

STEVE SHARPE: A STOCK REPORT

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CASE DESCRIPTION

This case pertains to the valuation approach for a common stock being considered for purchase by a student in a Student-Managed Fund (SMF) class at a university. The fundamental factors of analysis pertaining to the profile of the company include the firm's products/services, the nature of the demand for the products and the managerial comparisons for sales. In addition, earnings per share, return on sales, return on assets and return on equity are considered. However, historical data on price-earnings ratios and dividend payout ratios are very important in all valuations, but they are not stressed in the case.

The emphasis of the case relates to recognition of risk, as it pertains to the common stock of the firm, estimations of the required rate of return (sometimes known as the hurdle rate), calculation of the "present value factor" which permits analysts to determine the present value of annualized return data projected into a specific future period. A price of the common stock projected into the future can be discounted to compare its present value with the current market price to determine whether the stock is undervalued or overvalued. In like fashion, a holding period return calculated in a time period greater than five years can be annualized for comparison with the required return obtained from an asset pricing model to determine whether the stock is undervalued or overvalued.

This case has a difficulty level appropriate for senior level or first year MBA students. It is designed to be taught in a single class period. Approximately two hours of student preparation time should be adequate for most students depending on their proficiency.

JEL: G11; A29

KEYWORDS: Risk, Stock Report, Required Rate of Return, Student-Managed Fund

CASE INFORMATION

Steve Sharpe is a graduate of Lowell State University. While attending Lowell State he enrolled in the university's Student-Managed Fund (SMF) class a number of years ago. Now a faculty member at Wettown University, Steve teaches graduate and undergraduate investment classes and he would like to offer the heart of a stock report normally prepared by those enrolled in an SMF class. Steve would like to present to his students the use of the regression and some quantitative techniques pertaining to the valuation process. He called his friend Jack Pettyjohn to see if a case could be put together. Jack agreed because there is a shortage of cases from which good projects can be made for investment classes.

Descriptive measures and selected single-index monthly regression results of a company called *BIG-T* are provided. The purpose is to review pertinent concepts of describing and summarizing a bath of numerical data in the context of identifying portfolio properties. Although these concepts have been covered in basic statistics courses, it is important enough to go over again so that students may be better prepared for discussions regarding various risk measurements in portfolio management.

Table 1: Descriptive Measures of the Return Series

<i>Descriptive Measure</i>	<i>The Big-T</i>	<i>The S&P 500</i>
Arithmetic Mean	0.30%	0.59%
Mode	No Mode	No Mode
Count	104	104
Minimum	-12.24%	-14.46%
First Quartile	-2.31%	-1.89%
Median	0.70%	0.93%
Third Quartile	3.19%	3.80%
Maximum	10.22%	9.78%
Range	22.46%	24.24%
Variance	0.002250	0.002031
Standard Deviation	4.74%	4.51%
Geometric Mean	0.19%	0.49%

This table shows the descriptive measures of the monthly return series of Big-T and that of S&P 500. Note: For all the estimates expressed in percentages, two digits after the decimal point are taken. For example, the standard deviation of the Big-T fund is displayed as 4.74%, but the more accurate estimate obtained from the Excel spreadsheet (not shown) is 4.74301379856173%. For the ease of exposition, it is rounded off to 4.74%.

For the outputs shown in Table 2, the following regression equation was estimated.

$$r_{Big-T,t} = \alpha_{Big-T} + \beta_{Big-T} \times r_{M,t} + \varepsilon_{Big-T,t} \tag{1}$$

Equation (1) is called the single-index (market) model, where:

$r_{Big-T,t}$ = return for the *Big-T* over month t .

α_{Big-T} = regression coefficient representing the intercept term for the *Big-T*. It is the *Big-T*'s return component that is independent of the market's return.

β_{Big-T} = regression coefficient representing the slope of the regression line. It measures the expected change in the *Big-T*'s return given a change in the market's return.

