Using Coke-Cola and Pepsico to demonstrate optimal capital structure theory

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ABSTRACT

The purpose of this paper is to demonstrate how to apply the trade-off theory of capital structure to actual companies. The paper shows how to use a company's bond and stock information from published sources to determine both the cost of equity and the weighted average cost of capital for Coca-Cola and Pepsico at various levels of debt. The results demonstrate how increased financial leverage impacts each company's WACC. With increased financial leverage each company's WACC decreases until the optimal debt ratio is reached, after which, the WACC rises with the addition of more debt. The results show that both Coke and Pepsico are currently at their optimal debt ratio.

Keywords: capital structure, trade-off theory, cost of capital, optimal debt ratio

INTRODUCTION

In Gardner, McGowan, Moeller (2010), the trade-off theory of capital structure was applied to an existing firm with no long-term debt, Microsoft, to help understand how theoretical concepts can be applied in practice. The results indicated that Microsoft was not at its optimal capital structure and was therefore not maximizing its value as an all equity firm. The optimal debt ratio based on our analysis should be 37.5%. To expand this work, this paper applies the trade-off theory methodology to two firms with existing long-term debt within the same industry, Coca-Cola and Pepsico.

The simulation results provided in this paper indicate that the debt ratios of Coke and Pepsico are both optimal, which is in the range of 28.3% to 37.5% based on both firms' bond rating of A. Capital structure theory would indicate that these firms, Coke and Pepsico, are both maximizing their market capitalization values at their current debt levels.

BACKGROUND

Modigliani and Miller (1958) show that with a simple set of assumptions the value of a firm is independent of the capital structure. M&M (1958) assume that capital markets are certain and that there are no taxes or trading cost. Investors are able to borrow and lend at the same rate. The value of the firm defined in M&M (1958) is the discounted present value of the future cash flows assuming that the cash flows are no-growth perpetuity. The value of the firm is a function of the future cash flows generated by the investment opportunities available to the company. The financial structure of the company determines the proportion of future cash flows allocated to debt and the proportion of future cash flows allocated to equity. M&M (1958) assume that the weighted average cost of capital and the cost of debt remain constant. Consequently, as the proportion of debt financing used by the company increases, the cost of equity increases to keep the weighted average cost of capital equal.

Modigliani and Miller (1963) show that total net cash flow from the company increases by the amount of the tax shield and the total value of the firm increases proportionately. M&M (1963) show that the value of the company will increase by the present value of the tax shield which is equal to the total value of debt issued by the company multiplied by the marginal tax rate for the company. If the company increases the level of debt in the financial structure, the cost of equity increases because of the additional risk associated with the increased financial leverage. If the amount of debt issued by the company increases, the theoretical value of the company also increases.

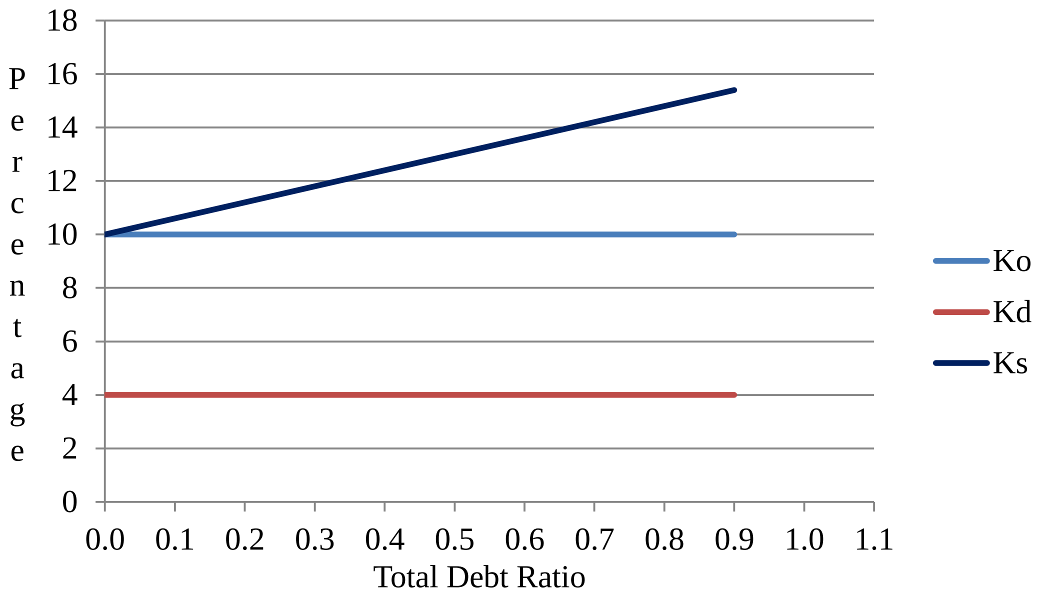
Including financial distress costs in the valuation of the company, causes the probability of bankruptcy to increase as the company increases the amount of debt in the financial structure, Miller (1977). Initially, with incremental increases in total debt, WACC decreases which causes the value of the company to rise. However, the probability of bankruptcy increases with increases in total debt. The increase in the value of the company caused by increased financial leverage is reduced by the additional bankruptcy costs. Bankruptcy costs are the probability of incurring bankruptcy costs multiplied by the value of the bankruptcy costs. As financial leverage increases, the additional value of the company from increased use of debt is equal to the increase in the total expected value of bankruptcy costs. At the optimal leverage level, company total value reaches a maximum after which the value of the company decreases. This model is referred to as the tradeoff theory of financial leverage. Krause and Litzenberger (1973) are credited with first using the term the trade-off theory.

