Calculating The Beta Coefficient And Required Rate Of Return For Coca-Cola

John C. Gardner, University of New Orleans, USA
Carl B. McGowan, Jr., Norfolk State University, USA
Susan E. Moeller, Eastern Michigan University, USA

ABSTRACT

In this paper, we demonstrate how to compute the required rate of return for Coca-Cola using modern portfolio theory with data downloaded from the internet. We demonstrate how to calculate monthly returns for the index and Coca-Cola and how to use the returns to compute the beta coefficient and the required rate of return using the downloaded data. We show how to validate the data for the market index and the company and how to compute the returns using the dividend and stock split adjusted prices. We demonstrate how to graph the characteristic line for Coca-Cola and use the graph to check that the regression was run correctly. We use Coca-Cola and the S&P 500 Index in this paper, but any company listed on Yahoo! Finance can be used as the example. This paper can be used as the basis of a lecture on intermediate corporate finance or investments to demonstrate the process using a real company.

Keywords: beta; characteristic line; required rate of return; Coca-Cola; teaching note

INTRODUCTION

Markowitz[1] (1952) began modern portfolio theory (MPT) which can be used to explain the relationship between risk and return for assets, particularly stocks. Stock of companies that have higher rates of return have higher levels of risk. In order to achieve a lower level of risk, an investor must accept a lower expected rate of return. This concept is called the dominance principle and allows for the creation of the efficient frontier. MPT partitions risk into non-systematic risk, which can be eliminated from a portfolio through diversification, and systematic risk that is market wide and cannot be diversified. Non-systematic risk is company specific and is reduced to zero in a large, well diversified portfolio. In order to determine systematic risk for a stock, we use the market model developed by Sharpe[2] (1964). The returns for a stock are regressed as the dependent variable against a market index used as the independent variable. The slope coefficient of the regression is the measure of systematic risk for the stock. Systematic risk measures the degree to which a stock moves with the market. A higher beta coefficient implies that returns for the stock move more than the market and a lower beta coefficient implies that returns for the stock move less that the market. The former are aggressive stocks and the latter are defensive stocks.

In this paper, we show how to retrieve data from the internet, how to compute returns for both the market index and the stock, and how to run a regression to determine the beta coefficient to measure the systematic risk for the stock. In addition, we show how to graph the data with a trend line and statistics to verify that the first regression is run correctly; that is, with the correct variable as the independent variable. We show how to do all of this analysis using Excel.

[1] Markowitz received The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1990.
[2] Sharpe received The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1990.

DOWNLOADING DATA FROM THE INTERNET

The data used for the analysis discussed in this paper are downloaded from the internet using the Yahoo! Finance website. The URL for Yahoo! Finance is http://finance.yahoo.com/. Once one arrives at the Yahoo! Finance website, the S&P 500 data can be found by clicking on the "S&P500" icon and then, clicking on the Historical Prices" icon. Click on the "Monthly" indicator to download monthly data and enter the dates. For this paper we download sixty-one monthly, observations in order to calculate sixty monthly returns. The data columns are: Date, Open, High, Low, Close, Average Volume, and Adjusted Close. The index and the Coca-Cola price are adjusted for splits and dividends. Move the cursor to the bottom of the data and click on "Download to Spreadsheet". Save the data to a spreadsheet and repeat the process for the Coca-Cola data. Begin by entering the Coca-Cola ticker symbol, KO, and download and save the data for the save time period.

CALCULATING RETURNS FOR THE S&P 500 INDEX AND FOR COCA-COLA3

In this paper, we use arithmetic returns to compute the beta coefficient for Coca-Cola. Arithmetic returns are calculated by dividing the ending index or stock value, ($Value_1$), by the beginning value, ($Value_0$), and subtracting one as in Equation [1]. An alternative method to calculate the return is to subtract the beginning value, ($Value_0$), from the ending value, ($Value_1$), and dividing by the beginning value, ($Value_0$), as in Equation [2]. Both returns are adjusted for dividends and stock splits. The returns used in the regression analysis are arithmetic returns.

$$\text{Return} = [(Value_1 - Value_0) - 1] \quad [1]$$
$$\text{Return} = [(Value_1 - Value_0)/Value_0)] \quad [2]$$

Five years of Monthly data are used to generate sixty data points[4].

