1. (Like problem 10.9 of the text) Suppose there are two stocks in the world, A and B. The expected returns are eleven percent for A and 18 percent for B, with standard deviations of eight percent for A and fifteen percent for B. The correlation coefficient of the two stocks is .4. What is the expected return and standard deviation of a portfolio that is 25 percent A and 75 percent B? 90 percent A and 10 percent B? Would a risk-averse investor willingly hold a portfolio that is 100 percent invested in stock A?

Answer:

<table>
<thead>
<tr>
<th>Portfolio Weights</th>
<th>.25, .75</th>
<th>.9, .1</th>
<th>1, 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Mean</td>
<td>.1625</td>
<td>.117</td>
<td>.11</td>
</tr>
<tr>
<td>Portfolio Standard Deviation</td>
<td>.121886</td>
<td>.079202</td>
<td>.08</td>
</tr>
</tbody>
</table>

The portfolio that is 90% A and 10% B has higher expected returns and lower risk measured by standard deviation of the rate of return.

2. (Like 10.30 of the text) Draw the security market line for the case in which the market-risk premium is eight percent and the risk-free rate is four percent. Suppose that asset A has a beta of .7 and an expected return of eight percent. Show it in the graph with well-labelled axes. Is asset A properly priced? If not, describe the type of arbitrage that is made possible by the pricing disparity. What happens to the price of asset A?

Answer: Asset A is overpriced. A portfolio consisting of 70% of the market portfolio (M) and 30% of the risk-free asset has the same risk, that is, the same beta, as asset A and it has a higher expected return. The needed arbitrage consists of selling short the overpriced asset A and with part of the proceeds buying portfolio B. The rest of the proceeds is the arbitrage profit. The position of being short A and long B is a zero beta position and therefore, in the context of CAPM, the same as riskless. The arbitrage tends to drive down the price of asset A and thus raising its expected return, eventually forcing asset A up to the security market line. 9.75
3. (Like 12.12 in the text) The equity beta for Showy Sneakers Inc. is 1.4. It has a debt-to-equity ratio of .5. The expected return on the market is 12.5 percent, the risk-free rate is four percent, the cost of debt capital to Showy Sneakers is seven percent, and the corporate tax rate is 34 percent. What is the required return to equity? What is its weighted average cost of capital? Explain, of course.

Answer:

\[ r_S = r_F + E[r_M - r_F] \beta \]
\[ = 4 + 8.5 \times 1.4 \]
\[ = 15.9 \]

This is the security market line. If there is enough space, define the variables. The market risk premium is the expected difference between the rate of return on the market and the risk free rate, that is 8.5.

\[ r_{WACC} = \frac{S}{S+B} r_S + \frac{B}{S+B} (1-T_C) r_B \]
\[ = \frac{2}{3} 15.9 + \frac{1}{3} 66 \times 7 \]
\[ = 12.14 \]

Here \( B = .5S \) leads to \( \frac{S}{S+B} = \frac{2}{3} \). The weighted average cost of capital is the proper rate for discounting the physical asset of a levered firm.

DO NOT HAND IN THE FOLLOWING PROBLEMS
LOOK AT THEM ENOUGH TO ASSURE THAT YOU COULD SOLVE THEM.

Supplemental 1. Find the mean, variance, covariance and correlation coefficient of the following two series, supposing that the data are from a sample. Put your answers in the table and your work below.

\[
\begin{array}{ccc}
\text{A} & \text{B} & \text{Answer} \\
50 & 40 & \text{Sample average} \\
32 & 60 & \text{Estimated variance} \\
-17 & -60 & \text{Estimated covariance} \\
33 & 31 & \text{Estimated Correlation Coefficient} \\
-1 & 2 & \end{array}
\]

\[
\begin{array}{ccc}
\text{A} & \text{B} & \text{Answer} \\
19.4 & 14.6 & \text{X} \\
755.3 & 2174.8 & \text{X} \\
1136.2 & \text{X} & \text{X} \\
\text{X} & \text{X} & \end{array}
\]

Supplemental 2. (Like problem 10.2 in the text) Suppose that you have invested in two stocks, A and B. You expect that returns on the stock will depend on the following three states of the economy, whose probabilities are given. Calculate the mean, standard deviation, covariance, and correlation of the two stocks. Put your answers in the table and your work nearby.

\[
\begin{array}{ccc}
\text{State} & \text{Probability} & \text{Return on A} & \text{Return on B} \\
\text{Bear} & .4 & 6.3 & -3.7 \\
\text{Normal} & .3 & 10.5 & 5.4 \\
\text{Bull} & .3 & 13.6 & 25.3 \\
\text{Answer} & \text{mean} & 9.75 & 7.73 \\
\text{standard deviation} & 3.062107 & 12.10363995 & 19. \\
\text{covariance} & 35.5425 & \text{X} \\
\text{correlation coefficient} & 0.958985 & \text{X} \\
\end{array}
\]

16
1. (Like 15.1) Gaucho Inc. and Triton Corp. are identical in every way except for their capital structures. They have the same operating cash flows. Neither firm pays taxes, and taxes on investors are ignored. Bankruptcy is not in the picture. Gaucho is an all-equity firm with equity valued at $4 million. Triton Corp. uses leverage in its capital structure. Its debt has a market value of $1.5 million. Investors can borrow or lend money at the same rate as Triton can. Explain why Triton has the same asset value as Gaucho by answering the following questions?

   a. Suppose that the market value of Triton equity is $3 million. Describe the homemade leverage that permits the investor to get the same returns as Triton more cheaply by buying stock in Gaucho and making one additional transaction.