$r_{M,t}$ = return on a selected market index (i.e., *S&P 500*) for month t .

$\varepsilon_{Big-T,t}$ = error term of the regression for month t . It measures the deviation of the observed return from the return predicted by the regression and has an expected value of zero.

Ordinary Least Squares estimates were obtained. The results are presented in Table 2.

Table 2: Selected Outputs from the Regression of the Single-index (Market) Model

Regression Statistics	
R-Square	89.90%
Adjusted R-Square	89.80%
The Standard Error of the Estimate	1.52%
The Coefficient of Correlation	0.9481
Observations	104

	Coefficients	Standard Error	t Statistic	P-value
Intercept	-0.0029	0.0015	-1.9180	0.0579
The Beta Estimate	0.9979	0.0331	30.1245	0.0000

This Table t shows the regression results from the Ordinary Least Squares estimation using Equation (1). The monthly return series are those of Big-T and that of S&P 500, respectively.

A return is composed of two pieces: yield and price change. Yield is the income divided by the purchasing price. The second component of it is the increase or decrease in the price of the security. For a common stock, the yield is the dividend divided by the price paid. For a bond, the yield is the interest divided by the price paid. Our concern pertaining to the return in this case is the common stock (equity) return. When considering returns it should be recognized that there is a difference between “expected” return and “realized” return. Expected return is what you pay for when you buy a security, while realized return is what you receive at the end of an investment horizon. When discussing returns in investing, two terms are defined as follows:

$$\text{Holding Period Return (HPR)} = \frac{P_1 + D}{P_0} \tag{2}$$

$$\text{Holding Period Yiled (HPY)} = \frac{(P_1 - P_0) + D}{P_0} \tag{3}$$

where:

P_1 = ending wealth or ending price.

P_0 = beginning wealth or beginning price.

D = dividend, distribution or income.

A simple application is given below. You invest \$100 ($P_0 = \100) in a common stock for a period, during which you received a \$5 dividend ($D = \5). The ending price of the stock is \$110 ($P_1 = \110.) Thus, in this example:

$$\text{Holding Period Return (HPR)} = \frac{P_1 + D}{P_0} = \frac{\$110 + \$5}{\$100} = 1.15.$$

$$\text{HPY} = \frac{(P_1 - P_0) + D}{P_0} = \frac{P_1 - P_0}{P_0} + \frac{D}{P_0} = \frac{\$110 - \$100}{\$100} + \frac{\$5}{\$100} = 0.10 + 0.05 = 0.15 = 15\%.$$

As mentioned previously, your return of 15% by investing in this common stock consists of the following two components:

Price change (price appreciation): $\frac{P_1 - P_0}{P_0} = \frac{\$110 - \$100}{\$100} = 0.10$ (or 10%), and

$$\text{Yield: } \frac{D}{P_0} = \frac{\$5}{\$100} = 0.05 \text{ (or 5\%)}$$

Alternatively,

$$HPY = HPR - 1 = 1.15 - 1 = 0.15 = 15\%$$

Every individual interested in putting together a plan for his or her retirement should be introduced to *Stocks, Bonds, Bills and Inflation (SBBI)*, a yearly publication of Ibbotson & Associates. If one had invested \$1 in large Cap common stocks, the annual geometric mean return ending at the end of 2009 would be about 9.80% for the full 84-year period. If one is concerned for a cost of equity, or other returns usable for future planning, arithmetic mean returns are shown to be 11.80% for the *S&P* stocks. Using Ibbotson data, the desirability of using equity (common stocks) for investing in a retirement plan considered for a long period, i.e., greater than 25 years, can be illustrated. The (inflation-adjusted) purchasing power can be calculated to show the equity desirability. In the following example, the period is 84 years.