CALCULATING BETA FOR COCA-COLA[5]

Modern Portfolio Theory shows that investors are rewarded for the systematic risk of an investment and not for the total risk of an investment because total risk includes firm specific risk that can be eliminated in a well diversified portfolio. The specific risk of an individual stock is the slope coefficient of the characteristic line which is the regression line between the monthly returns for the individual security and the monthly returns for the market index. Beta coefficient lines are calculated using a sixty month regression. In this example, the beta coefficient for Coca-Cola is calculated using sixty monthly observations of returns for Coca-Cola from 09/02/2003 to 08/01/2008 and returns for the S&P 500 Index for the same time period. Beta is the covariance between returns for Coca-Cola and returns for the S&P 500 divided by the variance for the S&P 500.

$$R_{KO} = Alpha_{KO} + Beta_{KO}\,(R_m) \quad [3]$$

R_{KO}	the return for Coca-Cola stock
$Beta_{KO}$	the slope of the regression line between returns for the market and returns for Coca-Cola
$Alpha_{KO}$	the intercept coefficient for the regression line between returns for the market and returns for Coca-Cola
(R_m)	the return on the S&P 500 Stock market Index
$(R_m - R_F)$	the market risk premium is the additional return that stock holders receive for the additional risk of holding stocks rather than the risk free asset, long-term government bonds.

Appendix A contains the data used to compute the Coca-Cola beta and are downloaded from Yahoo! Finance. Column 1 shows the date and Columns 2 and 3 contain the stock split and dividend adjusted index and price values, for the S&P 500 Index and for Coca-cola stock, respectively. The independent variable is the return for

[3] See Brigham and Ehrhardt (2008, pages 223-225) for a discussion of how to compute a beta coefficient.
[4] See Brigham and Ehrhardt (2008, page 223).
[5] See Brigham and Ehrhardt (2008, pages 223-225) for a discussion of how to compute a beta coefficient.

the S&P500 (Column 4) and the dependent variable is the return for Coca-Cola (Column 5). The returns are calculated by dividing the ending index or stock value by the beginning value and subtracting one. An alternative method to calculate the return is to subtract the beginning value from the ending value and dividing by the beginning value. Both returns are adjusted for dividend and stock splits. The returns used are arithmetic returns.

Table 1 contains the regression results for the regression between the return for the S&P500 and for Coca-Cola using Excel. The independent variable is the return for the S&P500 (x-axis) and the dependent variable is the return for Coca-Cola (y-axis). Both returns are adjusted for dividends and stock splits. The adjusted R^2 for the regression is 0.23 and the F-statistic is 18.65, both of which are statistically significant at the 0.0000 level. The regression coefficient is 0.7560 and has a t-statistic of 4.31 and is significant at the 0.0000 level.

Table 1: Coca-Cola versus the S&P 500 Regression of Arithmetic Means Returns from 09/02/03 to 08/01/08

Regression Statistics					
Multiple R	0.493288				
R Square	0.243333				
Adjusted R Square	0.230287				
Standard Error	3.723303				
Observations	60				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	258.57	258.57	18.65	0.000062
Residual	58	804.05	13.86		
Total	59	1062.63			
	Coefficients	***Standard Error***	***t Stat***	***P-value***	
Intercept	0.087056	0.485744	0.179223	0.858388	
X Variable 1	0.765019	0.177137	4.318793	0.000062	

