Compute the cost of capital for the following:

a. Bond (debt) (K_d)
b. Preferred stock (K_p)
c. Common equity in the form of retained earnings (K_e)
d. New common stock (K_n)
e. Weighted average cost of capital

36. A Dozen Monkeys Ltd. has the following right-hand side of its balance sheet:

Debt: 8% coupon, 12 years to maturity	$ 8,000,000
Preferred shares: 5% dividend	1,000,000
Common shares: 750,000 outstanding	1,500,000
Retained earnings	4,500,000
	$15,000,000

New debt could be issued to yield 10 percent, with flotation costs netting the firm $970 on each $1,000 bond. Preferred shares would require a current yield of 8 percent, with aftertax flotation costs of 4 percent. Common shares currently trade at $15.00, but new shares would be discounted to $14.25 to encourage sales. Aftertax flotation costs on new common shares would be 5 percent. The anticipated dividend growth rate is 6 percent. The expected dividend is $1.50. A Dozen Monkeys Ltd. has a 40 percent tax rate and would require new share capital to fund new investments.

a. Based on market value weightings, calculate Monkey's weighted average cost of capital.

37. Island Capital has the following capital structure:

Bonds	$20,000,000
Perpetuals (preferred shares)	4,000,000
Common shares	20,000,000
Retained earnings	19,500,000
	$63,500,000

The existing bonds have a coupon rate of 8 percent with 18 years left to maturity, but current yields on these bonds are 11 percent. Flotation costs of $25.00 per $1,000 bond would be expected on a new issue.

The existing perpetuals have a $25.00 par value and an annual dividend rate of 9 percent. New perpetuals could be issued at a $50.00 par value with an 8 percent yield. Flotation costs would be 3 percent.

There are four million common shares outstanding that currently trade at $18.00 per share and expect to pay a dividend next year of $1.75 that will continue to grow at 7 percent per annum for the foreseeable future. New shares could be issued at $17.50 and would require flotation expenses of 5 percent of proceeds.

Island's tax rate is 39 percent, and it is expected that internally generated funds will be sufficient to fund capital projects in the near future.

a. Compute Island Capital's current cost of capital with market value weightings.
b. How would the cost of capital calculation change if new shares are required to fund the equity component of the capital structure?

38. Trois-Rivières Manufacturing has 10,000 bonds (face value of $1,000 each) with a 10 percent coupon maturing in 8 years. Its preferreds (100,000 shares) have a face value of $25 and pay a 7.5 percent dividend, and it has 600,000 common shares outstanding. Retained earnings are reported at $4,500,000.

    During the last five years, Trois-Rivières Manufacturing has enjoyed steady growth, with common stock dividends growing from $0.80 to $1.23 (just recently paid). The common share price currently trades at $15.00. If new shares were issued at $15.00, they would require flotation expenses of 7 percent of proceeds.

    The preferred shares currently trade at $26.50, and any new issue would require flotation expenses of 5 percent of price to investors.

    The bonds currently pay interest semiannually and are trading at a price that yields a nominal 12 percent annual rate (12.36 effective annual rate). Flotation costs of new debt would be 4 percent of proceeds.

    Trois-Rivières' tax rate is 38 percent, and equity financing would require a new share issue.

    a. Calculate the weighted average cost of capital of Trois-Rivières Manufacturing.

39. Murchie's is considering diversification by way of acquisition to reduce its reliance on its volatile core business. Mad Max, the CEO, has asked for your calculation of a discount rate to be used to analyze the potential acquisition targets. The following information has been assembled.

Long-term bonds	$10,000,000
Subordinated perpetual bonds	2,000,000
Common shares	2,062,500
Retained earnings	937,500
	$15,000,000

    The yield on 98-day Treasury bills is 7.38 percent. Long-term debt has 15 years to maturity and has a coupon rate of 12 percent paid semiannually. Currently the bonds are trading at a premium of 15 percent to face value. A new debt issue would incur flotation costs of 3 percent of the issue price.