Large Cap Stocks	9.80%
Long-term Treasury Bonds	5.40%
Annual Average Inflation	3.00%

The purchasing power of the return provided by Large Cap stocks is estimated to be,

$$\left(\frac{1 + 9.80\%}{1 + 3.00\%} \right)^{84} = \left(\frac{1.098}{1.030} \right)^{84} \approx (1.06601942)^{84} \approx \$214.92.$$

The purchasing power of the return provided by Long-term Treasury bonds is estimated to be,

$$\left(\frac{1 + 5.40\%}{1 + 3.00\%} \right)^{84} = \left(\frac{1.054}{1.030} \right)^{84} \approx (1.02330097)^{84} \approx \$6.92.$$

Put differently, \$1 invested in Large Cap stocks on January 1st, 1926 grew to \$214.92 by the end of 2009 over the 84 years adjusted for inflation. However, the purchasing power only would have grown to \$6.92 if it had been invested in Long-term Treasury bonds. The choice of purchasing power of \$214.92 compared to a “choice” of purchasing power of \$6.92 is obviously preferred. Table 3 contains an illustration of difference between the arithmetic mean and the geometric mean.

If returns vary, the geometric mean will always be lower than its arithmetic mean. The larger the standard deviation, the larger the difference. Only if the returns are the same in each period, will the geometric mean equal the arithmetic mean. Otherwise, the geometric mean is less than the arithmetic mean.

Another geometric calculation may be needed from time to time. As part of an analysis, the need to know the growth rate of earnings per share (*EPS*) or that of sales will occur frequently. The geometric average of the earnings per share or that of the sales would be either the growth rate of *EPS* or that of the sales, respectively.

Table 3: Calculation for the Arithmetic and Geometric Mean

Year	Holding Period Yield		Holding Period Return
1998	28.36%	HPR = 1 + 28.36% = 1.2836	1.2836
1999	20.87%	HPR = 1 + 20.87% = 1.2037	1.2037
2000	-9.05%	HPR = 1 + (-9.05%) = 0.9095	0.9095
2001	-11.85%	HPR = 1 + (-11.85%) = 0.8815	0.8815
2002	-22.10%	HPR = 1 + (-22.10%) = 0.7790	0.7790
2003	28.37%	HPR = 1 + 28.37% = 1.2837	1.2837
2004	10.75%	HPR = 1 + 10.75% = 1.1075	1.1075
2005	4.83%	HPR = 1 + 4.83% = 1.0483	1.0483
2006	15.61%	HPR = 1 + 15.61% = 1.1561	1.1561
2007	5.48%	HPR = 1 + 5.48% = 1.0548	1.0548
The sum of these 10 HPYs	71.27%	The product of these 10 HPRs	1.7610395
Divide the above sum by 10	7.127%	Find the 10 th root of the above product, and subsequently subtract 1 from the resultant root	10 th root, 1.058223 Minus 1 from it, 5.822%
Arithmetic Mean	7.127%	Geometric Mean	5.822%

This Table provides selected data of the S&P 500 for the period from 1998 through 2007. For the arithmetic mean, the sum is divided by ten, the number of years. For the geometric mean calculation, the first step is to take the product of ten HPRs.

An academic definition of the required rate of return is the minimum return required to attract an investor to purchase a security. In this study, the required rate of return is estimated by the Capital Asset Pricing Model (CAPM). With the data used in this case, the CAPM formula is given as follows,

$$E(R_j) = R_{f1} + (R_m - R_{f2}) \times \text{beta}_j \tag{4}$$

where:

$E(R_j)$ = the required rate of return for security j .

R_{f1} = the current 20-year Treasury bond interest rate estimated at 4.08%.

R_{f2} = the 84-year average of the Treasury bond interest rate estimated at 5.80% by Ibbotson.

R_m = the 84-year arithmetic mean of the market return estimated at 11.80% by Ibbotson.

beta_j = security j 's response to the market's movement or volatility (risk).

