

## The Math of Value Creation<sup>1</sup> In-Class Problem<sup>2</sup>

As the CEO of National Media Management (NMM)<sup>3</sup> you've been struggling with how to formulate your firm's market value. You've seen that you're profitable, you know you have a reasonable WACC and ROIC, and you see that others are ascribing a level of value to your firm, so much so that you're facing a possible buyout offer. You've decided to get with your CFO and work through the metrics that help you convert your firm's financial values, ratios and metrics into a figure approximating its value. You have your firm's income statement and balance sheet, recall the following from your college finance courses, and must now begin to use all of this to determine some notion of your firm's value.

- The value of an asset is equal to its expected future cash flows discounted for rate and time
  - $Val_0 = \sum \frac{CF_1}{(1+r)^t}$
  - When the expected cash flow growth is constant, the model is rewritten as  $Val_0 = \frac{FCF_1}{WACC-g}$
  - This is the Gordon Growth Model
- Enterprise Value = Market Cap of Equity + Market Value of Long-Term Debt - Cash
- Invested Capital
  - Operations Approach: IC = Fixed Operating Assets + Net Working Capital
  - Financing Approach: IC = Total long-term Debt + Total Equity
- Net Investment = Invested Capital<sub>1</sub> – Invested Capital<sub>0</sub>
- Net Operating Profit Less Adjusted Capital (NOPLAT) = EBIT (1-T<sub>c</sub>)
- Free Cash Flow
  - FCF = NOPLAT + Non-Cash Expenses – NCS - ΔNWC
  - FCF = NOPLAT – Net Investment
  - $FCF = NOPLAT \left(1 - \frac{g}{ROIC}\right)$
- Market Value of a firm's Bond =  $C \frac{\left[1 - \frac{1}{(1+YTM)^N}\right]}{YTM} + \frac{F}{(1+YTM)^N}$
- $WACC = \left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right) (1-T_C)$
- Growth (g)
  - g<sub>explicit</sub> = near term expected growth rate of a firm's cash flow
  - g<sub>∞</sub> = expected long-run growth of the firm's cash flow
    - g = IR x ROIC
    - g = IGR or SGR
    - **g = 2.5% (given for use in this ICP)**
- Federal Corporate Tax rates<sup>4</sup> = 21%; State Corporate Tax Rates average 5%

<sup>1</sup> This problem and solution set is intended to present an abbreviated discussion of the included finance concepts and is not intended to be a full or complete representation of them or the underlying foundations from which they are built.

<sup>2</sup> This problem set was developed by Richard Haskell, PhD (rhaskell@westminstercollege.edu), Gore School of Business, Westminster College, Salt Lake City, Utah (updated 2020).

<sup>3</sup> While National Media Management is the name of an actual firm incorporated in the State of Utah from 1994-1999, the values presented are not representative of actual firm values.

<sup>4</sup> The 2017 Tax Cuts and Jobs Act altered Federal Corporate Income Tax rates and standardized them at 21% as of 1/1/2018; at the same time the Utah corporate income rate was equal to 4.95%

- a. **What is the firm's Invested Capital for 2019 considering both the Operations and Financing approaches?**

**Operations Approach: IC = Fixed Operating Assets + Net Working Capital**

$$IC_{2019} = 1,504,827 + (1,694,464 - 232,480) = 2,966,811$$

**Financing Approach: IC<sub>2019</sub> = Total Long-term Debt + Total Equity**

$$IC_{2019} = 985,349 + 1,981,462 = 2,966,811$$

- b. **What is the firm's NOPLAT<sub>2019</sub>?**

$$\begin{aligned} \text{NOPLAT}_{2019} &= \text{EBIT} (1-T) \\ &= 633,876 (1-.26) = 469,068 \end{aligned}$$

- c. **What is your firm's ROIC<sub>2019</sub>?**

$$\begin{aligned} \text{ROIC}_{2019} &= \frac{\text{NOPLAT}_{2019}}{IC_{2019}} \\ &= \frac{469,068}{2,966,811} = 0.1581 \text{ or } 15.81\% \end{aligned}$$

- d. **What is your firm's Net Investment (2019)?**

$$\begin{aligned} \text{Net Investment} &= \text{Invested Capital}_{2019} - \text{Invested Capital}_{2018} \\ &= 2,966,811 - 2,623,767 = 343,044 \end{aligned}$$