    The perpetual bonds were issued at a yield of 9 percent but currently are trading to yield 12 percent. The flotation costs of a new issue would be 4 percent.

    There are 750,000 common shares outstanding, currently priced at $4.50. Murchie's, with a beta of 1.7, is planning a dividend of $0.10. Future growth is suggested at a compound annualized rate of 15 percent. A new issue of common shares would net the firm $4.10 per share. Murchie's tax rate is 43 percent. Internally generated funds will not be sufficient to fund future expansion plans.

    a. Calculate Murchie's weighted average cost of capital.
    b. Calculate Murchie's weighted average cost of capital if it has negative income for tax purposes.
    c. Comment on the appropriateness of Murchie's present capital structure.
    d. Comment on the use of the weighted average cost of capital as calculated to analyze the suggested acquisitions.

APPENDIX 11A

Cost of Capital and the Capital Asset Pricing Model

The work of Harry Markowitz, examined in Chapter 13, highlights the importance of thinking of investments, their returns, and their risks in a portfolio context. The risk of an investment is not so much its individual risk but the risk it adds to a portfolio, or collection of assets. Individual, or unique, risks tend to disappear (they cancel each other out) within a portfolio. However, some risk still remains, and it is this risk that is of interest as it will shape the value that investors or shareholders place on assets. William Sharpe and others developed a model that focused on the risk that cannot be diversified away, which suggests that the nondiversifiable risk will determine the pricing of assets in an efficient market. Efficient markets are examined in Chapter 14.

The Capital Asset Pricing Model

The capital asset pricing model (CAPM) relates the risk-return tradeoffs of individual assets to market returns. It suggests the expected return of an asset based on the asset's risk that cannot be diversified away. Common stock returns over time have generally been used to test this model, since stock prices are widely available and efficiently priced, as are market indexes of stock performance. In theory, the CAPM encompasses all assets, but in practice it is difficult to measure returns on all types of assets or to find an all-encompassing market index. For our purposes, we use common stock returns to explain the model, and occasionally we generalize to other assets.

The basic form of the CAPM is a linear relationship between returns on individual stocks and stock market returns over time. By using least squares regression analysis, the return on an individual stock, K_j, is expressed in formula 11A–1.

$$K_j = \alpha + \beta_j R_m + e \quad \text{(11A–1)}$$

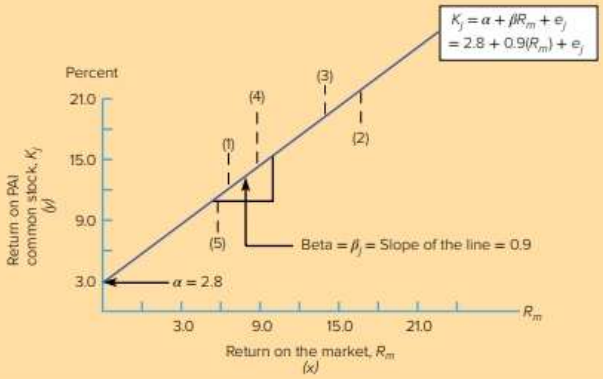
Where

K_j = Return on individual common stock of a company
α = Alpha, the intercept on the y-axis
β_j = Beta, the coefficient of stock (j)
R_m = Return on the stock market (an index of stock returns is used, usually the S&P/TSX Composite Index)
e = Error term of the regression formula

As indicated in Table 11A–1 and Figure 11A–1, this formula uses historical data to generate the alpha coefficient (α) and the beta coefficient (β_j), a measurement of the return performance of a given stock versus the return performance of the market. Assume we want to calculate a beta for Parts Associates Inc. (PAI), and we have the performance data for that company and the market shown in the table. The relationship between PAI and the market appears graphically in the figure.

