

7.14: Problems

? Problem 7.14.1

Find the expected return and standard deviation of each stock.

Stock A

Probability	Return
0.20	-30%
0.40	15%
0.40	30%

Stock B

Probability	Return
0.30	-5%
0.40	10%
0.30	20%

If you were going to put all of your money into one of these two stocks, which should you pick?

Answer

$$\text{Exp Ret } A = 0.20(-30\%) + 0.40(15\%) + 0.40(30\%) = -6\% + 6\% + 12\% = 12\%$$

$$\text{Exp Ret } B = 0.30(-5\%) + 0.40(10\%) + 0.30(20\%) = -1.5\% + 4\% + 6\% = 8.5\%$$

$$\text{St. Dev. } A = \sqrt{0.20(-30\% - 12\%)^2 + 0.40(15\% - 12\%)^2 + 0.40(30\% - 12\%)^2} \%$$

$$\text{St. Dev. } A = \sqrt{352.8 + 3.6 + 129.6}$$

$$\text{St. Dev. } A = 22.05\%$$

$$\text{St. Dev. } B = \sqrt{0.30(-5\% - 8.5\%)^2 + 0.40(10\% - 8.5\%)^2 + 0.30(20\% - 8.5\%)^2}$$

$$\text{St. Dev. } B = \sqrt{54.68 + 0.90 + 39.68}$$

$$\text{St. Dev. } B = 9.76\%$$

If you are going to put all of your money into one stock, you could choose either one. People that are more risk-averse will choose stock B while people that are less risk-averse will choose stock A. Note that both choices are consistent with risk aversion because the stock with the higher risk (stock A) also has a higher expected return.

? Problem 7.14.2

a. Find the expected return and standard deviation of each stock

Probability	Return of Stock C	Return of Stock D
0.30	-10%	25%
0.50	15%	10%
0.20	40%	0%

- b. Calculate the expected return and standard deviation of a portfolio made up of 50% stock C and 50% stock D if the correlation is -0.75.
- c. Would you prefer to put your money in stock C, stock D or the 50/50 portfolio? Explain.

Answer

Part a

$$\text{Exp Ret C} = 0.30(-10\%) + 0.50(15\%) + 0.20(40\%) = -3\% + 7.5\% + 8\% = 12.5\%$$

$$\text{Exp Ret D} = 0.30(25\%) + 0.50(10\%) + 0.20(0\%) = 7.5\% + 5\% + 0\% = 12.5\%$$

$$\text{St. Dev. C} = \sqrt{0.30(-10\% - 12.5\%)^2 + 0.50(15\% - 12.5\%)^2 + 0.20(40\% - 12.5\%)^2}$$

$$\text{St. Dev. C} = \sqrt{151.88 + 3.13 + 151.25}$$

$$\text{St. Dev. C} = 17.50\%$$

$$\text{St. Dev. D} = \sqrt{0.30(25\% - 12.5\%)^2 + 0.50(10\% - 12.5\%)^2 + 0.20(0\% - 12.5\%)^2}$$

$$\text{St. Dev. D} = \sqrt{46.88 + 3.13 + 31.25}$$

$$\text{St. Dev. D} = 9.01\%$$

Part b

$$\text{Exp Ret Port} = 0.5(12.5\%) + 0.5(12.5\%) = 12.5\%$$

$$\text{St. Dev. Port} = \sqrt{(0.5)^2(17.5\%)^2 + (0.5)^2(9.01\%)^2 + 2(0.5)(0.5)(17.5\%)(9.01\%)(-0.75)}$$

$$\text{St. Dev. Port} = \sqrt{76.56 + 20.30 + -59.13}$$

$$\text{St. Dev. Port} = 6.14\%$$

Part c

We should choose the portfolio because all three choices have the same expected return, but the portfolio has the lowest risk. All risk-averse investors will choose the portfolio over either stock individually in this situation.

? Problem 7.14.3

Assume you had two stocks. Stock A had an expected return of 20% and a standard deviation of 25%. Stock B had an expected return of 15% and a standard deviation of 20%. You want to create a portfolio made up of 65% stock A and 35% stock B. Find the expected return and standard deviation of this portfolio under the following conditions.