Table 1 and Figure 1 show the impact of the M&M (1958) model, called the net operating income approach. The cost of debt remains constant at 4% and the WACC is held constant at 10%. The cost of equity increases with increases in financial leverage from 10% to 15.4% at a total debt ratio of 90%. If debt is greater than 100%, the equity of the company is negative implying that the company is *de facto*, bankrupt.

Table 1
Capital Structure
Net Operating Income Approach

Wd	Rd	Ws	Rs	WdRd	WsRs	Ro	Wd/Ws	Ro	Rd	Rs
0.0	4	1.0	10.00	0.00	10.00	10.00	0.00	10.00	4.00	10.00
0.1	4	0.9	10.60	0.40	9.54	10.00	0.10	10.00	4.00	10.60
0.2	4	0.8	11.20	0.80	8.96	10.00	0.20	10.00	4.00	11.20
0.3	4	0.7	11.80	1.20	8.26	10.00	0.30	10.00	4.00	11.80
0.4	4	0.6	12.40	1.60	7.44	10.00	0.40	10.00	4.00	12.40
0.5	4	0.5	13.00	2.00	6.50	10.00	0.50	10.00	4.00	13.00
0.6	4	0.4	13.60	2.40	5.44	10.00	0.60	10.00	4.00	13.60
0.7	4	0.3	14.20	2.80	4.26	10.00	0.70	10.00	4.00	14.20
0.8	4	0.2	14.80	3.20	2.96	10.00	0.80	10.00	4.00	14.80
0.9	4	0.1	15.40	3.60	1.54	10.00	0.90	10.00	4.00	15.40
1.0	4	0.0	10.00	4.00	0.00	10.00				

