THE UNIVERSITY OF
MELBOURNE

FNCE10002 Principles of Finance
Semester 1, 2019

Modern Portfolio Theory and Asset Pricing I
Tutorial Questions for Week 5

This tutorial is divided into two parts. The answers to the questions in Part I need to be submitted at the **beginning** *of your tutorial. All answers must be* **handwritten** *and in* **original** *(photocopies/emails will not be accepted). Please follow the instructions on the Tutorial Hand-in Sheet available on the LMS via the Tutorials link. The answers to questions in Part II do not need to be submitted and will be discussed in your tutorial. Please make sure that you have worked through these questions and are prepared to discuss them if called upon by your tutor.*

Note that questions flagged as "EXM" are past exam questions that I've used in this subject or subjects similar in scope to this subject, while those flagged as "TXT" are sourced from the textbook. Detailed answers to the questions in Part II will only be provided in tutorials. Brief answers may be provided via the LMS after a time lag. This policy is in place to ensure that you attend your tutorials regularly and receive timely feedback from your tutor. If you are unsure of any answer you should check with your tutor, a pit stop tutor, online tutor or me.

Part I: Answers to be Submitted to Your Tutor

A.   Problems

A1.   Refer to your week 5 lecture notes in which we discussed the changes in price indices of world equities and collectibles like wine, stamps, cars, etc. measured in real US dollar terms during 1900 – 2017. Based on the information given, for each asset class and the overall average across these asset classes, calculate the (real) geometric average rate of return. (Note that in the graph year 0 is 1900 and the price indices shown are up to the end of 2017.) *Show all calculations*.

A2.^{EXM} The shares of EHA Ltd (a non-dividend paying stock) are currently selling for $20.00 per share. You have developed the following probability distribution of the price next year.

State of the Market	Probability	Price	
Bullish	0.3	$18.00	−10 %
Normal	0.3	$20.00	0 %
Bearish	0.4	$23.00	15 %

a)   Calculate the expected return and standard deviation of return for EHA Ltd.

3 %

b)   A Treasury bill with one year to maturity and a face value of $10,000 can be purchased today for $9,524. Given this, does EHA Ltd seem like a good investment at $20.00 per

$(10000 - 9524)/9524 = 5\%$

share? Assume that you intend to invest equal dollar amounts in either the Treasury bill or EHA Ltd's shares. If there was a market consensus with the above probability distribution for EHA Ltd's shares, what would you expect to happen to its share price? *Explain*. (*No calculations required*.)

[handwritten: ρ EHA ↓]

A3.[EXM] Stocks A and B have the following return distributions and expected returns.

State of the Market	Probability	Stock A's Return	Stock B's Return
Poor	0.25	–20.0%	30.0%
Fair	0.50	15.0%	20.0%
Great	0.25	20.0%	–10.0%
Expected return		**7.5%**	**15.0%**

a) Calculate the covariance of returns for the two securities.

b) Calculate the correlation coefficient for the two securities.

c) Calculate the expected return and standard deviation of returns for a portfolio with $10,000 invested in A and $15,000 in B.

d) What is (are) the source(s) of diversification benefits in this portfolio? *Explain*.

[handwritten: from Poor → Great stock A's Return is increasing while stock B's Return is decreasing]

Part II: Submission of Answers Not Required

B.   Short Answer Questions

B1.[EXM] You are given the following information on three stocks:

[handwritten: rE = 8%]

Stock A has an expected return of 8.0% with a standard deviation of 15.0%.
Stock B has an expected return of 10.0% with a standard deviation of 20.0%.
Stock C has an expected return of 10.0% with a standard deviation of 15.0%.

A risk averse investor has a choice between investing in the above stocks. Consider each statement separately and indicate whether the statement is *true* or *false* and briefly explain why.

a) The investor would prefer to invest in stock B rather than stock C.

[handwritten: F   rE ≈   SD↑ risk↑]

b) The investor would prefer to invest in stock C rather than stock A.

