Homework Assignment 2
Fall 2021
Due Date: November 25, 2021

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Question 1

Consider the following two mutually exclusive projects:

Year	Cash Flow(A)	Cash Flow(B)
0	-$470,000	-$40,000
1	30,000	21,000
2	60,000	15,000
3	60,000	18,000
4	670,000	11,500

Whichever project you choose, if any, you require a 16 percent return on your investment.

a) If you apply the NPV criterion, which investment will you choose? Why?

b) If you apply the IRR criterion, which investment will you choose? Why?

c) Based on your answers in (a) through (b), which project will you finally choose? Why?

Question 2

Consider the following information about three stocks:

35% 35% 30%

State of Economy	Probability of State of Economy	Rate of Return if State Occurs		
		Stock A	Stock B	Stock C
Boom	0.34	0.28	0.38	0.57
Normal	0.50	0.15	0.12	0.08
Bust	0.16	0.00	-0.27	-0.49

a) If your portfolio is invested 35 percent each in A and B and 30 percent in C, what is the portfolio expected return? The variance? The standard deviation?

b) If the expected T-bill rate is 3.20 percent, what is the expected risk premium on the portfolio?

Question 3

Suppose Johnson & Johnson and the Walgreen Company have expected returns and volatilities shown below, with a correlation of 22%.

	Expected Return	Standard Deviation
Johnson & Johnson	9%	15%
Walgreen Company	12%	22%

a) What is the expected return a portfolio that is equally invested in Johnson & Johnson's and Walgreen's stock?

b) What is the volatility (standard deviation) of this portfolio?

If the correlation between Johnson & Johnson's and Walgreen's stock were to increase,

c) Would the expected return of the portfolio rise or fall?

d) Would the volatility of the portfolio rise or fall?

Question 4

Consider the following information about Stocks I and II:

State of Economy	Probability of State of Economy	Rate of Return if State Occurs	
		Stock I	Stock II
Recession	0.16	0.24	-0.28
Normal	0.60	0.21	0.10
Irrational exuberance	0.24	0.09	0.45

The market risk premium is 8.5 percent, and the risk-free rate is 5 percent.

a) Which stock has the most systematic risk?

b) Which one has the most unsystematic risk?

c) Which stock is "riskier"? Explain.

Q1.

(a) $NPV_A = \frac{\$30000}{1.16} + \frac{\$60000}{1.16^2} + \frac{\$60000}{1.16^3} + \frac{\$670000}{1.16^4} - \$470000$

$= \$8926.34$ (2 d.p.) //

$NPV_B = \frac{\$21000}{1.16} + \frac{\$15000}{1.16^2} + \frac{\$18000}{1.16^3} + \frac{\$11500}{1.16^4} - \$40000$

$= \$7134.08$ (2 d.p.) //

$\because NPV_A > NPV_B > \$0$

$\therefore$ Investment A will be chosen. //

(b) $NPV_A = 0 = \frac{\$30000}{1+IRR} + \frac{\$60000}{(1+IRR)^2} + \frac{\$60000}{(1+IRR)^3} + \frac{\$670000}{(1+IRR)^4} - \$470000$

$IRR = 16.61\%$ (2 d.p.) //

$$NPV_B = 0 = \frac{\$21000}{1+IRR} + \frac{\$15000}{(1+IRR)^2} + \frac{\$18000}{(1+IRR)^3} + \frac{\$11500}{(1+IRR)^4} - \$40000$$

$$IRR = 25.50\% \text{ (2 d.p.)} //$$

$\because NPV_B > NPV_A >$ Required return rate (16%)

$\therefore$ Investment B will be chosen. //

(c) $\because$ IRR is unreliable in the nonconventional cash flows as shown in this case.

& NPV directly measures the increase in value to the firm.

$\therefore$ NPV criterion is applied when there is a conflict between NPV and another decision rule like this case.

$\therefore$ Investment A will be chosen. //

Q2.