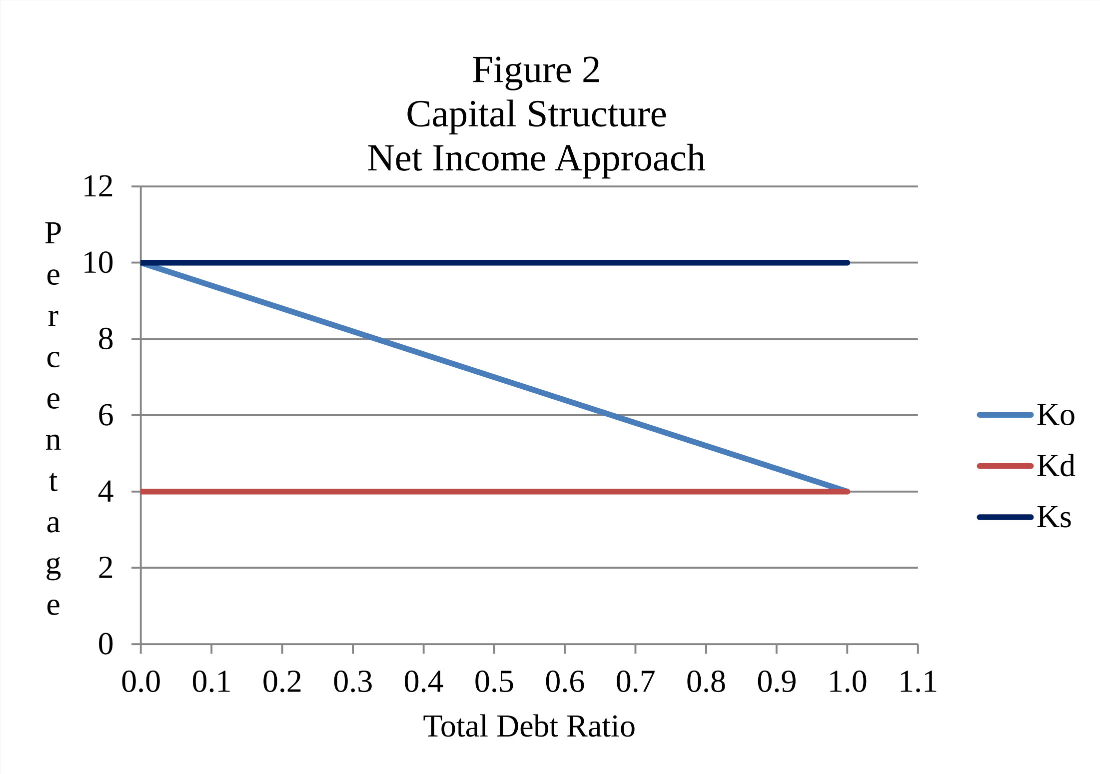
Figure 1
Capital Structure
Net Operating Income Approach



A second approach is the net income approach. Under the net income approach model, the cost of equity and the cost of debt are assumed to be constant. Therefore, as financial leverage increases, WACC decreases. Table 2 and Figure 2 demonstrate the effects of this model. We assume that the total debt ratio can range from 0% to 100% percent and that the cost of debt is 4% and the cost of equity is 10%. The WACC is a weighted average of the costs of the two components of the capital structure, debt and equity and ranges from 10% when the total debt ratio is 0% to 4% when the total debt ratio is 100%. The maximum amount of debt is 100%. Beyond that point, the equity of the company is negative implying that the company is *de facto*, bankrupt.

Table 2
Capital Structure
Net Income Approach

Wd	Rd	Ws	Rs	WdRd	WsRKs	Ro	Wd/Ws	Ro	Rd	Rs
0.00	4.00	1.00	10.00	0.00	10.00	10.00	0.00	10.00	4.00	10.00
0.10	4.00	0.90	10.00	0.40	9.00	9.40	0.10	9.40	4.00	10.00
0.20	4.00	0.80	10.00	0.80	8.00	8.80	0.20	8.80	4.00	10.00
0.30	4.00	0.70	10.00	1.20	7.00	8.20	0.30	8.20	4.00	10.00
0.40	4.00	0.60	10.00	1.60	6.00	7.60	0.40	7.60	4.00	10.00
0.50	4.00	0.50	10.00	2.00	5.00	7.00	0.50	7.00	4.00	10.00
0.60	4.00	0.40	10.00	2.40	4.00	6.40	0.60	6.40	4.00	10.00
0.70	4.00	0.30	10.00	2.80	3.00	5.80	0.70	5.80	4.00	10.00
0.80	4.00	0.20	10.00	3.20	2.00	5.20	0.80	5.20	4.00	10.00
0.90	4.00	0.10	10.00	3.60	1.00	4.60	0.90	4.60	4.00	10.00
1.00	4.00	0.00	10.00	4.00	0.00	4.00	1.00	4.00	4.00	10.00

