The Math of Value Creation[1]
In-Class Problem[2]

As the CEO of National Media Management (NMM)[3] 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 = $Invested\ Capital_1$ – $Invested\ Capital_0$**
- **Net Operating Profit Less Adjusted Capital (NOPLAT) = EBIT ($1-T_C$)**
- **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 = $\left(\frac{E}{V} \text{ x } R_E\right)$ + $\left(\frac{P}{V} \text{ x } R_P\right)$ + $\left(\frac{D}{V} \text{ x } R_D\right)(1-T_C)$**
- **Growth (g)**
  - **$g_{explicit}$ = near term expected growth rate of a firm's cash flow**
  - **g_∞ = expected long-run growth of the firm's cash flow**
    - ***g* = IR x ROIC**
    - ***g* = IGR or SGR**
    - ***g = 2.5% (given)***
- **Federal Corporate Tax rates[4] = 21%; State Corporate Tax Rates average 5%**

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[1] 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.

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

[3] 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.

[4] 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_{2019} = Total Long-term Debt +Total Equity

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

b. **What is the firm's $NOPLAT_{2019}$?**

$NOPLAT_{2019}$ = EBIT (1-T)

= 633,876 (1-.26) = 469,068

c. What is your firm's $ROIC_{2019}$?

$ROIC_{2019} = \frac{NOPLAT_{2019}}{IC_{2019}}$

$= \frac{469,068}{2,966,811}$ = 0.1581 or 15.81%

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

Net Investment = $Invested\ Capital_{2019}$ – $Invested\ Capital_{2018}$

= 2,966,811 – 2,623,767 = 343,044

e. What is the firm's $Net\ Capital\ Spending_{2019}$?

NCS = FA_1 - FA_0 + Depreciation

= 1,504,827 – 1,350,8624 + 145,734 = 299,699

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

ΔNWC = NWC_{2019} - NWC_{2018}

= $(CA\text{-}CL)_{2019}$ – $(CA\text{-}CL)_{2018}$

= (1,694,464 – 232,480) – (1,487,319 – 214,414) = 189,079

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

FCF = NOPLAT + Non-Cash Expenses – Net Capital Spending - ΔNet Working Capital

= 469,068 + 145,734 – 299,699 – 189,079

= 126,024

FCF = NOPLAT – Net Investment

= 469,068 – 343,044

= 126,024

FCF = NOPLAT $(1-\frac{g}{ROIC})$

$= 469,068\left(1-\frac{.025}{.1581}\right)$ = 394,895

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

h. What is the firm's Sustainable Growth Rate$_{2019}$ (SGR) and Internal Growth Rate$_{2019}$ (IGR)?

The $SGR = \frac{ROE\ x\ b}{1-ROE\ x\ b}$ = 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

$SGR = \frac{0.2027\ x\ 0.8872}{1-0.2027\ x\ .8872} = \frac{0.1798}{.8202} = 0.2192$ or 21.92%

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

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

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

$IGR = \frac{0.1256\ x\ 0.8872}{1-0.1256\ x\ .8872} = \frac{0.1114}{.8886} = 0.1254$ 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 = $\left(\frac{E}{V} \text{ x } R_E\right) + \left(\frac{P}{V} \text{ x } R_P\right) + \left(\frac{D}{V} \text{ x } R_D\right)(1\text{-}T_{TI})$

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 $R_E = \text{RF} + (\text{RM} - \text{RF})\beta$ = .02 + (.12 - .02)(1.3) = .15
- $R_P = \frac{Preferred\ Div\ Paid_{2019}}{Market\ Value\ of\ Preferred\ Stock_{2019}} = \frac{20{,}000}{330{,}000} = .0606$
- R_D = Current Yield or current borrowing rate = 7%
- Now let's use these values to construct WACC

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

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: $\mathbf{Value}_t = \frac{\mathbf{FCF_1}}{\mathbf{WACC - g}}$ (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.

$$\text{Value}_t = \frac{\mathbf{FCF_1}}{\mathbf{WACC - g}} = \frac{(126{,}024)(1+.025)}{.1277 - .025} = \frac{129{,}174.6}{.1027} = 1{,}257{,}786 \qquad (1)$$

l. You've also been told you can calculate the firm's value through a different metric: $\mathbf{Value} = \frac{\mathbf{NOPLAT}\left(1 - \frac{g}{ROIC}\right)}{\mathbf{WACC - g}}$ (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

$$\text{Value}_t = \frac{\text{NOPLAT}_{2020}\left(1 - \frac{g}{ROIC}\right)}{\text{WACC} - \text{g}} \qquad (2)$$

$$= \frac{469{,}068(1+.025)\left(1 - \frac{.025}{.1581}\right)}{.1277 - .025} = \frac{404{,}768}{.1027} = 3{,}941{,}266$$

Which is a different value than we got in part (k), why?

m. 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 values we've calculated for FCF since $\mathrm{NOPLAT}_1 \left(1 - \frac{g}{ROIC}\right)$ = FCF. So, why are the values for FCF so different? Because the traditional calculation for FCF (FCF = NOPLAT + Non-Cash Expenses – NCS - ΔNWC) doesn't capture the dynamic of ROIC or g used in FCF = NOPLAT $\left(1 - \frac{\mathrm{g}}{\mathrm{ROIC}}\right)$, nor should it.

n. Finally, g has been stated at 2.5%, but can be calculated as *g* = IR x ROIC. How do these valuations differ if we use a calculated *g* rather than the stated *g*? What do you make of any differences?

Calculated ***g*** = IR x ROIC = 0.7313 x 0.1581 = .1156 or 11.56%

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

Value = $\frac{(126{,}024)(1+.1156)}{.1277 - .1156} = \frac{140{,}593}{.0121}$ = 11,619,256

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

Value = $\frac{469{,}068(1+.1156)\left(1-\frac{.1156}{.1581}\right)}{.1277-.1156} = \frac{140{,}670}{.0121}$ = 11,625,617

And we see that these values are relatively similar (absent rounding differences in their inputs they would be exactly the same), which is different than what we found before when we used *g* = 2.5%. 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 FCF.

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, which sounds a lot like the IGR.

National Media Management

Balance Sheet

as of December 31

	2018	2019		2018	2019
Current Assets			Liabilitites		
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_M		12.00%
YTM	7.00%		R_F		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