	Rate of Return on Stock	
Year	PAI	Market
1	12.0%	10.0%
2	16.0	18.0
3	20.0	16.0
4	16.0	10.0
5	6.0	8.0
Mean return	**14.0%**	**12.4%**
Standard deviation	**4.73%**	**3.87%**

Table 11A–1 Performance of PAI and the market



Year	K_j	R_m	$\Sigma K_j R_m$ 936	$\Sigma K_j \Sigma R_m$ 4,340	ΣR_m^2 844	$(\Sigma R_m)^2$ 3,844
1	12%	10%	$\beta_j = \frac{n\Sigma K_j R_m - \Sigma K_j \Sigma R_m}{n\Sigma R_m^2 - (\Sigma R_m)^2} = \frac{5(936) - 4{,}340}{5(844) - 3{,}844} = 0.9$			
2	16	18	$\alpha = \frac{\Sigma K_j - \beta \Sigma R_m}{n} = \frac{70 - 0.9(62)}{5} = 2.8$			
3	20	16				
4	16	10				
5	6	8				
	70%	62%				

BA II [2nd] {STAT} LIN
Input [2nd] {DATA}
X01 = 10 [Enter] [↓] Y01 12 [Enter]
[↓] X02 = 18 [Enter] [↓] Y02 16 [Enter]
[↓] X02 = 16 [Enter] [↓] Y02 20 [Enter]
[↓] X02 = 10 [Enter] [↓] Y02 16 [Enter]
[↓] X02 = 8 [Enter] [↓] Y02 6 [Enter]
[2nd] [STAT] [↓] Repeat

SHARP	[Mode]		[1] [1]	Stat
Input 10	[(x, y)]	12	[Data]	Note that the values for the x axis (R_m are input first.)
18	[(x, y)]	16	{Data}	
16	[(x, y)]	20	{Data}	
10	[(x, y)]	16	{Data}	
8	[(x, y)]	6	{Data}	
[RCL]	{a} gives	2.79		This is the alpha coefficient.
[RCL]	{b} gives	.90		This is the beta coefficient.
[RCL]	{r} gives	.74		This is the correlation coefficient, a measure of how well the formula describes the relationship. The closer to 1.00, the better the fit.

Figure 11A–1 Linear regression of returns between PAI and the market

The alpha term in Figure 11A–1 of 2.8 percent is the ***y***-intercept of the linear regression. It is the expected return on PAI stock if returns on the market are zero. However, if the returns on the market are expected to approximate the historical rate of 12.4 percent, the expected return on PAI would be $K_j = 2.8 + 0.9(12.4) = 14.0$ percent. This maintains the historical relationship. If the returns on the market are expected to rise to 18 percent next year, expected return on PAI would be $K_j = 2.8 + 0.9(18.0) = 19$ percent.

The error term (***e***) is useful in determining the degree of confidence we would have in estimates of returns based on the regression line. From the historical data, it is evident that not all observations lie on the regression line, and yet we propose to use the relationship that it suggests to predict return expectations in the future. On the basis of the historical observations that do not fit on the line, the error terms, we can express the likelihood that our predicted returns are within an acceptable range of the prediction. Statistically, this involves calculating the standard error of the estimate.

As the CAPM is developed, our focus will be on the beta term. If we plot only excess returns—that is, asset and market returns above the risk-free rate of return—it is found that alpha is not significantly different from zero. In addition, our expectation for the error term is also zero. In a diversified portfolio, the error terms tend to offset each other.

Notice that we are talking in terms of expectations. The CAPM is an expectational (ex ante) model, and there is no guarantee that historical data will reoccur. One area of empirical testing involves the stability and predictability of the beta coefficient based on historical data. Research has indicated that betas are more useful in a portfolio context (for groupings of stocks) because the betas of individual stocks are less stable from period to period than portfolio betas. In addition, research indicates betas of individual common stocks have a tendency to approach 1.0 over time.