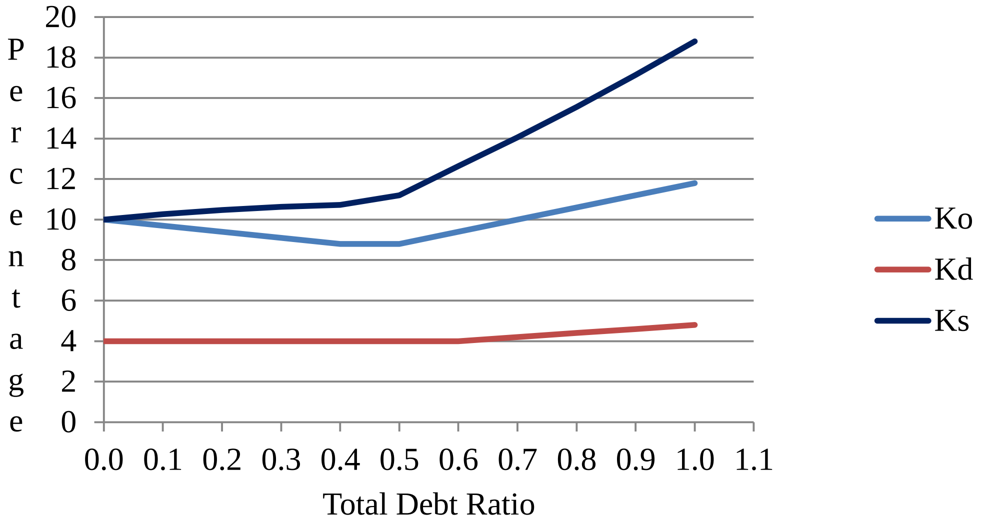


An alternative approach, called the traditional approach in Solomon (1963), assumes that the cost of debt and the cost of equity are constant initially but that both component costs increase beyond a certain range. That is, some proportion of debt does not increase the cost of debt. The cost of equity rises slightly initially and more rapidly beyond a certain range as the total debt ratio increases. In the example, debt is fixed up to 30% and equity rises only slightly, so that WACC decreases up to 40% and is constant up to 50%. Beyond 60% debt, the cost of equity increases by 0.60% and debt increase by 0.20%. Thus, WACC decreases to 40%, is constant to 50%, and rises after 60%. Table 3 and Figure 3 demonstrate the effects of this model.

Table 3
Capital Structure
Traditional
Approach

Wd	Rd	Ws	Rs	WdRd	WsRs	Ro	Wd/Ws	Ro	Rd	Rs
0.00	4.00	1.00	10.00	0.00	10.00	10.00	0.00	10.00	4.00	10.00
0.10	4.00	0.90	10.27	0.40	9.24	9.70	0.10	9.70	4.00	10.27
0.20	4.00	0.80	10.48	0.80	8.38	9.40	0.20	9.40	4.00	10.48
0.30	4.00	0.70	10.63	1.20	7.44	9.10	0.30	9.10	4.00	10.63
0.40	4.00	0.60	10.72	1.60	6.43	8.80	0.40	8.80	4.00	10.72
0.50	4.00	0.50	11.20	2.00	5.60	8.80	0.50	8.80	4.00	11.20
0.60	4.00	0.40	12.64	2.40	5.06	9.40	0.60	9.40	4.00	12.64
0.70	4.20	0.30	14.06	2.94	4.22	10.00	0.70	10.00	4.20	14.06
0.80	4.40	0.20	15.56	3.52	3.11	10.60	0.80	10.60	4.40	15.56
0.90	4.60	0.10	17.14	4.14	1.71	11.20	0.90	11.20	4.60	17.14
1.00	4.80	0.00	18.80	4.80	0.00	11.80	1.00	11.80	4.80	18.80

Figure 3
Capital Structure
Traditional Approach



The implications of the traditional approach are straightforward. For small increases in financial leverage, measured by the total debt ratio, WACC decreases. Beyond a certain point, the cost of debt begins to increase and the cost of equity increase more rapidly. Beyond the point, WACC begins to increase. In the middle area, the increased cost of debt and equity offset and the WACC remains constant. This area is the optimal range. For the example, WACC remains constant when the total debt ratio is between 40% and 50%.

