\rho = 0$$

$$\Rightarrow x\sigma_A^2 - \sigma_B^2 + x\sigma_B^2 + \sigma_A\sigma_B\rho - 2x\sigma_A\sigma_B\rho = 0$$

$$\Rightarrow x(\sigma_A^2 + \sigma_B^2 - 2\sigma_A\sigma_B\rho) - \sigma_B^2 + \sigma_A\sigma_B\rho = 0$$

$$\Rightarrow X^* = \frac{\sigma_B^2 - \sigma_A\sigma_B\rho}{\sigma_A^2 + \sigma_B^2 - 2\sigma_A\sigma_B\rho}$$

b)

$$\Rightarrow X^* = \frac{\sigma_B(\sigma_B - \sigma_A\rho)}{(\sigma_A^2 + \sigma_B^2 - 2\sigma_A\sigma_B\rho}$$

$$\rho = -1 \Rightarrow X^* = \frac{\sigma_B(\sigma_B + \sigma_A)}{\sigma_A^2 + \sigma_B^2 + 2\sigma_A\sigma_B}$$

$$X^* = \frac{\sigma_B(\sigma_B + \sigma_A)}{(\sigma_A + \sigma_B)^2}$$

$$X^* = \frac{\sigma_B}{\sigma_A + \sigma_B}$$

Problem 4 (15 marks)

Suppose that you currently have $250,000 invested in a portfolio with an expected return of 12% and a volatility of 10%. The efficient (tangent) portfolio has an expected return of 17% and a volatility of 12%. The risk-free rate of interest is 5%.

a) Compute the Sharpe ratio for your portfolio (2.5 marks)

b) Compute the Sharpe ratio for the efficient portfolio (2.5 marks)

c) Suppose that you want to maximize your expected return without increasing your risk. How can you achieve this goal? In this case, without increasing your risk, what is the maximum expected return you can expect? (10 marks)

SOLUTION

a)

$$\text{Sharpe ratio} = \frac{\text{excess portfolio return}}{\text{portfolio volatility}} = \frac{.12 - .05}{.10} = 0.7$$

b)

$$\text{Sharpe ratio} = \frac{\text{excess portfolio return}}{\text{portfolio volatility}} = \frac{.17 - .05}{.12} = 1.0$$

c) By investing in a combination of the risk-free asset and the efficient portfolio. We find the weights and expected returns as follows:

$SD(R_{xp}) = xSD(R_p)$
$.10 = x(.12)$
$x = .10 / .12$
$x = .833333$ invested in the efficient portfolio

So, $E[R_{xp}] = r_f + x(E[R_p] - r_f)$
$= .05 + .8333(.17 - .05) = .15$ or 15%

Problem 5 (10 marks)

Develop the formula of the variance of a portfolio, Q, composed of 4 risky securities; A, B, C, and D; with X_A, X_B, X_C and X_D being the percentage of wealth invested in each of the securities. Please provide a detailed proof and not just the final formula.

SOLUTION

Knowing that

- COV (X_AR_A, X_BR_B) = COV (X_BR_B, X_AR_A) = X_AX_B COV (R_B , R_A)
- COV (X_AR_A, X_AR_A)= X_A^2COV (R_A, R_A)= X_A^2VAR (R_A)
- N = 4, then there are 4 VAR and 12 COV

$$Var(R_Q) = Cov(R_Q, R_Q)$$

$$\sigma_Q^2 = Cov\left(\sum_{i=1}^{N} X_i R_i \; ; \; \sum_{i=1}^{N} X_i R_i\right)$$

$$\sigma_Q^2 = Cov(X_AR_A + X_BR_B + X_CR_C + X_DR_D \; ; \; X_AR_A + X_BR_B + X_CR_C + X_DR_D)$$

$$\sigma_Q^2 = \underbrace{Cov(X_AR_A; X_AR_A)}_{\sigma_A^2} + Cov(X_AR_A; X_BR_B) + Cov(X_AR_A; X_CR_C) + Cov(X_AR_A; X_DR_D)$$
$$+ Cov(X_BR_B; X_AR_A) + \underbrace{Cov(X_BR_B; X_BR_B)}_{\sigma_B^2} + Cov(X_BR_B; X_CR_C) + Cov(X_BR_B; X_DR_D)$$
$$+ Cov(X_CR_C; X_AR_A) + Cov(X_CR_C; X_BR_B) + \underbrace{Cov(X_CR_C; X_CR_C)}_{\sigma_C^2} + Cov(X_CR_C; X_DR_D)$$
$$+ Cov(X_DR_D; X_AR_A) + Cov(X_DR_D; X_BR_B) + Cov(X_DR_D; X_CR_C) + \underbrace{Cov(X_DR_D; X_DR_D)}_{\sigma_D^2}$$