[handwritten: T   SD ≈   rE↑]

c) The investor would prefer to invest in stock A rather than stock B.

[handwritten: Cannot compare   sharp ratio = expected return / SD]

C.   Multiple Choice Questions

For each question pick the *most reasonable* response based *only* on the information provided.

C1.[EXM] Daniel Singh, the owner of a major recording studio, is a strictly buy-and-hold type of investor. You have the following information on Daniel's portfolio during 2016-18.

[handwritten: a   b]

Year	End-of-Year Value	Total Portfolio Income
2016	$100,000	--
2017	$125,000	$5,000
2018	$70,000	$5,000

[handwritten: $r_{20} = \frac{125000 + 5000}{100000} - 1 = 0.3$]

[handwritten: $r_{21} = \frac{70000 + 5000}{125000} - 1 = -0.4$]

*[handwritten: $\bar{r} = [(1 + r_{20})(1 + r_{21})]^{\frac{1}{2}} - 1$]*

Note that the end-of-year portfolio values do not include the total portfolio income which is assumed to be paid at the end of each year. Based on this information, the geometric average return Dan has earned on his investment is **closest** to:

$100\,000 \times (1 + \overline{r_g})^2 = 70\,000$

a) −16.3% p.a.
b) −11.7% p.a.
c) −9.5% p.a.
d) −5.0% p.a.

C2.   How does the long run relationship between the average return and the historical volatility of individual stocks in the US differ from the relationship between the average return and the historical volatility of large, well-diversified portfolios in the same market?
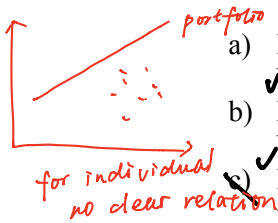
a) For large portfolios, there is a negative relationship between realized returns and volatility, but for individual stocks there no clear relation.
b) For large portfolios, there is a positive relationship between realized returns and volatility, but for individual stocks there no clear relation.
c) For individual stocks, there is a negative relationship between realized returns and volatility, but for large portfolios there no clear relation.
d) For individual stocks, there is a positive relationship between realized returns and volatility, but for large portfolios there no clear relation.

C3.^EXM   Two securities that have the *same* expected returns and standard deviation of returns would offer diversification benefits to investors under what condition?

a) Never.
b) Only if their returns are perfectly negatively correlated.
c) Only if their returns are less than perfectly positively correlated.
d) Only if their returns are perfectly positively correlated.

C4.^EXM   The shares DBY Ltd are currently selling for $8.00 per share. You have developed the following probability distribution of the price and dividend one year from now.

State of the Market	Probability	Price	Dividend
Bearish	0.3	$6.80	$0.40
Normal	0.4	$7.60	$0.40
Bullish	0.3	$9.60	$0.80

$r = \dfrac{7.2 - 8}{8} = -10.0\%$

$r = 0$

$r = 30\%.$

Assuming year end cash flows, the standard deviation of the rate of returns for DBY Ltd shares is **closest** to:

$E = 0.06$

$SD = \sqrt{0.3\,(-0.1 - 0.06)^2 + 0.4\,(0 - 0.06)^2 + 0.3\,(0.3 - 0.06)^2}$

a) 2.6%.
b) 12.7%.
c) 16.3%.
d) 25.4%.

C5.^EXM   Stock A has an expected return of 6% and a standard deviation of returns of 15% while stock B has an expected return of 8% and a standard deviation of returns of 25%. If the stocks are perfectly negatively correlated the expected return on the minimum variance portfolio consisting of these stocks is:

$A: \ rE_A = 6\% \quad SD = 15\%$

$B: \ rE_B = 8\% \quad SD = 25\%$

$\rho_{12} = -1$

$E(r_p) = w_1 E(r_1) + w_2 E_2$
$= 0.625 \times 0.06$
$+ 0.375 \cdot 0.08$

$\sigma_p = w_1 \cdot 0.15 - (1 - w_1) \cdot 0.25 = 0$
$0.40 w = 0.25$

a) 6.75%.
b) 7.25%.
c) 20.00%.