THE TRADE-OFF THEORY OF FINANCIAL LEVERAGE

The trade-off theory of financial leverage shows the impact of increases in financial leverage on the company's weighted average cost of capital (WACC). Increases in debt in the company's capital structure increase the tax benefit since the interest payments on the debt is a tax deductible expense. At the same time, the company's cost of equity increases because the additional debt in the company's capital structure increases the riskiness of the equity. WACC will decline as long as the positive impact of the tax shelter is greater than the negative effect of the increase in the cost of equity resulting from the added risk. Eventually, the tax shelter benefit will be less that the additional cost of equity. At this point, investors will required a higher cost of debt and an even higher cost of equity because investors believe that the risk level of the company's risk from the financial leverage has increased beyond the optimal point for the company. A company's market capitalization is maximized when the WACC is minimized because the trade-off theory assumes that the company incurs additional bankruptcy risk and bankruptcy cost resulting from the additional financial leverage. The company's WACC starts to rise beyond the optimal level of financial leverage. The minimum WACC, is the point at which the market value of the company is maximized because this is the total debt level at which the of capital structure is optimized.

In this study, the trade-off theory of capital structure is applied to Coca-Cola and Pepsico. To apply the trade-off theory requires calculating the weighted average cost of capital (WACC) under different total debt ratio levels using actual market values for the cost of debt and the cost of equity using actual financial data for Coke and Pepsi and simulated data for alternative levels of debt.

The Weighted Average Cost of Capital

The weighted average cost of capital (WACC) is calculated by multiplying the proportion of each component of the capital structure by the cost of that component, M&M (1958). The component cost of debt is adjusted for taxes by multiplying by one minus the marginal tax rate. The proportion of both debt and equity are market based proportions where the market value of debt is the number of bonds outstanding times the number of bonds. The market value of equity is determined by multiplying the number of shares outstanding times the market price per share. The cost of debt is the yield to maturity on outstanding debt and the cost of equity is the CAPM determined cost of equity. Graham and Harvey (2001) report in a survey that 73.5 percent of corporate financial decision makers use the Capital Asset Pricing Model to calculate the cost of equity. Therefore,

$$WACC = w_d R_d(1\text{-}tax) + w_s(R_s)$$

where, WACC is the weighted average cost of capital, w_d is the proportion of debt, w_s is the proportion of equity, R_d is the marginal cost of debt, tax is the marginal tax rate, and R_s is the marginal cost of common stock equity. The component cost of debt is reduced by the amount of the tax shield.

The yield to maturity on outstanding bonds is the discount rate that equates the market price of the bonds to the coupon payments and the face value of the bond.

$$P_o = \Sigma CP_t/(1+ R_d)^t + MV/(1+ R_d)^T$$

where, Po is the market price of the bond, CP_t is the coupon payment of the bond, MV is the face value of the bond, and T is the time to maturity. The yield to maturity is the discount rate that equates the market price of the bond to the present value of the coupon payments plus the face value of the bond.

The cost of equity is calculated with the CAPM, Sharpe (1964). Using CAPM, the return on investment is the risk free rate of return plus a risk premium. The risk premium is beta, the amount of risk, times the market price of risk ($R_m - R_f$). This risk premium calculated with expected return in the market minus the risk free rate of return. The cost of equity is $R_s = R_f + \beta_s(R_m - R_f)$ where, R_s is the return on equity, R_m is the return on the market, R_f ,is the risk free rate, and β_s is the beta for the equity. Beta is the slope coefficient of the characteristic line and measures the systematic risk of the equity.

EMPIRICAL RESULTS

Table 4 shows the calculations needed to determine the simulated cost of debt for Coke/Pepsico for a range of bond ratings are from AAA to B and are taken from Standard and Poor (2006, page 54). Line 1 shows the total debt ratio for the average company at each bond rating level. Damodaran (2012) provides the risk premium above the Treasury bond rate for each bond rating. The simulated yield to maturity for each bond rating is equal to the bond yield risk premium from Damodaran (2012)[1] added to the average bond rate for treasury bonds taken from *Stocks, Bonds, Bills and Inflation* (2011). The bond yield to maturities range from 4.64% for a bond with an AAA rating to 9.05% for B rated bonds. As a company's financial leverage increases, the bond rating declines and their cost of debt increases. The results in Table 1 are used for both Coke and Pepsico since the yield to maturity is market determined.