The most common proxy for a risk-free security is a 20-year Treasury bond interest rate. Consequently, any reference to R_f in this case uses a current 20-year T-bond rate. At the end of May 2010, the rate was about 4.08%. There may be two reasons why a T-bond rate is the better proxy because (1) it contains long-term inflation expectations, which more closely matches the usual investment horizon of stock investments, and (2) it is influenced less by the Federal Reserve's policy actions.

Thus, as an example, the required rate of return of the *Big-T* shown in Table 2 is estimated by applying Equation (4) as follows:

$$\begin{aligned}
 E(R_{Big-T}) &= R_{f1} + (R_m - R_{f2}) \times \beta_j \\
 &= 4.08\% + \left(\frac{1 + 11.80\%}{1 + 5.80\%} - 1 \right) \times 0.9979 \\
 &= 0.0408 + 0.0567 \times 0.9979 \\
 &= 0.0408 + 0.05658 = 0.09738 \approx 9.74\%.
 \end{aligned}$$

In Equation (4), $R_m - R_{f2}$ is defined as the *equity risk premium*. When applying Ibbotson data, the equity risk premium needs to be estimated by dividing the market return by the long-term average of the Treasury bond as shown in the above example. This approach is referred to as a *geometric subtraction*. If one took an arithmetic subtraction instead, i.e., $R_m - R_{f2} = 11.80\% - 5.80\% = 6\% = 0.060$ the equity risk premium would have been estimated as 6%. The difference is approximately 0.33%, $6\% - 5.67\% = 0.33\%$. As long as Ibbotson data is used in Equation (4), the geometric subtraction estimate is considered more accurate. For instance, the faculty at Lowell State University has used this approach for eleven years with success.

The valuation process is illustrated with a sample data. Besides the aforementioned Ibbotson data, the most recent *Value Line Investment Survey* is used as well. Where possible we will follow a Q&A format to illustrate the valuation process.

Question: What data and sources are needed to calculate the required rate of return?

Answer: The needed data and sources are summarized below (Table 4).

Table 4: Relevant Ibbotson Data (1926-2009)

Relevant Ibbotson Data (1926 – 2009)	
Large-cap Annual Arithmetic Mean Return	11.80%
The Standard Deviation	20.50%
The current 20-year Treasury Bond Interest Rate at the End of May 2010	4.08%
Long-term Government Bond Annual Arithmetic Mean Return	5.80%
Selected Value Line Data: Projections for SnackCo	
Projected Rate of Growth of the Earnings	12.0%
Projected Rate of Growth of the Dividends	5.5%
Projected Future P/E Estimate	20
The Value Line Beta Estimate of SnackCo	0.60
Estimated Average Future Annual Dividend Yield	1.9%

The assumption is made that the date of all calculations is May 31, 2010. Therefore, the base year for all calculations is 2009 for earnings per share and dividends. The 2009 annual earnings for SnackCo is \$3.77 per share and the 2009 annual dividends is \$1.75 per share. The current price of the stock is \$60.00.

Question: What is the estimate of SnackCo’s required return?

Answer: Apply Equation (4). Please remember to use a geometric subtraction to figure out the estimate of the equity risk premium.

$$\begin{aligned}
 E(R_{SnackCo}) &= R_{f1} + (R_m - R_{f2}) \times \text{beta}_{SnackCo} \\
 &= 4.08\% + \left(\frac{1 + 11.80\%}{1 + 5.80\%} - 1 \right) \times 0.60 \\
 &= 0.0408 + 0.0567 \times 0.60 \\
 &= 0.0408 + 0.03402 = 0.07482 \approx 7.48\%.
 \end{aligned}$$

Question: What is the present value factor?

Answer: The factor is the result of a calculation that permits an analyst to discount a future value back to the present date. By doing so, the analyst can determine whether or not there has been any value added during the interim from the present date to the specific future date.

Question: What is involved in calculating such a factor?