The Security Market Line

The capital asset pricing model evolved from formula 11A–1 into a risk premium model where the basic assumption is that investors expected to take more risk must be compensated by larger expected returns. Investors should also not accept returns that are less than they can get from a riskless asset. For CAPM purposes, it is assumed that short-term government Treasury bills may be considered a riskless asset.[9] When viewed in this context, an investor must achieve an extra return above that obtainable from a Treasury bill to induce the assumption of more risk. This brings us to the more common and theoretically useful model:

$$K_j = R_f + \beta_j(R_m - R_f) \quad \text{(11A–2)}$$

Where

R_f = Risk-free rate of return
β_j = Beta coefficient from formula 11A–1
R_m = Return on the market index
$R_m - R_f$ = Premium or excess return of the market versus the risk-free rate (since the market is riskier than R_f, the assumption is that the expected R_m will be greater than R_f)
$\beta_j(R_m - R_f)$ = Expected return above the risk-free rate for the stock of company ***j***, given the level of risk

The model centres on beta, the coefficient of the premium demanded by an investor to invest in an individual stock. For each individual security, beta measures the sensitivity (volatility) of the security's return to the market. By definition, the market has a beta of 1.0, so if an individual company's beta is 1.0, it can expect to have returns as volatile as the market and total returns equal to the market. A company with a beta of 2.0 would be

[9] A number of studies have also indicated that longer–term government securities may appropriately represent R_f (the risk–free rate).

twice as volatile as the market and would be expected to generate more returns, whereas a company with a beta of 0.5 would be half as volatile as the market.

The term $(R_m - R_f)$ indicates common stock is expected to generate a rate of return higher than the return on a Treasury bill. This makes sense, since common stock has more risk. In fact, research by Roger Ibbotson shows that this risk premium over the last 83 years is close to 6.5 percent on average, but exhibits a wide standard deviation.[10] In the actual application of the CAPM to cost of capital, companies often use this historical risk premium in their calculations. In our example, we use 6.5 percent to represent the expected $(R_m - R_f)$.

Ibbotson SBBI Classic Yearbook
corporate.morningstar.com/

For example, assuming the risk-free rate is 5.5 percent and the market risk premium $(R_m - R_f)$ is 6.5 percent, the following returns would occur with betas of 2.0, 1.0, and 0.5:

$$K_2 = 5.5\% + 2.0(6.5\%) = 5.5\% + 13.0\% = 18.5\%$$
$$K_1 = 5.5\% + 1.0(6.5\%) = 5.5\% + 6.5\% = 12.0\%$$
$$K_{.5} = 5.5\% + 0.5(6.5\%) = 5.5\% + 3.25\% = 8.75\%$$

FINANCE IN ACTION

Risks and Returns

In early 2017 the following betas were reported for three companies listed on the Toronto Stock Exchange (TSX).

BCE (BCE)	0.38
Telus (T)	0.94
Encana (ECA)	1.87

These betas give us a sense of the performance we should expect from each of the companies. We measure performance based on changes in the company's market share price. BCE would be least sensitive to market movements, whereas Encana, a world leader in energy producer, would be most sensitive to market movements. In an up market, Encana's share price would be expected to outperform the two other companies. This would, however, be appropriate, given that with a higher beta Encana would be riskier. In a down market, Encana would be expected to underperform the other companies.

A portfolio with equal value weightings of the three stocks would have a beta of 1.06 (0.38 × 0.33 + 0.94 × 0.33 + 1.87 × 0.33). This portfolio, with virtually the same beta, would be expected to perform similarly to the market, which has a beta of 1. A portfolio beta would be a more reliable estimate of performance because, through the benefits of diversification, the individual risks of each company would be reduced. Although beta measures risk in relation to the market fairly well, it does not capture the individual risk of a company's performance (the error term in formula 11A–1).