	Table 4KO Debt Ratios and Interest Rates for S&P Debt Ratings Coca-Cola							
	Bond Rating		AAA	AA	A	BBB	BB	B
1	TD/(TD+E)		0.124	0.283	0.375	0.425	0.537	0.758
2	Yield (%)		4.64%	4.79%	5.14%	5.74%	7.49%	9.14%

Table 5KO shows the computations to calculate the CAPM beta for Coke at different levels of financial leverage. Currently, KO's beta is 0.57. Similar Tables for Pepsi are in Appendix A. The empirical results for Pepsi are similar. KO's total assets (book value) are $72,921 million for 12/31/2010, owners' equity (book value) is $31,317 million, and debt (book value) is $41,604 million. KO's market premium for outstanding debt as published in Morningstar (December 2010) is 9.785829%. Thus, the market value of KO's outstanding bonds for 12/31/2010 is $45,675 million. KO's market capitalization for 12/31/2010 was $150.56 billon. KO's market based debt to equity ratio is 0.29 and KO's total debt ratio is 0.2264.

KO's unlevered beta, using Hamada (1969) is 0.4789

$$\beta_{levered} = [1+(1-Tc)(D/E)]^* \beta_{unlevered}$$

$$\beta_{KO} = 0.57 = [1+(1-.35)(0.2264)] = 0.4789$$

[1] Damodaran (2012) http://pages.stern.nyu.edu/~adamodar/

The results in Table 5KO show that the beta coefficient for KO at 0% debt would be 0.4789 and beta would rise as the bond rating declined and the debt ratio increased. At a bond rating of B, the beta coefficient for KO would be 1.9790.

	Table 5KO Relevered Betas Coca-Cola							
1	Unlevered Beta	0.4789						
2	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
3	Debt/Equity	0.0000	0.1416	0.3947	0.6000	0.7391	1.1598	3.1322
4	Re-Levered Beta	0.4789	0.5230	0.6679	0.7663	0.8329	1.0344	1.9790

Table 6KO shows the computations required to calculate the CAPM required rate of return for KO at various bond ratings. These computations assume a risk free rate of 4.14% which is the Treasury bond yield for the month of December 2010[2] and an equity risk premium of 6.0% taken from *Stocks, Bonds, Bills, and Inflation, Market Results for 1926 - 2010, 2011 Yearbook*, published by Morningstar (2011) which is the difference between the long-term equity market return of 11.9% and the Treasury bond rate of 5.9%. A beta of .57 Coca-Cola is from *Yahoo! Finance* at the end of December 2010. The unlevered beta is 0,4789 and the CAPM required rate of return for KO is 7.01% with no debt and increases to 17.16% at a bond rating of B.

k_s = 4.14 + 0.4789 (6.00%) = 7.01%

	Table 6KO Computing Require Rate of Return for Equity Coca-Cola							
	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
1	Rf	4.14%	4.14%	4.14%	4.14%	4.14%	4.14%	4.14%
2	Rm-Rf	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
3	Beta	0.4789	0.5230	0.6679	0.7663	0.8329	1.0344	1.9790
4	CAPM Required ROR	7.01%	7.28%	8.15%	8.74%	9.14%	10.35%	16.01%