   **Answer:** The investor borrows $1.5 million (the additional transaction) and buys Gaucho for $4 million, for a net cost of $2.5 million. Because the firms have the same operating cash flows, the investor now has the same pattern of cash flows as if he had bought the equity of Triton, but he saved $0.5 million.

   b. Suppose that the market value of Triton equity is $2 million. Describe the homemade leverage that permits the investor to get the same returns as Gaucho more cheaply by buying stock in Triton and making one additional transaction.

   **Answer:** The investor buys bonds worth $1.5 million (the additional transaction). For instance, he could simply buy all of Triton’s outstanding bonds. He or she also buys all of Triton’s equity for $2 million for a total cost of $3.5 million. The total is less than the cost of buying Gaucho and, because the firms have the same operating cash flows, the investor now has the same pattern of cash flows as if he had bought Gaucho, but he has saved $0.5 million.

   c. In the situation of part b, describe a profitable riskless arbitrage.

   **Answer:** Sell Gaucho short, receiving $4 million. Buy all of Triton’s equity and debt (or $1.5 million of corporate debt of some other firm). Cost of the purchases is $3.5 million. Pocket the arbitrage profit of $0.5 million. The position is riskless because the cash flows the arbitrageur owes from his short position in Gaucho are all supplied by his long position in Triton and bonds.

   d. Given that the market value of Triton is $4 million, what is the value of the equity of Triton? __$2.5 million__ What is Triton’s debt-equity ratio? __0.666__

2. (Like 14.4 of the text) The shareholders of Wyoming Anchovies need to elect 13 members to the board of directors. What fraction of the shares of is needed to assure the election of at least one director under cumulative voting? Explain. Why might it be possible to elect one director with even fewer shares?

   **Answer:** Under cumulative voting, all candidates are on a single slate, and the 13 top vote-getters will be seated on the board. To be assured of a seat, the minority shareholder needs a fraction \( \frac{1}{13} \) of the shares of the firm, plus one share. Suppose he had exactly \( \frac{1}{13} \). The majority has then \( \frac{12}{13} \) of the shares. In the worst case the majority distributes her votes equally among the 13 candidates she favors, so that each of her candidates gets \( \frac{1}{13} \). There is now a 14-way tie in the voting. If the minority share-holder has just one more share, he breaks the tie and his candidate is seated on the board along with 12 candidates from the majority.

   If the majority is confused, disorganized, lacks discipline, or is otherwise imperfectly coordinated, she (or they) will not distribute the \( \frac{13}{14} \) of the votes evenly among 13 candidates. That means some majority candidate gets less than \( \frac{1}{13} \) of the votes and that candidate might be defeated by the minority candidate will less than \( \frac{1}{13} \) of the votes.
3. (Similar to items 15.12-15.15.) An all-equity firm is subject to a 34 percent corporate tax rate. The firm’s initial market value is $15,000,000 and there are 3,000,000 shares outstanding. The firm issues $3,000,000 worth of bonds using the proceeds to repurchase its common stock. The firm is in no danger of financial distress and only corporate taxes are considered. By the Modigliani-Miller theory, show that the new market value of the firm is $16,020,000 and the new value of the equity is $13,020,000. Explain briefly.

Answer: This is Modigliani-Miller with taxes but no threat of bankruptcy. The value of the levered firm is

\[ V_L = V_U + T_C B \] (4)

The problem says that \( V_U = $15 \) million. Then \( T_C B = .34 \ast $3 \) million or $1.02 million. Hence the firm is worth $16.02 million. From \( V_L = S_L + B \) one finds the value of equity, \( S_L \), is $16.02 − $3 = $13.02 million.

The equity holders require a 20 percent rate of return on the all-equity firm. The bond rate is 10 percent. What rate of return do they require on the levered firm? (Hint3: Modigliani-Miller II with taxes)

Answer: Apply

\[ r_S = r_0 + \frac{B}{S_L} (1 - T_C)(r_0 - r_B) \] (5)

with the result \( r_S = .2 + \frac{3}{13.02}(.66)1 = 0.21521 \). The answer should define all of the variables.

1. Explain the Miller model of debt and equity. What are the effects of a rise in the rate of taxation of capital gains?

Answer: In answering this problem a person should define and use the following terms: tax-class clientele, demand for earnings packaged as equity, demand for earnings packaged as debt. He or she should describe the actions of financial managers of firms in the model. The answer should refer very briefly to Modigliani-Miller with no taxes and state that, "in equilibrium a firm cannot raise its value by restructuring." It should describe disequilibrium. Two diagrams should appear, the channels diagram and the goal-post diagram, accurately labelled. The second diagram should also illustrate the decrease in demand (the shift in the demand curve) for equity, and the consequent decrease in the quantity demanded of equity, the increase in the quantity demanded of debt, and the fall in the price of debt and equity.

![Image of Capital-gains tax increase diagram]
2. (Miller model again) $T_C = .34$ is the corporate tax rate, the value of EBIT packaged as equity is $v_e$ and the demand for such equity is

$$e = 300 - 10v_e - 300T_C$$

Similarly demand for EBIT packaged as debt is

$$d = 180 - 10v_d$$

where $v_d$ is the value of debt. Total cash flows in the economy are 150. What are the values of $d$ and $e$ in equilibrium? Illustrate in a diagram.

**Answer:** The diagram needed here is the goal-post diagram of the Miller model. Algebraically, solve the two equation using $v_d = v_e$ and $d = e = 150$. The solution is $v_e = v_d = 11.4$, $e = 84$, and $d = 66$.

(Second part) If the corporate tax rate falls to $T_C = .3$, what happens to $e, d, v_e$, and $v_d$? Illustrate.

**Answer:** The diagram should show the shift upwards of the demand curve for equity. The numerical solutions are $v_e = v_d = 12$, $e = 90$, and $d = 60$. 