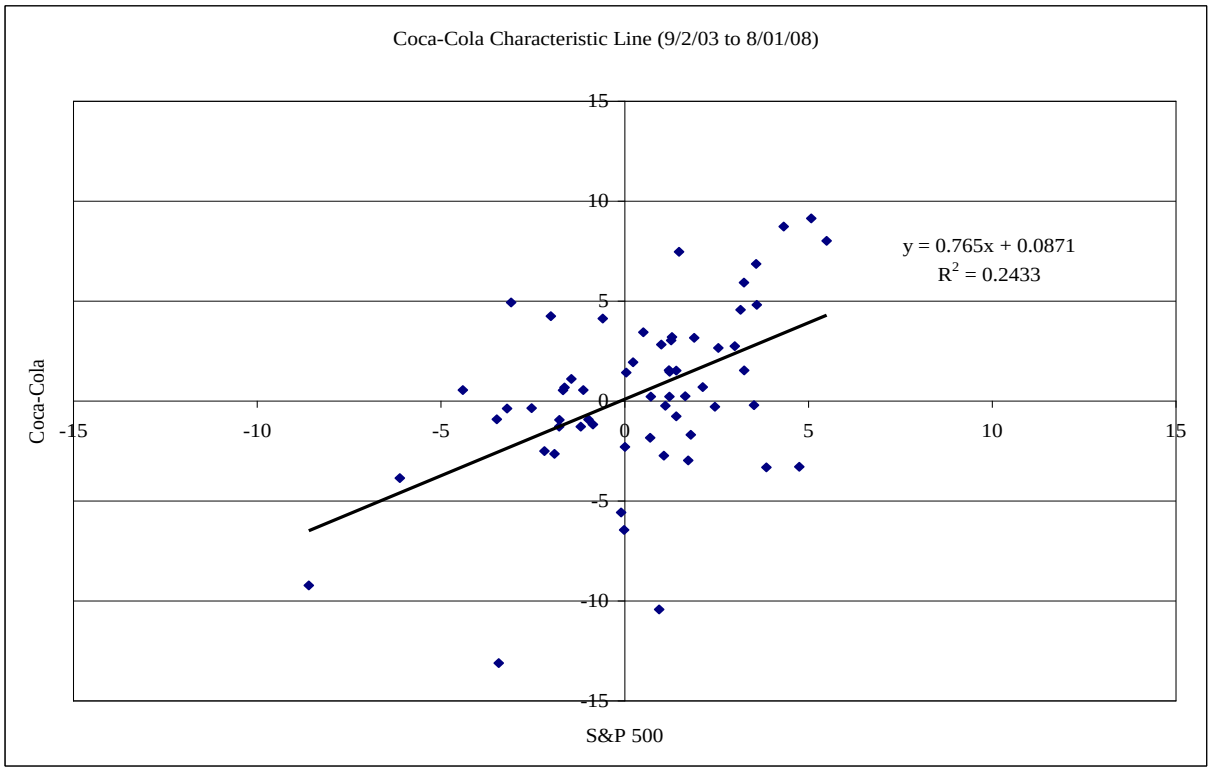

Figure 1: Characteristic Line - Coca-Cola

Figure 1 is a graph of the data used to compute the Coca-Cola beta, which is the characteristic line for Coca-Cola. Figure 1 was created in Excel using the Chart function. The independent variable is the return for the S&P500 (x-axis) and the dependent variable is the return for Coca-Cola (y-axis). Both returns are adjusted for dividends and for stock splits. The chart contains the trend line and R^2. The statistics in the graph are the same as the regression statistics in Table 1. The pedagogical purpose of the graph is to chart the characteristic line for Coca-Cola and to confirm that the regression was run with the correct independent and dependent variable. If the trend line and statistics in the graph are not identical to the numbers in the regression, the student has reversed the variables.

CALCULATING THE REQUIRED RATE OF RETURN FOR STOCKS[6]

Graham and Harvey (2002) find that 73.5 percent of respondents to their survey indicate that the company of the survey respondent uses the capital asset pricing model (CAPM) to determine the component cost of common stock equity capital. In this paper, we use the CAPM to compute the required rate of return for Coca-Cola. The required rate of return for Coca-Cola is the minimum rate of return demanded by stockholders of Coca-Cola stock. The model used in this paper is based on the CAPM derived from the work of Sharpe (1964).

$$R_{KO} = R_f + Beta_{KO} (R_m - R_F) \quad [4]$$

R_{KO} = the required rate of return for Coca-Cola Stock
R_f = the risk free rate of return
$Beta_{KO}$ = the beta coefficient for Coca-Cola
R_m = the rate of return on the stock market
$(R_m - R_F)$ = the market risk premium

The required rate of return for Coca-Cola is the risk-free rate of return plus the risk premium for Coca-Cola. The risk premium is the beta for Coca-Cola time the market price of risk.

COMPUTING THE REQUIRED RATE OF RETURN FOR COCA-COLA (KO) USING THE CAPM[7]

The risk free rate is the total return (income plus capital appreciation) on Long-term Government Bonds taken from SBBI 2007[8]. For the years from 1926 to 1976, SBBI uses the Government Bond File from the Center for Research in Security Prices. For the period from 1976 to 2006, the returns in SBBI 2007 are computed from data taken from the *Wall Street Journal*. The yield for the bond is the discount rate that equates the expected future cash flows, coupon payments and maturity value, to the current price. Table 2 contains a summary of the input data and sources of that data.

Table 2: Input Data and Sources

Variable	Value	Source
$Beta_{KO}$	0.7650	Computed
R_f	0.0580	SBBI, 2007, page 31
R_m	0.1230	SBBI, 2007, page 31
K_e	0.1077	Computed

We use the security market line to compute the required rate of return for Coca-Cola. We use the long-term bond rate taken from SBBI (2007) which equals 5.8% and the long-term market return of 12.3%. The market risk premium is 6.5%. This yields a cost of equity for Coca-Cola of 10.77%.

