

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

*The subject firm in this problem set is National Media Management, a Utah based LLC from 1994 through 1999. The Income Statement, Balance Sheet, and Other Financial Information used herein are also used in other In-Class Problems in support of building a body of Corporate Finance In-Class Problems.*

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 know the following values, and must now turn those figures into some dollar value to approximating your firm's value.

- **Enterprise Value: two forms – different or the same?**
    - Enterprise Value = Market cap of all stock + Book value of long-term debt – cash
    - Enterprise Value = Market Cap of all stock + market value of long-term debt
    - Can this be seen from a book value vs. market value approach?
  - **Invested Capital**
    - Operations Approach: IC = Fixed Operating Assets + Net Working Capital
    - Financing Approach: IC = Total long-term Debt + Total Equity
  - **Net Operating Profit Less Adjusted Capital (NOPLAT) = EBIT (1-T<sub>C</sub>)**
  - **WACC =  $\left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right) (1-T_C)$**
  - **g: three forms – different or the same?**
    - **g = 1.5% = growth of NOPLAT = growth of FCF**
    - **g = growth rate of dividend (common)**
    - **g = IR x ROIC**
- a. **What are the firm's Invested Capital values for 2013 and 2014 considering both the Operations and Financing approaches?**

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

$$IC_{2013} = 1,351,384 + (1,487,319 - 214,414) = 2,624,289$$

$$IC_{2014} = 1,457,343 + (1,814,464 - 192,480) = 3,079,327$$

### **Financing Approach: IC<sub>2013</sub> = Total Long-term Debt + Total Equity**

$$IC_{2013} = 999,244 + 1,625,045, = 2,624,289$$

$$IC_{2014} = 1,119,823 + 1,959,504 = 3,079,327$$

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<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 (2015).

<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.

**b. What is your firm's NOPLAT<sub>2014</sub>?**

$$\begin{aligned}\text{NOPLAT}_{2014} &= \text{EBIT} (1-T) \\ &= 633,876 (1-.35) = 412,019\end{aligned}$$

**c. What is your firm's ROIC<sub>2014</sub>?**

$$\begin{aligned}\text{ROIC}_{2014} &= \frac{\text{NOPLAT}}{\text{Invested Capital}} \\ &= \frac{412,019}{3,079,327} = 0.1338 \text{ or } 13.38\%\end{aligned}$$

**d. What is your firm's Net Investment (2014)?**

$$\begin{aligned}\text{Net Investment} &= \text{Invested Capital}_{t+1} - \text{Invested Capital}_t \\ &= 3,079,327 - 2,624,289 = 455,038\end{aligned}$$

**e. What is your firm's Net Capital Spending<sub>2014</sub>?**

$$\begin{aligned}\text{NCS} &= \text{FA}_1 - \text{FA}_0 + \text{Depreciation} \\ &= 1,457,343 - 1,351,384 + 145,734 = 251,693\end{aligned}$$

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

$$\begin{aligned}\Delta\text{NWC} &= \text{NWC}_1 - \text{NWC}_0 \\ &= (\text{CA}-\text{CL})_1 - (\text{CA}-\text{CL})_0 \\ &= (1,814,464 - 192,480) - (1,487,319 - 214,414) = 349,079\end{aligned}$$

**g. What is your firm's Free Cash Flow (FCF) for 2014?**

$$\begin{aligned}\text{FCF} &= \text{NOPLAT} - \text{Net Investment} \\ &= 412,019 - 455,038 \\ &= -43,019\end{aligned}$$

$$\begin{aligned}\text{FCF} &= \text{NOPLAT} + \text{Non-Cash Expenses} - \text{Net Capital Spending} - \Delta\text{Net Working Capital} \\ &= 412,019 + 145,734 - 251,693 - 349,079 \\ &= -43,019\end{aligned}$$

$$\begin{aligned}\text{FCF} &= \text{NOPLAT} \left(1 - \frac{g}{\text{ROIC}}\right) \\ &= 412,019 \left(1 - \frac{.015}{.1338}\right) = 365,828.53\end{aligned}$$

Why are these FCF's so different?

- h. **What is this firm's WACC for 2014 using a purely book value approach in which long-term debt and equity are taken at book values?** *Note: While it is not clear that a book value approach is a preferred method for the calculation of WACC, it is useful in this particular example.*

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

To calculate the firm's WACC we'll rely on principally on a book value approach since we don't have enough information to consider a completely market based approach.

- E = book value of Common Stock = 319,465
- P = book value of Preferred Stock = 200,000
- D = book value of firm's long term debt = Mortgages + Credit Line + Bonds  
= 285,300 + 134,508 + 700,015  
= 1,119,823

*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. All of this debt is included in the firm's capital structure and WACC measures the cost of that structure.*

E/V (common stock)	0.1949
P/V (preferred stock)	0.1220
D/V (total long term debt)	0.6831

