Practice Set

CAPM
1. Suppose the annual rate of return on short-term government securities (risk-free) is 3%. Suppose asset A has a beta of 2 and an expected annual return of 15%.

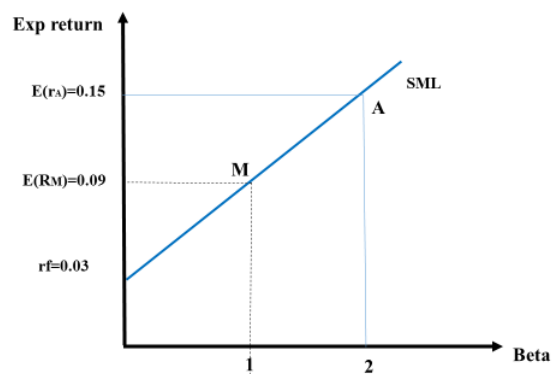   a) What is the expected annual return on the market according to CAPM?

    Answer

    $$E(R_A) = r_f + \beta_A (E_M - r_f)$$

    Thus: $E_M = \dfrac{E(R_A) - r_f}{\beta_A} + r_f = \dfrac{0.15 - 0.03}{2} + 0.03 = 0.09$ or 9%

    a) Draw a diagram showing the security market line, the risk free rate, the expected annual return of the market and the annual return of asset A.

    Answer

    b) Calculate the expected annual return on an asset B with a beta of 0.7

    Answer

    $$E(R_B) = r_f + \beta_B (E_M - r_f) = 0.03 + 0.7 \times (0.09 - 0.03) = 0.03 + 0.07 \times 0.06 = 0.072$$

    c) Suppose you bought asset B at £10 and sold it after one year for £12. Calculate the realized annual return on asset B.
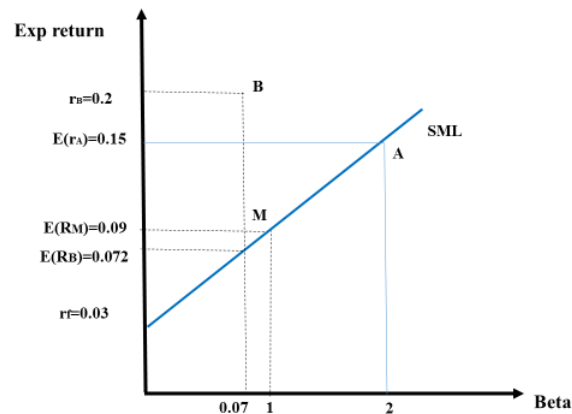
    Answer

    $$R_B = \frac{120 - 100}{100} = 0.2$$

d) Determine whether asset B is overpriced or underpriced by the market.

Answer

Asset B has a higher return than the one determined through CAPM, which means that the market does not price correctly this asset. Asset B is underpriced by the market.

The alpha of stock B is: $\alpha_B = 0.2 - 0.072 = 0.128 > 0$

e) Explain the difference between security market line and capital market line.

Answer

CML graphs risk premiums of **efficient portfolios** as a function of portfolio standard deviation

Standard deviation is a valid measure of risk for efficiently diversified portfolios that are candidates for an investors' overall portfolio.

SML graphs individual asset risk premiums as a function of asset risk, where the appropriate risk measure is the contribution of that asset to the total portfolio risk - the beta
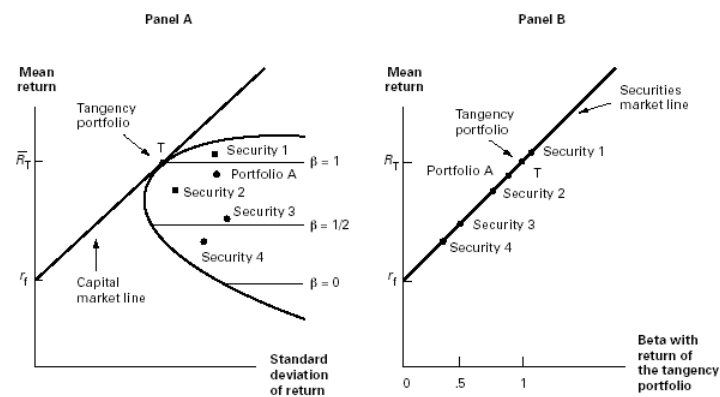
2. The T-bill rate is 4% and the expected return on the market is 12%. Using the CAPM:

    (a) What is the risk premium on the market?

    Answer

    Market risk premium = $E(r_m) - r_f = 0.12 - 0.04 = 0.08 = 8.0\%$

    (b) What is the expected return on an investment with a beta of 1.5?

    Answer

    Use the security market line: $E(r) = r_f + \beta(E(r_m) - r_f)$

    $E(r) = 0.04 + [1.5 \times (0.12 - 0.04)] = 0.16 = 16.0\%$

    (c) What is the expected return of an investment with a beta of 0.8?

    Answer

    $E(r) = r_f + \beta(E(r_m) - r_f)$ with $\beta = 0.8$

    $E(r) = 0.04 + [0.8 \times (0.12 - 0.04)] = 0.104 = 10.4\%$

    (d) If the market expects a return of 11.2% from stock X, what is its beta?

    Answer

    $E(r) = r_f + \beta(E(r_m) - r_f)$

    $0.112 = 0.04 + \beta(0.12 - 0.04) \Rightarrow \beta = 0.9$

3. You are a consultant to a large manufacturing corporation that is considering a project with the following net cash flows (in millions of dollars):

Years	Cash Flow
0	-40
1-10	15

    The project's beta is 1.8. Assuming that the risk free rate is 8% and the expected market return is 16%, what is the NPV (net present value) of the project?

    Answer

    The appropriate discount rate for the project is:

    $r_f + \beta[E(r_m) - r_f] = 0.08 + [1.8 \times (0.16 - 0.08)] = 0.224 = 22.4\%$

    Using this discount rate:

$$NPV = -40 + \sum_{t=1}^{10} \frac{15}{1.224^t} = 18.09$$

4. Suppose the rate of return on short-term government securities (risk-free) is 5%. Suppose also that the expected return required by the market for a portfolio with a beta of 1 is 12%. According to the CAPM:

   (i) What is the expected rate of return on the market portfolio?

   Answer: 12%

   (ii) What would be the expected rate of return on a stock with beta=0?

   Answer: 5%

   (iii) Suppose you consider buying a share of stock at $40. The stock is expected to pay $3 dividends next year and you expect it to sell then for $41. What is the return you expect from the stock? The stock risk has been evaluated at beta= -0.5. Is the stock overpriced or underpriced?

   Answer

   Actual expected return: 10%
   CAPM Expected return: 0.05+(0.12-0.05)×(-0.5)=0.015 or 1.5%
   The stock is underpriced

5. An investor knows the following information about the mean returns and covariances for three Italian companies: Unicredito Italiano, Telecom Italia and Fiat.

Stock	Correlation with			Historical Return	Variance
	Unicredito Italiano	Telecom Italia	Fiat		
Unicredito Italiano	1	0.14	0.15	16.8%	19.2
Telecom Italia	0.14	1	0.36	-6%	22.8
Fiat	0.15	0.36	1	49%	58.1

   a) Compute the tangency portfolio weights assuming a risk free asset yield of 5%.