- e. **What is the firm's Net Capital Spending<sub>2019</sub>?**

$$\begin{aligned} \text{NCS} &= \text{FA}_1 - \text{FA}_0 + \text{Depreciation} \\ &= 1,504,827 - 1,350,862 + 145,734 = 299,699 \end{aligned}$$

- f. **What is the firm's ΔNet Working Capital?**

$$\begin{aligned} \Delta\text{NWC} &= \text{NWC}_{2019} - \text{NWC}_{2018} \\ &= (\text{CA}-\text{CL})_{2019} - (\text{CA}-\text{CL})_{2018} \\ &= (1,694,464 - 232,480) - (1,487,319 - 214,414) = 189,079 \end{aligned}$$

- g. **What is the firm's Free Cash Flow (FCF) for 2019? Calculate this from each of the three methods indicated**

$$\begin{aligned} \text{FCF} &= \text{NOPLAT} + \text{Non-Cash Expenses} - \text{Net Capital Spending} - \Delta\text{Net Working Capital} \\ &= 469,068 + 145,734 - 299,699 - 189,079 \\ &= 126,024 \end{aligned}$$

$$\begin{aligned} \text{FCF} &= \text{NOPLAT} - \text{Net Investment} \\ &= 469,068 - 343,044 \\ &= 126,024 \end{aligned}$$

$$\begin{aligned} \text{FCF} &= \text{NOPLAT} \left(1 - \frac{g}{\text{ROIC}}\right) \\ &= 469,068 \left(1 - \frac{.025}{.1581}\right) = 394,895 \end{aligned}$$

Hmmm, why are these FCF's so different? It's a question worth thinking about.

**h. What are the firm's Sustainable Growth Rate<sub>2019</sub> (SGR) and Internal Growth Rate<sub>2019</sub> (IGR)?**

The  $SGR = \frac{ROE \times b}{1 - ROE \times b}$  in which  $b = \frac{NI - Div}{NI}$ . It represents the firm's available growth rate through the use of its equity.

$$ROE = \frac{NI}{TE}$$

$$ROE = \frac{401,734}{1,981,462} = 0.2027$$

$$b = \frac{NI - Div}{NI}$$

$$b = \frac{401,734 - 45,317}{401,734} = \frac{356,417}{401,734} = 0.8872$$

$b$  is also referred to as the retention or plow-back rate

$$SGR = \frac{0.2027 \times 0.8872}{1 - 0.2027 \times 0.8872} = \frac{0.1798}{.8202} = 0.2192 \text{ or } 21.92\%$$

The  $IGR = \frac{ROA \times b}{1 - ROA \times b}$  - it represents the firm's available growth rate through the use of its assets.

$$ROA = \frac{NI}{TA}$$

$$ROA = \frac{401,734}{3,199,291} = 0.1256$$

$$IGR = \frac{0.1256 \times 0.8872}{1 - 0.1256 \times 0.8872} = \frac{0.1114}{.8886} = 0.1254 \text{ of } 12.54\%$$

**i. What is this firm's WACC for 2019 using a purely market value approach in which long-term debt and equity are taken at market values?**

$$WACC = \left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right)(1 - T_{TI})$$

To calculate the firm's WACC we'll rely on a market-based approach where possible.

- E = market value of Common Stock = shares outstanding x price per share = 4,022,755
- P = market value of Preferred Stock = shares outstanding x price per share = 330,000
- D = book value of firm's long-term debt = Market Value of Bonds + Mortgages + Credit Line
  - Mkt Val per Bond =  $C \frac{\left[1 - \frac{1}{(1+YTM)^N}\right]}{YTM} + \frac{F}{(1+YTM)^N} = 27.85 \frac{\left[1 - \frac{1}{(1+.035)^{40}}\right]}{.035} + \frac{1000}{(1+.035)^{40}} = 847.3112$
  - Number of Bonds = Book Value of Bonds / Face Value = 628,000/1000 = 628
  - Market Value of Bonds = Mkt per Bond x Number of Bonds = 847.3112 x 628 = 532,111.4336
  - Market Value of LTD = 532,111 + 271,700 + 85,649 = 889,460
- V = E + P + D = 4,022,755 + 330,000 + 889,460 = 5,242,215

*Note that these aren't simply the marketable securities representing the firm's long-term debt, but all of the firm's long-term debt, including those debt instruments for which we'll take the book value as its market value (mortgages, bank loans, credit lines, etc). All of this debt is included in the firm's capital structure*