$w_1 = 0.625$

    d) Not computable because there is not enough information given.

D. Problems and Case Studies

D1.[EXM] You are given the following information on three securities.

Security	Expected Return	Standard Deviation	Correlations A	B	C
A	10.0%	6.0% σ_A	1.0		
B	14.0%	11.0% σ_B	0.6 σ_{AB}	1.0	
C	15.0%	18.0% σ_C	0.8 σ_{AC}	0.0 σ_{BC}	1.0

a) Given an investment of $10,000 each in securities A and B, what is the expected return on this portfolio?

(handwritten) $W_A = 0.5$; $W_B = 0.5$; $E(p_{AB}) = W_A E(A) + W_B E(B) = 0.5 \cdot 0.1 + 0.5 \cdot 0.14 = 12.0\%$

b) Calculate the standard deviation of the portfolio of securities A and B offering an expected return of 12%.

(handwritten) $\sigma_{AB} = \sigma_A \cdot \sigma_B \cdot \rho_{12} = 0.06 \cdot 0.11 \cdot 0.6 = 0.003 96$. X → covariance
$SD = \sqrt{W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + 2 W_1 W_2 \sigma_1 \sigma_2 \rho_{12}}$

c) Calculate the standard deviation of the portfolio of securities A and C offering an expected return of 12%.

(handwritten) $W_A + W_C = 1$; $E(p_{AC}) = W_A \cdot 0.1 + (1 - W_A) \cdot 0.15 = 0.12$; $0.15 - 0.05 W_A = 0.12$
$\sigma_{AC} = \sqrt{W_A^2 \sigma_A^2 + W_C^2 \sigma_C^2 + 2 W_A W_C \sigma_A \sigma_C \rho_{AC}}$; $W_A = 0.6$ $W_C = 0.4$; $= 0.1031$

d) Which one of the two portfolios above would be more attractive to a risk averse investor? *Explain.*

(handwritten) $E(p_{rAB}) = 12\%$; $\sigma_{AB} = 0.00396$; $E(p_{rAC}) = 12\%$; $\sigma_{AC} = 0.1031$; $\sigma_{AB} < \sigma_{AC}$ when $E(p_r)$ is the same ; portfolio AB is more attractive.

D2. Refer to the case study "Time to Short Sell TEAM?" discussed in class. Suppose you decide to borrow and short sell 1,000 shares of the company at the end of September 2018 for US$96. You hold this position until the end of October 2018 when the price has fallen to US$76 and then cover your short position by buying back the shares at this price.

a) Calculate the dollar profit or loss on this short position at the end of October 2018. Calculate the percent profit or loss based on the dollar amount sold short.

Now assume that the day after you covered your short position you decide to borrow and short sell 1,000 shares of the company at US$76 per share. You hold this position until the end of December 2018 when the price has risen to US$89 and then cover your short position by buying back the shares at this price.

b) Calculate the dollar profit or loss on this short position at the end of December 2018. Calculate the percent profit or loss based on the dollar amount sold short.

c) What would the dollar profit or loss have been if instead of closing this position at the end of December 2018 you had held this position until the middle of March 2019 when the share price was around $108? Calculate the percent profit or loss based on the dollar amount sold short in this case.

d) Evaluate the overall risk associated with short selling. *No calculations needed.*

(handwritten)
(a) Difference = input − output
= 1000 ($96 − $76)
= $20,000
profit (since sell high buy low)

(b) Difference = 1000 ($76 − $89)
= −$13,000
loss (sell low buy high)

(c) p = 1000 ($76 − $108)
= −$32,000
percent = $\frac{\$76 - \$108}{\$76}$ = −0.421 = −42%

(d) higher value which more risky