Answer: The specific period is determined first, then that period is determined in the form of years and parts of a year if not to a rounded year time. In this case, the period is from today's date, May 31, 2010, to the end of Year 2015. The number of remaining days in 2010 from the end of May to the end of December, i.e., June 1 to December 31, is 214. This part of Year 2010 is 0.5863013 (214 days/365 days). We add five years to this fraction so that there will be 5.5863013 years until the end of Year 2015. The discount factor is based on the required rate of return that has been estimated to be 7.48%. This factor is then based on the time to the end of 2015, which is 5.863013 years. Therefore, the present value factor is obtained by compounding the required rate of return for the time period to the end of 2015, $(1 + 7.48\%)^{5.863013} = 1.5264215$. The future value of the stock at the end of 2015 can be discounted back to May 31, 2010 by dividing it by this present value factor of 1.5264215. Alternatively, if you prefer to multiply rather than divide, the multiplier is 0.655127, $\frac{1}{1.5264215} = 0.655127$. Whether one divides the future value of the stock by 1.5264215 or multiplies it by 0.655127, the present value of the stock is the same.

Question: What is the dividend growth model?

Answer: For many years, most investment textbooks accept the theory that the dividend is all an investor receives from a share of common stock. Myron Gordon takes one further step and adds the fact that many stocks will be growing and consequently the dividend payments will reflect this growth. The model adds growth aspect to the summation of the dividends to be paid in the future. Gordon's model adds growth to the equation and simplifies the approach to be,

$$P_0 = \frac{D_0 \times (1 + g)}{k - g} = \frac{D_1}{k - g} \tag{5}$$

where,

P_0 = expected stock price today.

D_0 = the dividend just paid.

D_1 = the expected dividend to be paid next period.

k = the expected rate of return of the stock.

g = the constant dividend growth rate, and $g < k$.

Question: Describe the approach you are using and show the values.

Answer: First, we estimate the future stock price at the end of 2015. We grow the 2009 dividend of \$1.75 at the 5.50% annual growth rate until the end of 2016. This resultant estimated future dividend will be used as D_1 . D_1 , the 7th year dividend, is estimated as,

$$D_1 = \$1.75 \times (1 + 5.50\%)^7 = \$1.75 \times 1.45468 \approx \$2.55 .$$

The next step is to capitalize \$2.55 at a *Value Line* estimate of the average dividend yield of 1.9%, which is $\frac{\$2.55}{1.9\%} = \134.21 . We then use the present value factor estimated earlier. As we said, you have the option of dividing \$134.21 by 1.5264215 or multiplying it by the multiplier of 0.655127. Either way, the stock price today is estimated to be \$87.92, $\frac{\$134.21}{1.5264215} = \87.92 or $\$134.21 \times 0.655127 = \87.92 . Since the price of the stock today is about \$60, it appears that it is undervalued.

Question: What is the nature of the annualized expected return?

Answer: The last calculation is a six-year holding period return (*HPR*). The numerator is the price expected at the end of the period plus the sum of the dividends expected to be paid in the six-year interval. This estimated future price is obtained by projecting the earnings per share (*EPS*) from the 2009 base and in turn multiplying it by the projected *P/E* ratio provided by Value Line. The final step for the *HPR* is to divide the total of the price and the sum of the dividends by the current price of \$60.00. After determining this *HPR* for the whole six-year period, it must be annualized for comparison with the required rate of return. If the resultant annualized *HPY* is greater than the required return, the security is considered to be undervalued.

Question: Can you show the valuation process using the *P/E* model?

Answer: It can be shown in an equation as a guide for the data.

$$\frac{\text{Price}_{2015} + \text{Sum of the expected dividends in the interim}}{\text{Price}_{2010}} = \frac{\text{Price}_{2015} + \text{Sum of the dividends from now through 2015}}{\text{The market price of the stock on May 31, 2010 of } \$60.00}$$

The steps, one at a time, should help clarify the process.