In constructing an individual's portfolio of investments, betas can be used (and are by investment managers) to assemble a collection of stocks. Betas would be used to construct a portfolio based on an investor's attitude toward risk and expected returns. Higher-beta portfolios would expect greater returns, but with greater risks.

Q1 What are the current betas of these companies?

Q2 Can you find any Canadian companies with higher betas?

reuters.com/finance/stocks

[10] Ibbotson, *SBBI Classic Yearbook, Stocks, Bonds, Bills and Inflation:* 2013 (Chicago, IL: Morningstar, 2013).

The beta term measures the riskiness of an investment relative to the market. To outperform the market, one would have to assume more risk by selecting assets with betas greater than 1.0. Another way of looking at the risk-return tradeoff would be that if less risk than the market is desired, an investor would choose assets with a beta of less than 1.0. Beta is a good measure of a stock's risk when the stock is combined into a portfolio, and therefore, it has some bearing on the assets a company acquires for its portfolio of real capital.

In Figure 11A–1, individual stock returns were compared to market returns, and the beta from formula 11A–1 was shown. From formula 11A–2, the risk premium model, a generalized risk-return graph called the security market line (SML) can be constructed that identifies the risk-return tradeoff of any common stock (asset) relative to the company's beta. This is shown in Figure 11A–2.

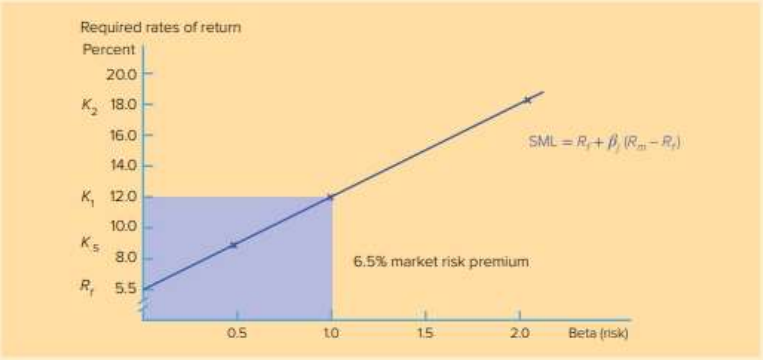


Figure 11A–2 The security market line (SML)

The required return for all securities can be expressed as the risk-free rate plus a premium for risk. Thus, we see that a stock with a beta of 1.0 would have a risk premium of 6.5 percent added to the risk-free rate of interest, 5.5 percent, to provide a required return of 12 percent. Since a beta of 1.0 implies risk equal to the stock market, the return is also at the overall market rate. If the beta is 2.0, twice the market risk premium of 6.5 percent must be earned, and we add 13 percent to the risk-free rate of 5.5 percent to determine the required return of 18.5 percent. For a beta of 0.5, the required return is 8.75 percent.

Cost of Capital Considerations

When calculating the cost of capital for common stock, remember that K_e is equal to the expected total return from the dividend yield and capital gains.

$$K_e = \frac{D_1}{P_0} + g$$

K_e is the return required by investors based on expectations of future dividends and growth. The SML provides the same information, but in a market-related risk-return model. As required returns rise, prices must fall to adjust to the new equilibrium return level, and as required returns fall, prices rise. Stock markets are generally efficient, and when stock prices are in equilibrium, the K_e derived from the dividend model is equal to K_j derived from the SML. However, just as with the dividend valuation model we had to allow for flotation costs on a new share issue, we must do the same for the CAPM. We adjust K_j by multiplying by P_0/P_n.

The SML helps us to identify several circumstances that can cause the cost of capital to change. Figure 11–2 examined required rates of returns over time with changing interest rates and stock prices. Figure 11A–3 does basically the same thing, only through the SML format.