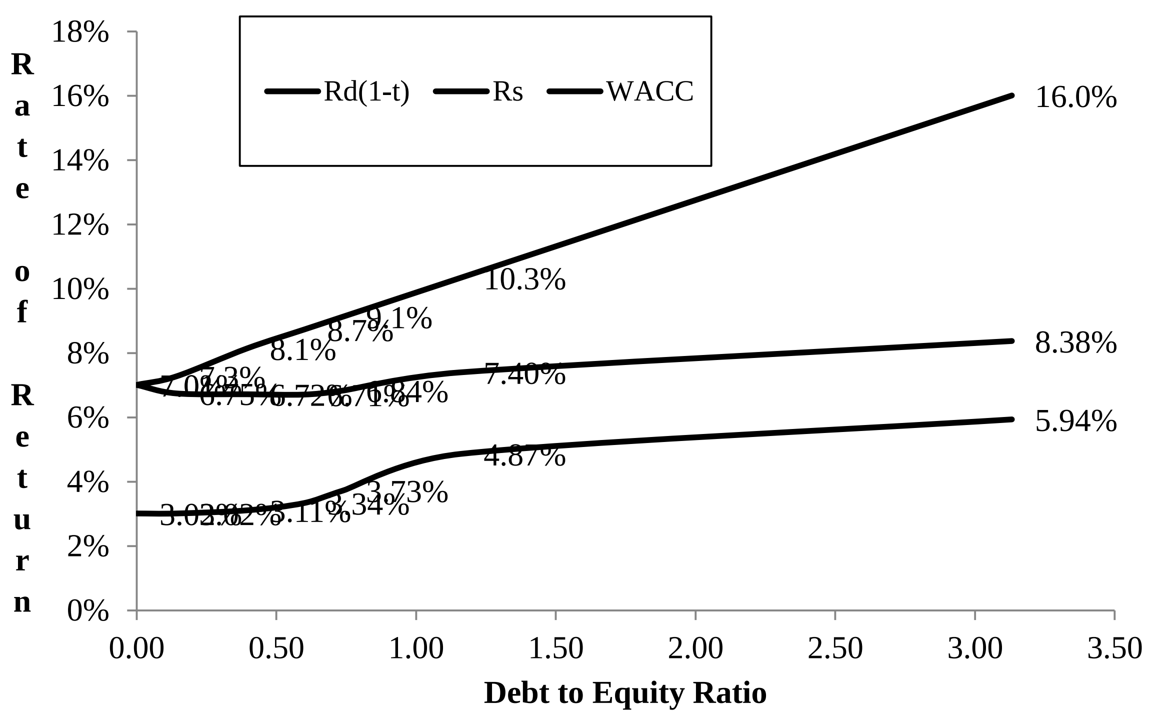
[2] http://www.federalreserve.gov/releases/h15/data/Monthly/H15_TCMNOM_Y30.txt

Table 7KO and Figure 4 combines the results from the first three tables to calculate the WACC for KO at various levels of financial leverage and the resulting bond ratings. The cost of debt in Line 1 is taken from Table 4KO and the tax rate in Line 2 is assumed to be 35%. Line 3 is the after tax cost of debt and is Line 2 multiplied by line 3. The total debt ratio is Line 4 is from Table 4KO. The weighted component cost debt (W_d*R_d) in Line 5 is Line 3, the after tax cost of debt multiplied by the total debt ratio, Line 4. Line 6 is the CAPM required rate of return for equity and Line 7 is the total equity ratio. Line 8 is the weighted component cost of equity and is Line 6 multiplied by Line 8. WACC, Line 9, is Line 5 added to Line 8.

Table 7KO
Computing WACC
Coca-Cola

	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
1	Cost of Debt	0.00%	4.64%	4.79%	5.14%	5.74%	7.49%	9.14%
2	Tax Rate (%)	35%	35%	35%	35%	35%	35%	35%
3	Cost of Debt times (1-tax)	0.00%	3.02%	3.11%	3.34%	3.73%	4.87%	5.94%
4	Total Debt/(TD + TE) (%)	0.0000	0.1240	0.2830	0.3750	0.4250	0.5370	0.7580
5	Wd*Kd	0.00%	0.37%	0.88%	1.25%	1.59%	2.61%	4.50%
6	CAPM Required ROR	7.01%	7.28%	8.15%	8.74%	9.14%	10.35%	16.01%
7	Total Equity/(TD+TE) (%)	1.0000	0.8760	0.7170	0.6250	0.5750	0.4630	0.2420
8	Ws*Ks	7.01%	6.38%	5.84%	5.46%	5.25%	4.79%	3.88%
9	WACC	7.01%	6.75%	6.72%	6.71%	6.84%	7.40%	8.38%

Figure 4 WACC for Coca-Cola



SUMMARY AND CONCLUSIONS

Currently, KO's S&P bond rating is A+ and this implies a WACC between 6.99 % and 7.00%. That is, KO's current debt ratio appears to be optimal. Additionally, the empirical results of the simulation show support for Solomon's (1963) traditional approach to determining the optimal capital structure. There is a range over which the WACC for KO is the same, 7.02% to 6.99%. The same analysis was done for Pepsi with similar results.

In this paper, it is demonstrated how the trade-off theory of capital structure can be applied to two actual firms, Coke-Cola and Pepsico. This analysis supports the results found in Gardner, McGowan, and Moeller (2010) for Microsoft although Coke and Pepsi are at their optimal debt structures where Microsoft is not. More work needs to be done to explain why the results indicate that all three companies should be at the same optimal capital structures. It may be a function of the range of debt ratios imbedded in the bond rating.