[6] See Ross, Westerfield, and Jordan (2008, page 483).
[7] See Brigham and Ehrhardt (2008, pages, 226-228) and Ross, Westerfield, and Jordan (2008, pages 426-427).
[8] *Stocks, Bonds, Bills, and Inflation, Market Results for 1926 -2006, 2007 Yearbook, Classic Edition*, Morningstar, 2007.

$R_{KO} = R_f + Beta_{KO} (R_m – R_F)$ [5]

10.77% = 5.8% + 0.7650 (12.3% - 5.8%)
10.77% = 5.8% +0.7650 (6.5%)
10.77% = 5.8% + 4.97%

The required rate of return for Coca-Cola stock is 10.77%.

SUMMARY AND CONCLUSIONS

In this paper, we demonstrate how to compute the required rate of return for Coca-Cola using modern portfolio theory. Data is downloaded from Yahoo! Finance for both Coca-Cola and for the S&P 500 Index. The adjusted stock price for Coca-Cola and the S&P 500 Index are used to compute a five-year, monthly series of returns. The characteristic line is the regression line from the regression in which the monthly returns for the S&P 500 Index are the independent variables and the monthly returns for Coca-Cola are the dependent variables. The regression is run using the Data Analysis Tool Pak in Excel and the Chart function. We use SBBI 2007 data to compute the required rate of return using the market model. We compute a required rate of return for Coca-Cola equal to 10.77%

The objective of this paper is to demonstrate how to download the data needed to compute the required rate of return for Coca-Cola using Modern Portfolio Theory. We demonstrate how to calculate monthly returns for the index and Coca-Cola and how to use the returns to compute the beta coefficient and the required rate of return using the downloaded data. We show how to validate the data for the market index and the company and how to compute the returns using the dividend and stock split adjusted prices. We demonstrate how to graph the characteristic line for Coca-Cola and use the graph to check that the regression was run correctly. We use Coca-Cola and the S&P 500 Index in this paper, but any company listed on Yahoo! Finance can be used as the example. This paper can be used as the basis of a lecture on intermediate corporate finance or investments to demonstrate the process using a real company.

AUTHOR INFORMATION

John C. Gardner is the KPMG Professor of Accounting and Director of the Global Entrepreneurship Initiative in the Department of Accounting at the University of New Orleans. He earned his undergraduate degree in accounting from SUNY at Albany, and MBA and Ph.D. degrees in finance from Michigan State University. Dr. Gardner has published in leading accounting, finance and management science journals including *The Accounting Review, Journal of Accounting Research, Contemporary Accounting Research, Accounting, Organizations and Society, Journal of Financial and Quantitative Analysis and Decision Sciences.* His research interests include multi-national corporation financial management, capital structure, and financial and forensic accounting.

Carl B. McGowan, Jr., PhD, CFA is a Professor of Finance at Norfolk State University, has a BA in International Relations (Syracuse), an MBA in Finance (Eastern Michigan), and a PhD in Business Administration (Finance) from Michigan State. From 2003 to 2004, he held the RHB Bank Distinguished Chair in Finance at the Universiti Kebangsaan Malaysia and has taught in Cost Rica, Malaysia, Moscow, Saudi Arabia, and The UAE. Professor McGowan has published in numerous journals including *Applied Financial Economics, Decision Science, Financial Practice and Education, The Financial Review, International Business and Economics Research Journal, The International Review of Financial Analysis, The Journal of Applied Business Research, The Journal of Business Case Studies, The Journal of Diversity Management, The Journal of Real Estate Research, Managerial Finance, Managing Global Transitions, The Southwestern Economic Review, and Urban Studies.*

Susan E. Moeller is a Professor of Finance at Eastern Michigan University since 1990. Prior to joining EMU, Dr. Moeller taught at Northeastern University in Boston and at the University of Michigan - Flint. Her corporate experience was with Ford Motor Company. She has published in a number of journals including, *Journal of Economic and Financial Education, Journal of Business Case Studies, Journal of Global Business, Journal of International Finance, Journal of Financial and Strategic Decisions, Management International Review, Journal of Applied Business Research* and *AAII Journal.*

REFERENCES

1. Brigham, Eugene F. and Michael C. Ehrhardt. *Financial Management, Theory and Practice*, Twelfth Edition, Thomson/Southwestern, Mason, OH, 2008.
2. Damodaran, Aswath. "*Applied Corporate Finance*," Second Edition, John Wiley& Sons, Inc., 2006.
3. Graham, John R. and Campbell R. Harvey. "The Theory and Practice of Corporate Finance: Evidence form the Field," *Journal of Financial Economics*, 2002, pp. 187-243.
4. http://nobelprize.org/nobel_prizes/economics/laureates/1990/press.html
5. Markowitz, Harry. "Portfolio Selection," *The Journal of Finance*, March 1952, pp. 77-91.
6. Ross, Stephen A., Randolph W. Westerfield, and Bradford D. Jordan. *Fundamentals of Corporate Finance*, Eighth Edition, McGraw-Hill Irwin, New York, 2008.
7. William R. Sharpe, Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, *The Journal of Finance*, September 1964, pp. 425-552.
8. *Stocks, Bonds, Bills, and Inflation, Market Results for 1926 -2006, 2007 Yearbook, Classic Edition*, Morningstar, 2007.