$$\sigma_Q^2 = X_A^2\sigma_A^2 + X_B^2\sigma_B^2 + X_C^2\sigma_C^2 + X_D^2\sigma_D^2 + 2X_AX_B\,Cov(R_A, R_B)$$
$$+ 2X_AX_C\,Cov(R_A, R_C) + 2X_AX_D\,Cov(R_A, R_D) + 2X_BX_C\,Cov(R_B, R_C)$$
$$+ 2X_BX_D\,Cov(R_B, R_D) + 2X_CX_D\,Cov(R_C, R_D)$$

Essay Question (10 marks)

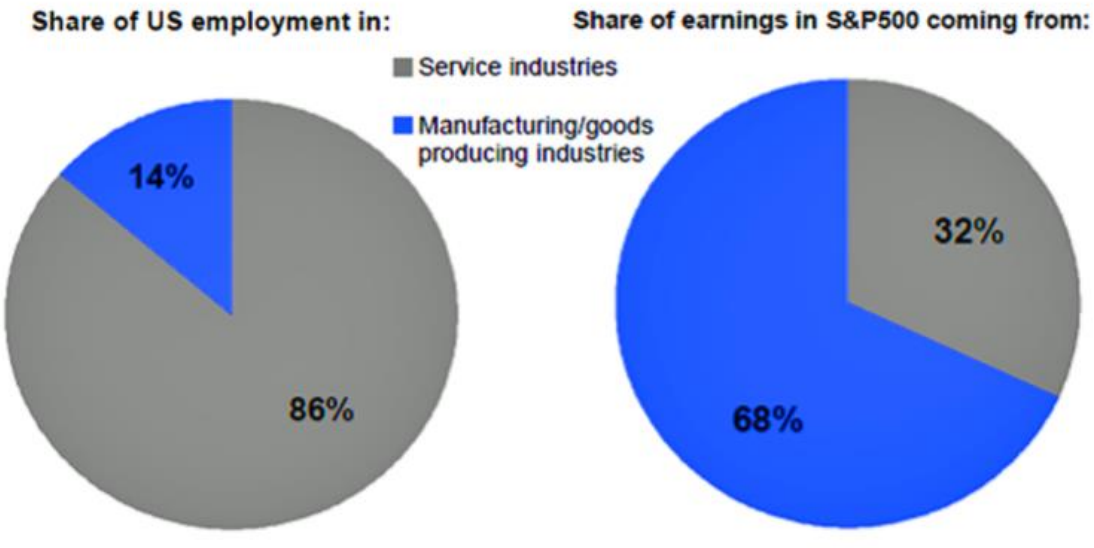
On Tuesday September 19, 2017, in an interview with CBS News, Michael Bloomberg, the former New York City mayor, said that he is puzzled by why S&P 500 continues to rise despite the genuine problems that are plaguing the U.S. economy:

> *"I cannot for the life of me understand why the market keeps going up....Our economy has some real challenges: The infrastructure's falling apart, we're destroying jobs with technology, we are keeping the best and the brightest from around the world from coming to America to create new jobs and create new businesses....All of those things would give you pause to worry about the future."*
>
> Source: Business Insider.

As a financial analyst, what would be your answer to Bloomberg's "puzzle"? (Please provide a concise answer).

SOLUTION

In a nutshell, Michael Bloomberg was missing the fact that the stock market does not necessarily represent the economy because many companies that make up the stock market do business overseas. Moreover, most of the earnings in the S&P 500 come from large firms operating in the manufacturing/energy/goods-producing industries however those industries represent only 14% of total employment in the U.S. economy (see below charts, using 2015 data). Thus changes in S&P 500 do not necessarily reflect changes in GDP.



Note: Service industries are: Financials, Multiline Retail, Specialty Retail, Internet & Catalog Retail, Diversified Consumer Services, Hotels, Restaurants & Leisure, IT Services, and Health Care Providers & Services. Source: David Bianco, Ju Wang, Winnie Nip.

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