1. Compute earnings per share projected to the end of 2015.

$$EPS_{2015} = \$3.77 \times (1 + 12\%)^6 = \$3.77 \times 1.9738227 = \$7.4413115 \approx \$7.44$$

2. Project the Year-End 2015 Stock Price.

$$P_{2015} = EPS_{2015} \times \text{Projected P/E} = \$7.4413115 \times 20 \approx \$148.83$$

3. Sum all the expected dividends in the interim.

Table 5: Sum of all the Expected Dividends in the Interim

Sum all the expected dividends in the interim	
The remaining dividends to be paid in 2010	\$0.96
The expected dividend in 2011	$\$1.75 \times (1+5.5\%)^2 = \1.9478
The expected dividend in 2012	$\$1.75 \times (1+5.5\%)^3 = \2.0549
The expected dividend in 2013	$\$1.75 \times (1+5.5\%)^4 = \2.1679
The expected dividend in 2014	$\$1.75 \times (1+5.5\%)^5 = \2.2872
The expected dividend in 2015	$\$1.75 \times (1+5.5\%)^6 = \2.4130
The sum is estimated to be	\$11.8308

4. Compute the *HPR* for the whole period from May 31, 2010 to December 31, 2015.

$$\text{The HPR for the whole period} = (\$148.33 + \$11.8308) / \$60 = 2.6776133$$

5. Annualize the *HPR*.

There will be 5.5863013 years until the end of Year 2015, i.e., $N=5.5863013$.

$$\begin{aligned} \text{The annualized HPR} &= (\text{The HPR for the whole period})^{1/N} = (2.6776133)^{1/5.5863013} \\ &= 1.1928088 \end{aligned}$$

6. Compute the annualized *HPY*.

$$\text{The annualized HPY} = \text{The annualized HPR} - 1 = 1.1928088 - 1 = 0.1928088 \approx 19.28\%$$

Since the estimated *HPY* of 19.28% is greater than the required return of 7.48%, the stock is undervalued.

QUESTIONS

1. Using the regression output contained in Tables 1 and 2,
 - a. Determine the beta estimate from two sources. Show how.
 - b. How much of the variability in Big-T is answered by the market. Show how.
 - c. Calculate and show work to obtain the covariance.
 - d. Calculate the total risk for Big-T.

Information for Questions 2-5. For a company we will call “Big-T”, selected Value Line data are given.

EPS projected growth rate of 14%,

Dividend projected growth rate of 14%,

P/E projected to be 20,

Most recent full year (2009) *EPS* is \$3.37 and the dividend is \$0.60 per share,

Big-T pays quarterly dividends each year,

The projected average annual dividend yield is 0.8%, and

The beta estimate is 0.55.

2. Using data provided in the case and as shown above, calculate the required rate of return using the Ibbotson’s approach as illustrated.
3. (a) Calculate N , the number of years, from August 31, 2010 through the end of Year 2015.
(b) Calculate the present value factor assuming the present date is August 31, 2010.
4. Using the dividend growth model, find the present value of the price determined by using the 7th year expected dividend.
5. Calculate the annualized *HPY* estimate for Big-T. Use all data available in the case and as given. (Hint: use the *HPR*, sum of the dividends expected between August 31, 2010 and the end of 2015, and assume the present stock price on August 31, 2010 of \$54.00.)

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TEACHING NOTES

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This case has a difficulty level appropriate for senior level or first year MBA students. It is designed to be taught in a single class period. Approximately two hours of student preparation time should be adequate for most students depending on their proficiency.

QUESTIONS

Question 1: Using the regression output contained in Tables 1 and 2,

- Determine the beta estimate from two sources. Show how.
- How much of the variability in *Big-T* is answered by the market. Show how.
- Calculate and show work to obtain the covariance.
- Calculate the total risk for *Big-T*.