- To find  $R_E$  we'll use the Modigliani and Miller (M&M) corollary applied to the Dividend Growth model:
  - $P_0 = \frac{Div\ Paid_{2015}}{r-g}$  rearrange this to solve for  $r$ , which M&M argue can be viewed as  $R_E$
  - $R_E = \frac{Div\ Paid_{2015}}{P_0} + g = \frac{(25,317 \times 1.015)}{4,392,644} + .015 = .02085$
- $R_P = \frac{preferred\ dividends}{book\ value\ of\ preferred} = \frac{20,000}{200,000} = .10$
- $R_D = \frac{long\ term\ interest\ expense_1}{book\ value\ of\ long\ term\ debt_0} = \frac{90992}{999,244} = .091$

Now let's use these values to construct WACC

$$\begin{aligned} WACC &= \left(\frac{319,465}{1,639,288} \times .02085\right) + \left(\frac{200,000}{1,639,288} \times .10\right) + \left(\frac{1,119,823}{1,639,288} \times .091\right) (1-.35) \\ &= (.1949 \times .02085) + (.122 \times .10) + (.6831 \times .091)(.65) \\ &= .00406 + .0122 + .0404 = .0567 \\ &= .0567 \text{ or } 5.67\% \end{aligned}$$

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

$$\begin{aligned} \text{IR} &= \frac{\text{Net Investment}}{\text{NOPLAT}} \\ &= \frac{455,038}{412,019} = 1.1044 \text{ or } 110.44\% \end{aligned}$$

- j. 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:  $\text{Value}_t = \frac{\text{NOPLAT}_{t+1}}{\text{WACC}-g}$  (in this case this is a NOPLAT augmented form of the Dividend 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 2014. Note: While it's not clear NOPLAT is the preferred cash flow variable for use in valuation calculations, it's convenient to use in this example**

$$\begin{aligned} \text{Value}_t &= \frac{\text{NOPLAT}_{t+1}}{\text{WACC}-g} & (1) \\ &= \frac{(412,019)(1+0.015)}{.0567 - .015} = \frac{418,199.285}{.0417} = 10,028,759.83 \end{aligned}$$

- k. You've also been told you can calculate the firm's value through a different metric:  $\text{Value} = \frac{\text{NOPLAT} \left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC}-g}$  (this is the KVD form of a continuing value equation). What is the calculated value of the firm based on this formulation?**

If we use the value for  $g$  given stated in the assumptions, then

$$\begin{aligned} \text{Value}_t &= \frac{\text{NOPLAT}_{t+1} \left(1 - \frac{g}{\text{ROIC}}\right)}{\text{WACC}-g} & (2) \\ &= \frac{412,019 \left(1 - \frac{.015}{.1338}\right)}{.0567 - .015} = \frac{365,828.53}{.0417} = 8,772,866.43 \end{aligned}$$

Which is a different value than we got in part (g).

- l. How are these values different (if they are), and how is it that these two equational forms, based on similar algebraic structures, led us to these values?**

The values are different of course. The difference in this case is motivated by the different cash flow variables. In part j we used NOPLAT and in part k we used  $\text{NOPLAT}_{t+1} \left(1 - \frac{g}{\text{ROIC}}\right)$ , which we know is equal to FCF.

- m. Finally,  $g$  has been stated at 1.5%, but can be calculated as  $g = IR \times ROIC$ . How do these values differ if we use a calculated  $g$  rather than the stated  $g$ ? What do you make of any resulting differences?

Calculated  $g = IR \times ROIC = 1.1044 \times 0.1338 = .1478$  or 14.78%

Now plug this value for  $g$  in to (1)

$$\text{Value} = \frac{(412,019)(1+.1478)}{.0567 - .1478} = \frac{472,915.408}{-.0911} = -5,191,168.04$$

And similarly plug the value for  $g$  into (2)

$$\text{Value} = \frac{412,019(1-\frac{.1478}{.1338})}{.0567 - .1478} = \frac{-43,111.106}{-.0911} = 473,228.39$$

And we find that the two valuation calculations are significantly different than they were when we used  $g = 0.015$ . The differences between them can be explained by the interpretation of the two types of  $g$  used. The stated  $g$  is simply sometimes an assigned value based on forecasted revenues and expenses, and other times it's actually an observed growth rate in NOPLAT.

The calculated  $g$  appears to be more of a theoretically composed value that may tell us about the limit of growth sustainable by the firm. This sounds a lot like the SGR, so let's test see what the SGR looks like for this firm for the same period. First we need to calculate ROE and  $b$  (retention rate), and we can then calculate the SGR:

$$ROE = \frac{NI}{TE} \tag{3}$$

$$ROE = \frac{352,875}{1,959,504} = 0.1801$$

$$b = \frac{NI - Div}{NI} \tag{4}$$

$$b = \frac{352,875 - 45,317}{352,875} = \frac{307,558}{352,875} = 0.87158 - b \text{ is also referred to as the retention or plow-back rate}$$

$$SGR = \frac{ROE \times b}{1 - ROE \times b} \tag{5}$$

$$SGR = \frac{0.1801 \times 0.87158}{1 - 0.1801 \times 0.87158} = \frac{0.15697}{.84303} = 0.18488$$

So, this value is actually higher than the calculated  $g$ , so that  $g$  must not be expressly a sustainable growth limit, but it might still inform us of a level of growth to which the company should aspire given its internal components. But it doesn't measure market metrics at all and growth is a function of internal components as well as external market conditions. I think this leave the calculated  $g$  as a theoretical value, rather than something we can observe or expect to rely on.