- Correlation between stock A and B is 1.0
- Correlation between stock A and B is 0.5
- Correlation between stock A and B is 0.0
- Correlation between stock A and B is -0.5
- Correlation between stock A and B is -1.0

Answer

Part a

$$\text{Exp Ret Port} = 0.65(20\%) + 0.35(15\%) = 18.25\%$$

$$\text{St. Dev. Port} = \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(1.0)}$$

$$\text{St. Dev. Port} = \sqrt{264.06 + 49 + 227.5}$$

$$\text{St. Dev. Port} = 23.25\%$$

Part b

$$\text{Exp Ret Port} = 0.65(20\%) + 0.35(15\%) = 18.25\%$$

$$\text{St. Dev. Port} = \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(0.5)}$$

$$\text{St. Dev. Port} = \sqrt{264.06 + 49 + 113.75}$$

$$\text{St. Dev. Port} = 20.66\%$$

Part c

$$\text{Exp Ret Port} = 0.65(20\%) + 0.35(15\%) = 18.25\%$$

$$\text{St. Dev. Port} = \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(0)}$$

$$\text{St. Dev. Port} = \sqrt{264.06 + 49 + 0}$$

$$\text{St. Dev. Port} = 17.69\%$$

Part d

$$\text{Exp Ret Port} = 0.65(20\%) + 0.35(15\%) = 18.25\%$$

$$\text{St. Dev. Port} = \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(-0.5)}$$

$$\text{St. Dev. Port} = \sqrt{264.06 + 49 + -113.75}$$

$$\text{St. Dev. Port} = 14.12\%$$

Part e

$$\text{Exp Ret Port} = 0.65(20\%) + 0.35(15\%) = 18.25\%$$

$$\text{St. Dev. Port} = \sqrt{(0.65)^2(25\%)^2 + (0.35)^2(20\%)^2 + 2(0.65)(0.35)(25\%)(20\%)(-1.0)}$$

$$\text{St. Dev. Port} = \sqrt{264.06 + 49 + -227.5}$$

$$\text{St. Dev. Port} = 9.25\%$$

Note that the expected return is not a function of the correlation while the standard deviation declines as the correlation drops. This is the "free lunch" of diversification - as long as we invest in securities with a correlation of less than one, we will lower our risk (st. deviation will be less than the weighted average of each stock's st. deviation) without lowering our expected return (the exp. return will be the weighted average of each stock's expected return).

? Problem 7.14.4

The stock of Ralph's Restaurants has a standard deviation of 70% and has a correlation with the market of 0.40. The expected return for the market is 13% and it has a standard deviation of 20%. Currently the risk-free rate of return is 5%.

- What is the beta for Ralph's Restaurants?
- What is the required return for Ralph's Restaurants?
- What is the expected return for Ralph's restaurants in equilibrium?

Answer

Part a

$$\text{Beta} = \frac{(70)(0.40)}{20} = 1.40$$

Part b

$$\text{Req. Return} = 5\% + 1.40(13\% - 5\%) = 5\% + 11.2\% = 16.2\%$$

Part c

In equilibrium, expected return equals required return. Since the required return is 16.2% the expected return should be 16.2% as well.

? Problem 7.14.5

We are purchasing a stock that just paid a dividend (D_0) of \$1.50. The growth rate in dividends for this stock is 4% and it has a beta of 1.3. The expected return on the market is 12% and the current Treasury rate is 7%. How much should we pay for this stock?

Answer

First, we know that the stock price should be found by using the following formula

$$P_0 = D_1 / (k - g)$$

Now, we need to find each of the three inputs. g is given at 4%.

$$D_1 = D_0(1 + g), \text{ so } D_1 = 1.50(1.04) = \$1.56.$$

$$k = k_{rf} + \beta (\overline{k_m} - k_{rf})$$

$$k = 7\% + 1.3(12\% - 7\%)$$

$$k = 13.5\%$$

Once we get all the inputs, we plug them back into the pricing model

$$P_0 = 1.56 / (.135 - .04) = \$16.42.$$

The most we should pay for the stock today is \$16.42

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