Solution 1:

$$(a) \text{ The beta estimate} = \frac{\text{The Covariance}_{(\text{the Big-T, The S\&P 500})}}{\text{The Variance of the Market}} = \frac{0.9481 \times 0.0474 \times 0.0451}{0.0451^2} \approx 0.9964$$

The beta estimate shown in Table 2 is 0.9979. A matter of rounding causes the difference.

(b) The relationship between the company returns and the S&P 500 returns shows that the variability of the company returns is answered by the R^2 of 0.898 or 89.80%. Thus, the unanswered variability is $R^2 - 1 = 0.898 - 1 = 0.102$, or 10.20%.

(c) The covariance is calculated by multiplying the correlation of the two securities by each of the standard deviations of the two securities involved.

The Covariance $(\text{Big-T, The S\&P500}) = 0.9481 \times 0.0474 \times 0.0451 = 0.0020267$ as shown in Assignment 1(a) above.

(d) Total risk is the variance of the return on Big-T. The Variance $\text{Big-T} = 0.0474^2 = 0.0022467$

Question 2: Using data provided in the case and as shown above, calculate the required rate of return using the Ibbotson's approach as illustrated.

Solution 2:

$$\begin{aligned} E(R_{\text{Big-T}}) &= R_{f1} + (R_m - R_{f2}) \times \text{beta}_{\text{Big-T}} \\ &= 4.08\% + \left(\frac{1 + 11.80\%}{1 + 5.80\%} - 1 \right) \times 0.55 \\ &= 0.0408 + 0.0567 \times 0.55 \\ &= 0.0408 + 0.0831185 = 0.071985 \approx 7.20\%. \end{aligned}$$

For the “purest” who would rather use theory than what practitioners use, the equity risk premium would be estimated as, $\frac{1 + \text{Common stock return}}{1 + \text{T-bill rate}} - 1 = \frac{1 + 11.80\%}{1 + 3.70\%} - 1 = 1.0781099 - 1 \approx 7.81\%$ where the T-bill rate is an historical average given by Ibbotson.

The current three-month T-Bill rate is about 0.17%, retrieved from [/www.ustreas.gov/offices/domestic-finance/debt](http://www.ustreas.gov/offices/domestic-finance/debt). The required return for the theorist would be, $0.0017 + 0.55 \times (0.0781) = 0.044655$ or 4.47%. When interest rates are normal and not manipulated for economic purposes, the two approaches are close. It is not too likely that a flat yield curve would permit the same required return to be estimated. For purposes of this case, the required return of 7.20% will be used.

Question 3: (a) Calculate N , the number of years, from August 31, 2010 through the end of Year 2015. (b) Calculate the present value factor assuming the present date is August 31, 2010.

Solution 3: The present value factor is used to discount a price or value from some point in the future (a precise date) back to the day of the calculation. Today's date is assumed to be August 31, 2010. The remaining time in the year is 122 days (September 30 + October 31 + November 30 + December 31).

(a). N (Time to the end of Year 2015).

The time remained in Year 2010 is, $\frac{122 \text{ Days}}{365 \text{ Days}} = 0.3342466$ (years)

The period from August 31, 2010 to the end of Year 2015 is, $5 + 0.3342466 = 5.3342466$ (years).

(b). Present Value Factor Calculation. The present value factor is obtained by compounding the required rate of return for the period toward the end of 2015, $(1 + 7.20\%)^N = 1.072^{5.3342466} = 1.44899348$. The future value of the stock at the end of 2015 can be discounted back to August 31, 2010 by dividing it by this present value factor of 1.44899348. Alternatively, if you prefer to multiply rather than divide, the multiplier is 0.69013423, $\frac{1}{1.44899348} = 0.69013423$. Whether one divides the future value of the stock by 1.44899348 or multiplies it by 0.69013423, the present value of the stock is the same.

Question 4: Using the dividend growth model, find the present value of the price determined by using the 7th year expected dividend.