Appendix 1

Empirical Results for Pepsico

Table 5PEP
Relevered Betas
Pepsico

1	Unlevered Beta	0.4114						
2	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
3	Debt/Equity	0.000	0.142	0.395	0.600	0.739	1.160	3.132
4	Re-Levered Beta	0.4114	0.449	0.574	0.658	0.716	0.889	1.700

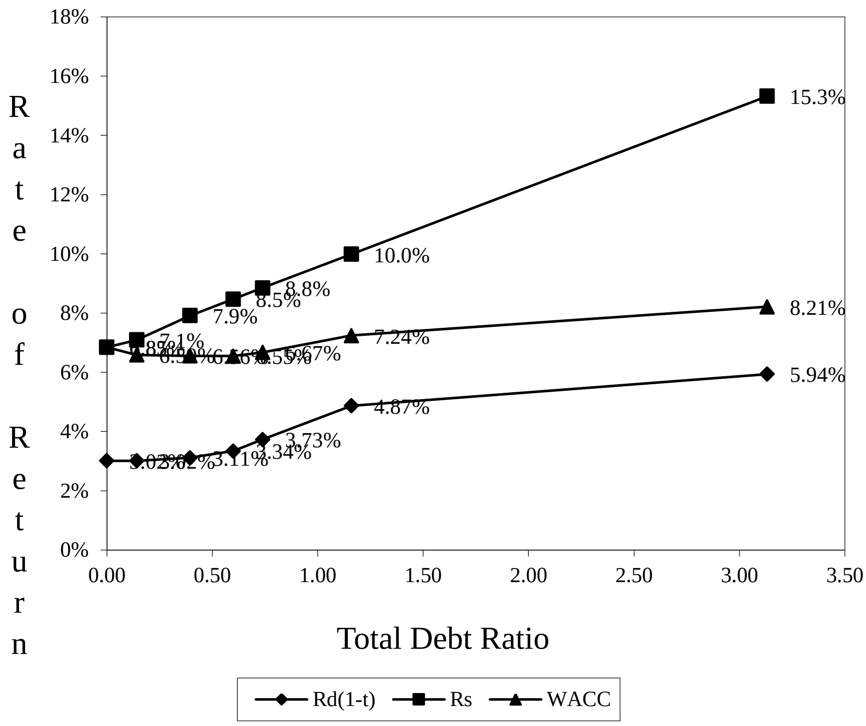
Table 6PEP
Computing Require Rate of Return for Equity
Pepsico

	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
1	Rf	4.14%	4.14%	4.14%	4.14%	4.14%	4.14%	4.14%
2	Rm-Rf	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
3	Beta	0.4114	0.4493	0.5738	0.6583	0.7155	0.8886	1.7001
4	CAPM Required ROR	6.61%	6.84%	7.58%	8.09%	8.43%	9.47%	14.34%

Table 7PEP
Computing WACC
Pepsico

	Bond Rating	No Debt	AAA	AA	A	BBB	BB	B
1	Cost of Debt	0.00%	4.64%	4.79%	5.14%	5.74%	7.49%	9.14%
2	Tax Rate (%)	35%	35%	35%	35%	35%	35%	35%
3	Cost of Debt times (1-tax)	0.00%	3.02%	3.11%	3.34%	3.73%	4.87%	5.94%
4	Total Debt/(TD + TE) (%)	0.0000	0.1240	0.2830	0.3750	0.4250	0.5370	0.7580
5	Wd*Kd	0.00%	0.37%	0.88%	1.25%	1.59%	2.61%	4.50%
6	CAPM Required ROR	6.61%	6.84%	7.58%	8.09%	8.43%	9.47%	14.34%
7	Total Equity/(TD+TE) (%)	1.0000	0.8760	0.7170	0.6250	0.5750	0.4630	0.2420
8	Ws*Ks	6.61%	5.99%	5.44%	5.06%	4.85%	4.39%	3.47%
9	WACC	6.61%	6.36%	6.32%	6.31%	6.43%	7.00%	7.97%

Figure 5
WACC for Pepsico



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