APPENDIX A

Rates of Return S&P500 and COCA-COLA

Date	S&P500	KO	$R_{S\&P500}$	R_{KO}
8/1/2008	1249.01	52.07	-1.45	1.11
7/1/2008	1267.38	51.50	-0.99	-0.92
6/2/2008	1280.00	51.98	-8.60	-9.22
5/1/2008	1400.38	57.26	1.07	-2.73
4/1/2008	1385.59	58.87	4.75	-3.29
3/3/2008	1322.70	60.87	-0.60	4.12
2/1/2008	1330.63	58.46	-3.48	-0.92
1/2/2008	1378.55	59.00	-6.12	-3.86
12/3/2007	1468.36	61.37	-0.86	-1.18
11/1/2007	1481.14	62.10	-4.40	0.55
10/1/2007	1549.38	61.76	1.48	7.46
9/4/2007	1526.75	57.47	3.58	6.86
8/1/2007	1473.99	53.78	1.29	3.20
7/2/2007	1455.27	52.11	-3.20	-0.38
6/1/2007	1503.35	52.31	-1.78	-1.28
5/1/2007	1530.62	52.99	3.25	1.53
4/2/2007	1482.37	52.19	4.33	8.73
3/1/2007	1420.86	48.00	1.00	2.83
2/1/2007	1406.82	46.68	-2.18	-2.51
1/3/2007	1438.24	47.88	1.41	-0.77
12/1/2006	1418.30	48.25	1.26	3.03
11/1/2006	1400.63	46.83	1.65	0.24
10/2/2006	1377.94	46.72	3.15	4.57
9/1/2006	1335.85	44.68	2.46	-0.29
8/1/2006	1303.82	44.81	2.13	0.70
7/3/2006	1276.66	44.50	0.51	3.44
6/1/2006	1270.20	43.02	0.01	-2.29
5/1/2006	1270.09	44.03	-3.09	4.93
4/3/2006	1310.61	41.96	1.22	0.21
3/1/2006	1294.87	41.87	1.11	-0.24
2/1/2006	1280.66	41.97	0.05	1.43
1/3/2006	1280.08	41.38	2.55	2.65
12/1/2005	1248.29	40.31	-0.10	-5.58
11/1/2005	1249.48	42.69	3.52	-0.21
10/3/2005	1207.01	42.78	-1.77	-0.95
9/1/2005	1228.81	43.19	0.69	-1.84
8/1/2005	1220.33	44.00	-1.12	0.55
7/1/2005	1234.18	43.76	3.60	4.81
6/1/2005	1191.33	41.75	-0.01	-6.45
5/2/2005	1191.50	44.63	3.00	2.74
4/1/2005	1156.85	43.44	-2.01	4.25
3/1/2005	1180.59	41.67	-1.91	-2.64
2/1/2005	1203.60	42.80	1.89	3.16
1/3/2005	1181.27	41.49	-2.53	-0.36
12/1/2004	1211.92	41.64	3.25	5.93
11/1/2004	1173.82	39.31	3.86	-3.32
10/1/2004	1130.20	40.66	1.40	1.52
9/1/2004	1114.58	40.05	0.94	-10.42
8/2/2004	1104.24	44.71	0.23	1.94
7/1/2004	1101.72	43.86	-3.43	-13.11
6/1/2004	1140.84	50.48	1.80	-1.69
5/3/2004	1120.68	51.35	1.21	1.54
4/1/2004	1107.30	50.57	-1.68	0.54
3/1/2004	1126.21	50.30	-1.64	0.68
2/2/2004	1144.94	49.96	1.22	1.46
1/2/2004	1131.13	49.24	1.73	-2.98
12/1/2003	1111.92	50.75	5.08	9.14
11/3/2003	1058.20	46.50	0.71	0.22
10/1/2003	1050.71	46.40	5.50	8.01
9/2/2003	995.97	42.96	-1.19	-1.29
8/1/2003	1008.01	43.52		

NOTES