Solution 4: Dividend Growth Model

The purpose of the model is to estimate a price (value) at the end of Year 2015 by means of capitalizing the 7th year's dividend. First, we estimate the future stock price at the end of 2015. We grow the 2009 dividend of \$0.60 at the 14% annual growth rate until the end of 2016. This resultant estimated future dividend will be used as D_1 . D_1 , the 7th year dividend, is estimated as,

$$D_1 = \$0.60 \times (1 + 14\%)^7 = \$0.60 \times 2.50226879 = \$1.50136127 \approx \$1.50 .$$

The next step is to capitalize \$1.50 at a *Value Line* estimate of the average dividend yield of 0.8%, $\frac{\$1.50136127}{0.8\%} \approx \187.67 . We then use the present value factor estimated earlier. As indicated in the teaching notes of Assignment 3, you have the option of dividing \$187.67 by 1.44899348 or multiplying it by the multiplier of 0.69013423. Either way, the stock price today is estimated to be \$129.52, $\frac{\$187.67}{1.44899348} = \129.52 or $\$187.67 \times 0.69013423 = \129.52 . Since Big-T is currently selling for about \$54.00, it is considered to be undervalued by a significant amount.

Question 5: Calculate the annualized *HPY* estimate for Big-T. Use all data available in the case and as given. (Hint: use the *HPR*, sum of the dividends expected between August 31, 2010 and the end of 2015, and assume the present stock price on August 31, 2010 of \$54.00.)

Solution 5: Holding Period Return: The holding period return for the whole period of six years from August 31, 2010 to December 31, 2015 is the heart of the case. The steps, one at a time, should help clarify the process.

1. Compute earnings per share projected to the end of 2015

$$EPS_{2015} = \$3.37 \times (1 + 14\%)^6 = \$3.37 \times 2.19497262 = \$7.39705779 \approx \$7.40$$

2. Project year-end 2015 stock price.

$$P_{2015} = EPS_{2015} \times \text{Projected P/E} = \$7.39705779 \times 20 \approx \$148.00$$

3. Sum all the expected dividends in the interim.

Sum all the expected dividends in the interim	
The remaining dividends to be paid in 2010	\$0.566 (\$0.75-\$0.184 = \$0.566)
The expected dividend in 2011	$\$0.60 \times (1+14\%)^2 = \0.77976
The expected dividend in 2012	$\$0.60 \times (1+14\%)^3 = \0.88895
The expected dividend in 2013	$\$0.60 \times (1+14\%)^4 = \1.01338
The expected dividend in 2014	$\$0.60 \times (1+14\%)^5 = \1.15525
The expected dividend in 2015	$\$0.60 \times (1+14\%)^6 = \1.31698
The sum is estimated to be	\$5.72032

4. Compute the *HPR* for the whole period from August 31, 2010 to December 31, 2015.

$$\text{The HPR for the whole period} = (\$148.00 + \$5.72032) / \$54.00 = 2.84667259$$

5. Annualize the *HPR*.

There will be 5.3342466 years until the end of Year 2015, i.e., $N=5.3342466$.

The annualized HPR = (whole period HPR)^{1/N} = (2.84667259)^{1/5.3342466} = 1.2166725

6. Compute the annualized *HPY*.

The annualized HPY = The annualized HPR – 1 = 1.2166725 – 1 = 0.2166725 ≈ 21.67% .

Compared to the required return of 7.2%, the *expected* annualized *HPY* of 21.67% is much higher so that Big-T is considered undervalued. Greater confidence is provided when the dividend growth model confirms the undervalued position of the *P/E* Model.

Both approaches show the security to be undervalued. It is possible that the two approaches could give differing answers. If you are a Gordon fan, you may select the capitalized dividend as your choice. Practitioners would probably prefer the *EPS* or *P/E* approach. In either case, both calculations should be made. Agreement provides more confidence in the valuation.

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