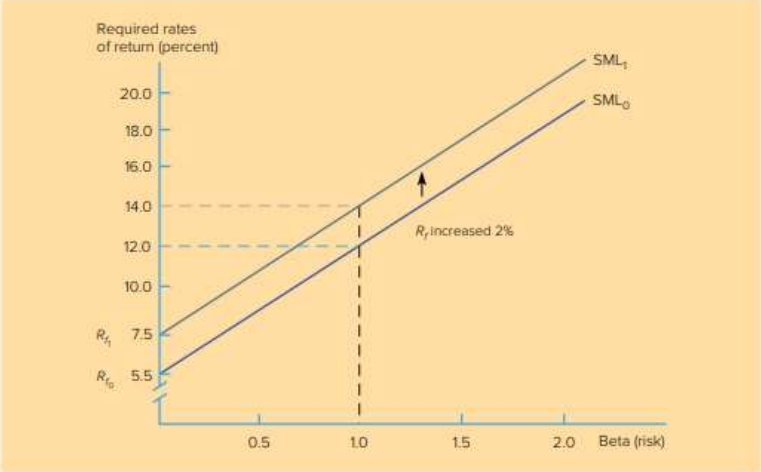


Figure 11A–3 The SML and changing interest rates

When interest rates increase from the initial period (R_{f_0} versus R_{f_1}), the security market line in the next period is parallel to SML_0, but higher. This means that required rates of return have risen for every level of risk, as investors desire to maintain their risk premium over the risk-free rate.

One very important variable influencing interest rates is the rate of inflation. As inflation increases, lenders try to maintain their real dollar purchasing power, so they increase the required interest rates to offset inflation. The risk-free rate can be thought of as

$$R_f = RR + IP$$

Where

RR = The real rate of return on a riskless government security when inflation is zero
IP = An inflation premium that compensates lenders (investors) for loss of purchasing power

An upward shift in the SML indicates that the prices of all assets shift downward as interest rates move up. In Chapter 10, this was demonstrated in the discussion showing that when market interest rates went up, bond prices adjusted downward to make up for the lower coupon rate (interest payment) on the old bonds.

Another factor affecting the cost of capital is a change in risk preferences by investors. As investors become more pessimistic about the economy, they require larger premiums for assuming risks. Even though the historical average market risk premium may be close to 6.5 percent, this is not stable, and investors' changing attitudes can have a big impact on the market risk premium. A more risk-averse attitude shows up in higher required stock returns and lower stock prices. For example, if investors raise their market risk premium to 8 percent, the rates of return from the original formulas increase as follows:

$$K_2 = 5.5\% + 2.0\ (8.0\%) = 5.5\% + 16.0\% = 21.5\%$$
$$K_1 = 5.5\% + 1.0\ (8.0\%) = 5.5\% + 8.0\% = 13.5\%$$
$$K_{.5} = 5.5\% + 0.5\ (8.0\%) = 5.5\% + 4.0\% = 9.5\%$$

The change in the market risk premium causes the required market return (beta = 1.00) to be 13.5 percent instead of the 12 percent, from Figure 11A–2. Any asset riskier than the market would have a larger increase in the required return. For example, a stock with a beta of 2.0 would need to generate a 21.5 percent return, instead of the 18.5 percent in the figure. The overall shape of the new security market line (SML_1) is shown in Figure 11A–4. Note the higher slope for SML_1, in comparison to SML_0.