E/V (common stock)	0.7674
P/V (preferred stock)	0.0630
D/V (total long-term debt)	0.1697

Since we only have book values to draw on and we want the simplest of all possible cost of capital calculations, we'll use the following:

- To find  $R_E$  we'll use the CAPM method in which  $R_E = R_F + (R_M - R_F)\beta = .02 + (.12 - .02)(1.3) = .15$
- $R_P = \frac{\text{Preferred Div Paid}_{2019}}{\text{Market Value of Preferred Stock}_{2019}} = \frac{20,000}{330,000} = .0606$
- $R_D =$  Current Yield or current borrowing rate = 7%
- Now let's use these values to construct WACC

$$\begin{aligned} \text{WACC} &= \left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right)(1-T_C) \\ &= \left(\frac{4,022,755}{5,242,215} \times .15\right) + \left(\frac{330,000}{5,242,215} \times .0606\right) + \left(\frac{889,460}{5,242,215} \times .07\right)(1-.26) \\ &= (.7644 \times .15) + (.063 \times .0606) + (.1697 \times .07)(.74) \\ &= .1151 + .0038 + .0088 = .1277 \end{aligned}$$

j. What is the firm's Investment Rate (IR)?

$$\text{IR} = \frac{\text{Net Investment}}{\text{NOPLAT}} = \frac{343,044}{469,068} = 0.7313 \text{ or } 73.13\%$$

k. You've been given to understand that when the rate of change of the cash flow variable is constant, value can be calculated through a continuing value formula as follows:  $\text{Value}_t = \frac{\text{FCF}_1}{\text{WACC}-g}$  (this is an FCF augmented form of the Gordon Growth equation using WACC as the discount factor). With this in mind, what is the estimated value of the firm? Assign this value as of 2019 using a 2.5% growth rate.

$$\text{Value}_t = \frac{\text{FCF}_1}{\text{WACC}-g} = \frac{(126,024)(1+.025)}{.1277 - .025} = \frac{129,174.6}{.1027} = 1,257,786 \quad (1)$$

National Media Management					
Balance Sheet					
as of December 31					
	2018	2019		2018	2019
Current Assets			Liabilities		
Cash	213,960	263,850	Accounts Payable	214,414	232,480
Accounts Receivable	651,552	768,318	Total	214,414	232,480
Inventory	621,807	662,296			
Total	1,487,319	1,694,464			
			Long Term Debt		
Fixed Assets			Mortgages (interest only)	271,700	271,700
Buildings	722,862	757,328	Credit Line	99,022	85,649
Equipment	378,000	447,499	Bonds	628,000	628,000
Technology	250,000	300,000	Total	998,722	985,349
Total	1,350,862	1,504,827			
			Owner's Equity		
Total Assets	2,838,181	3,199,291	Common Stock	292,564	292,564
			Preferred Stock	200,000	200,000
			Accumulated Retained Earnings	1,132,481	1,488,898
	-	(0.00)	Total	1,625,045	1,981,462
			Total Liabilities and Owner's Equity	2,838,181	3,199,291

Additional Financial Information					
Preferred Stock			Common Stock		
Shares Outstanding		200,000	Shares Outstanding		292,564
12/31 Price per Share		1.65	12/31 Price per Share		13.75
Market Value (Market Cap)		330,000	Market Value (Market Cap)		4,022,755
Bond Information			Beta		1.30
Coupon Rate	5.57%		R <sub>M</sub>		12.00%
YTM	7.00%		R <sub>F</sub>		2.00%
Years Remaining	20				
Face Value	1000				
P/YR	2				

National Media Management		
Income Statement		
January 1 - December 31, 2019		
Sales		
Products		7,535,221
Services		2,152,025
Total Sales		9,687,246
Operating Expenses		
Admin and Mgt		852,873
Production		1,529,884
Materials		6,524,879
Depreciation		145,734
Total Expenses - COGS		9,053,370
Operating Income		633,876
Non-Operating Expense		
Credit Line Interest Expense		44,579
Mortgage Interest Expense		11,412
Bond Interest Expense		35,001
Total Non-Operating Expense		90,992
Pre-Tax Income		542,884
Tax		141,150
Net Income		401,734
Distribution of Earnings		
Dividends (Common)		25,317
Dividends (preferred)		20,000
Retained Earnings		356,417