(a) Expected return:

$$0.34 \times (0.35 \times 0.28 + 0.35 \times 0.38 + 0.3 \times 0.57)$$
$$+ 0.5 \times (0.35 \times 0.15 + 0.35 \times 0.12 + 0.3 \times 0.08)$$
$$+ 0.16 \times [0.35 \times 0.00 + 0.35 \times (-0.27) + 0.3 \times (-0.49)]$$
$$= 0.17729 \ //$$

Variance:

$$0.34 \times (0.462 - 0.17729)^2$$
$$+ 0.5 \times (0.05925 - 0.17729)^2$$
$$+ 0.16 \times (-0.03864 - 0.17729)^2$$
$$= 3.1595\% \quad (4 \text{ dp.}) \ //$$

Standard deviation:

$$\sqrt{0.03159500178}$$
$$= 17.7750\% \quad (4 \text{ dp.}) \ //$$

(b) Expected risk premium:

$$17.729\% - 3.20\%$$
$$= 14.529\% \ //$$

Q3.

(a) Expected return : $0.5 \times 9\% + 0.5 \times 12\%$

$= 10.5\%$ //

(b) Variance of two stocks :

$0.5 \times (15\%)^2 + 0.5 \times (22\%)^2$

$+ 2(0.5)^2 \times (15\%) \times (22\%)^2$

$= 0.03908$

$\therefore$ Volatility (Standard deviation) :

$\sqrt{0.03908}$

$= 19.7687\%$ (4 d.p.) //

(c) $\because$ Correlation $= \dfrac{\text{Covariance of two stocks}}{SD_{Johnson} \times SD_{Walgreen}}$

& $E(R_p) = W_1 \times E(R_1) + W_2 \times E(R_2)$

$\therefore$ The increase in correlation will not affect any items in expected return.

$\therefore$ No. //

(d) Volatility $= \sqrt{\text{Variance of two stocks}}$

$$= \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\,(\text{Correlation})}$$

(Correlation: ++)

∵ The increase in will lead to an increase in volatility.

∴ The volatility will rise. //

Q4.

(a) By applying Beta coefficient (β):

$$E(R_I) = R_f + \beta_I \times (E(R_m) - R_f)$$

$\because E(R_m) = 8.5\% + 5\% = 13.5\%$

& $E(R_I) = 0.16 \times 0.24 + 0.6 \times 0.21 + 0.24 \times 0.09$

$= 0.186$

$\therefore$ We have: $0.186 = 0.05 + \beta_I \times (0.135 - 0.05)$

$\beta_I = 1.6$ //

$\because E(R_I) = 0.16 \times (-0.28) + 0.6 \times 0.1 + 0.24 \times 0.45$

$= 0.1232$

$\therefore$ We have: $0.1232 = 0.05 + \beta_2 (0.135 - 0.05)$

$\beta_2 = 0.8612$ (4 d.p.)

$\because \beta_1 > \beta_2$

$\therefore$ Stock I has the most systematic risk. //

(b) Unsystematic risk = Total risk − systematic risk

$= SD - \beta \times \sqrt{Var(R_m)}$

$\because (SD_I)^2 = 0.16(0.24-0.186)^2 + 0.6(0.21-0.186)^2 + 0.24(0.09-0.186)^2$

$SD_I = \sqrt{0.03024}$

$= 5.4991\%$ (4 d.p.)

$\therefore$ Unsystematic risk of Stock I:

$5.4991\% - 1.6 \times \sqrt{Var(R_m)}$

$\because (SD_{II})^2 = 0.16(-0.28-0.1232)^2 + 0.6(0.1-0.1232)^2 + 0.24(0.45-0.1232)^2$

$SD_{II} = 22.7960\%$ (4 d.p.)

$\therefore$ Unsystematic risk of Stock II:

$22.7960\% - 0.8612 \times \sqrt{Var(R_m)}$

$\because$ From the above, we can observe that

Total risk of Stock I < Stock II

& Systematic risk of Stock I > Stock II.

$\therefore$ Stock II has the most unsystematic risk. //

(c) $\because SD_{II} > SD_I$ (Total risk of Stock II > Stock I)

$\therefore$ Stock II is "riskier". //