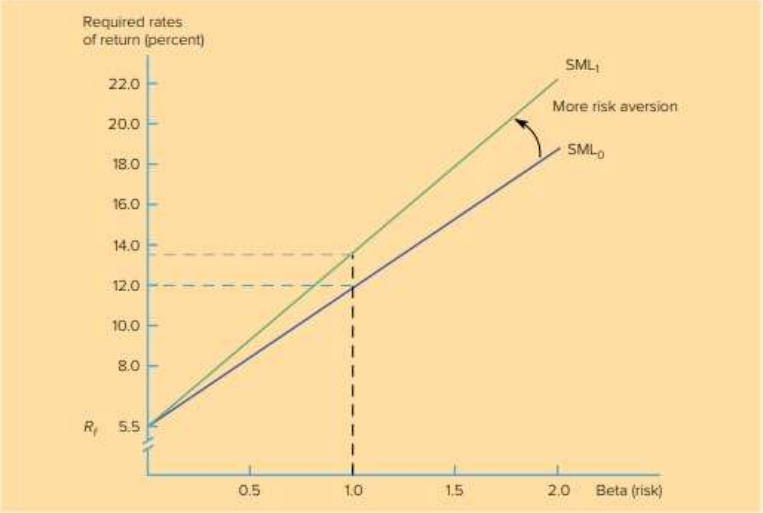


Figure 11A–4 The SML and changing investor expectations

In many instances, rising interest rates and pessimistic investors go hand in hand, so the SML may change its slope and intercept at the same time. This combined effect would cause both severe drops in the prices of risky assets and much larger required rates of return for such assets.

The capital asset pricing model and the SML have been presented to further your understanding of market-related events that affect the firm's cost of capital, such as market returns and risk, changing interest rates, and changing risk preferences.

Although the capital asset pricing model has received criticism because of the difficulties of dealing with the betas of individual securities and because of the problems involved in consistently constructing the appropriate slope of the SML to represent reality, it provides some interesting insights into risk-return measurement.

REVIEW OF FORMULAS

1. $$K_j = \alpha + \beta_j R_m + e \qquad (11A\text{–}1)$$

2. $$K_j = R_f + \beta_j (R_m - R_f) \qquad (11A\text{–}2)$$

DISCUSSION QUESTIONS

11A–1. How does the capital asset pricing model help explain changing costs of capital? (LO2)

11A–2. Why does K_e approximate K_j, or why does $D_1/(P_0 - g)$ approximate $R_f + \beta_j(R_m - R_f)$? (LO3)

11A–3. How does the SML react to changes in the rate of interest, changes in the rate of inflation, and changing investor expectations? (LO1, LO3)

11A–4. If an individual stock lay above the SML, what would be an appropriate investment strategy? Why? (LO2)

11A–5. Why would an efficient market be an important assumption for the development of the CAPM? (LO1)

11A–6. Why do you think the CAPM is or is not useful to the financial manager? (LO2)

INTERNET RESOURCES AND QUESTIONS

Betas and other useful share information are available on many Canadian companies at Thomson Reuters:
reuters.com/finance/stocks

BigCharts provides historical quotes on stocks and the S&P/TSX Composite Index (CA:$ISPTX) going back several years:
canada.bigcharts.com

Perimeter CBID identifies yields on Government of Canada bonds that can represent the risk-free rate:
pfin.ca

The Bank of Canada provides some current and historical yields on securities:
bankofcanada.ca

11A–1. Calculate the expected yield for the following securities using current information and the framework of the CAPM: BlackBerry (BB), Teck (TECK.B), CNR (CNR), Potash (POT), and the S&P/TSX Composite Index. The TSX (tmx.com) has betas as well, although different than Reuters. For the market portfolio, determine the average annual return on the S&P/TSX Composite Index over the last five years. Do your results seem reasonable in today's market?

PROBLEMS

1. Assume $R_f = 4$ percent and $R_m = 8$ percent. Compute K_j for the following betas, using formula 11A–2.
   a. 0.7
   b. 1.4
   c. 1.7
2. For the preceding problem, assume an increase in interest rates changes R_f to 7.0 percent; also assume that the market premium $(R_m - R_f)$ changes to 6.5 percent.
   a. Compute K_j for the three betas of 0.7, 1.4, and 1.7.
3. The risk-free interest rate on one-year debt is 7 percent and the return on the market is expected to be 13 percent. A stock with a beta of 1.2 pays no dividends over the next year. If it is currently priced at $15.00, what will its price be at the end of the year?