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

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)[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.

- **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 - cash**
- **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 $(1\text{-}T_C)$**
- **Free Cash Flow**
  - **FCF = NOPLAT + Non-Cash Expenses – NCS - ΔNWC**
  - **FCF = NOPLAT – Net Investment**
  - **FCF = NOPLAT** $\left(1 - \frac{g}{ROIC}\right)$
- **WACC =** $\left(\frac{E}{V} \text{ x } R_E\right) + \left(\frac{P}{V} \text{ x } R_P\right) + \left(\frac{D}{V} \text{ x } R_D\right)(1\text{-}T_C)$
- **g = expected long-run growth of the firm's FCF**
  - ***g* = % ΔGDP**
  - ***g* = IR x ROIC**
  - ***g* = IGR or SGR**
  - ***g* = 5% *(given)***

[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 (2015).
[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.

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 – 214414) = 2,624,289

IC_{2014} = 1,505,349 + (1,694,464 - 232,480) = 2,967,333

Financing Approach: IC_{2013} = Total Long-term Debt + Total Equity

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

IC_{2014} = 1,304,730 + 1,932,603 = 2,967,333

b. **What is your firm's $NOPLAT_{2014}$?**

$NOPLAT_{2014}$ = EBIT (1-T)

= 633,876 (1-.35) = 412,019

c. What is your firm's $ROIC_{2014}$?

$$ROIC_{2014} = \frac{\text{NOPLAT}}{\text{Invested Capital}}$$

$$= \frac{412{,}019}{2{,}967{,}333} = 0.1389 \text{ or } 13.89\%$$

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

Net Investment = $\text{Invested Capital}_{t+1} - \text{Invested Capital}_{t}$

= 2,967,333 – 2,624,289 = 343,044

e. What is your firm's Net Capital Spending_{2014}?

NCS = FA_1 - FA_0 + Depreciation

= 1,505,349 – 1,351,384 + 145,734 = 299,699

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

ΔNWC = NWC_1 - NWC_0

= $(CA\text{-}CL)_1 - (CA\text{-}CL)_0$

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

g. What is your firm's Free Cash Flow (FCF) for 2014? ***Calculate this from each of the three methods indicated***

FCF = NOPLAT + Non-Cash Expenses – Net Capital Spending - ΔNet Working Capital
= 412,019 + 145,734 – 299,699 – 189,079
= 68,975

FCF = NOPLAT – Net Investment
= 412,019 – 343,044
= 68,975

FCF = NOPLAT $(1-\frac{g}{ROIC})$
= $412{,}019\left(1-\frac{.05}{.1389}\right)$ = 263,704

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 and it's not clear you have enough information to calculate this from a purely market value driven approach.*

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

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 = 292,564
- P = book value of Preferred Stock = 200,000
- D = book value of firm's long term debt = Mortgages + Credit Line + Bonds
  = 271,700 + 134,508 + 628,522
  = 1,034,730
- V = E + P + D = 292,564 + 200,000 + 1034,730,= 1,527,294

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; WACC measures the cost of that structure.

E/V (common stock)	0.1916
P/V (preferred stock)	0.1310
D/V (total long term debt)	0.6775

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 $R_E = \frac{Common\ Div\ Paid_{2014}}{Book\ value\ of\ Common\ Stock_{2014}} = \frac{25,317}{292,564} = .0865$
- $R_P = \frac{Preferred\ Div\ Paid_{2014}}{Book\ value\ of\ Preferred\ Stock_{2014}} = \frac{20,000}{200,000} = .10$
- $R_D = \frac{Long\ term\ interest\ expense_{2014}}{Book\ value\ of\ long\ term\ debt_{2013}} = \frac{90,992}{999,244} = .091$

Now let's use these values to construct WACC

$$WACC = \left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right)(1-T_C)$$
$$= \left(\frac{292,564}{1,527,294} \times .0865\right) + \left(\frac{200,000}{1,527,294} \times .10\right) + \left(\frac{1,034,730}{1,527,294} \times .091\right)(1-.35)$$
$$= (.1916 \times .0865) + (.1310 \times .10) + (.6775 \times .091)(.65)$$
$$= .0166 + .0131 + .0401 = .0698$$

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

$$IR = \frac{\text{Net Investment}}{\text{NOPLAT}} = \frac{343,044}{412,019} = 0.8326 \text{ or } 83.26\%$$

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

$$\text{Value}_t = \frac{\mathbf{FCF_1}}{\mathbf{WACC-g}} = \frac{(68,975)(1+.05)}{.0698-.05} = \frac{72,423.75}{.0198} = 3,657,765.15$$

k. 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

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

$$= \frac{412,019\left(1-\frac{.05}{.1389}\right)}{.0698-.05} = \frac{263,704.03}{.0198} = 13,318,385.35$$

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

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 values we've calculated for FCF since $\text{NOPLAT}_1 \left(1 - \frac{g}{ROIC}\right)$ = 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 used in FCF = NOPLAT $\left(1 - \frac{\text{g}}{\text{ROIC}}\right)$, nor should it.

m. Finally, g has been stated at 5.00, 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 = 0.8326 x 0.1389 = .1156 or 11.56%

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

Value = $\frac{(68{,}975)(1+.1156)}{.0698 - .1156} = \frac{76{,}948.351}{-.0458}$ = -1,680,098.47

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

Value = $\frac{412{,}019\left(1-\frac{.1156}{.1389}\right)}{.0698-.1156} = \frac{69{,}114.78}{-.0458}$ = -1,509,056.29

And we find that the two valuation calculations are significantly different than they were when we used *g* = 0.05. 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. 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:

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

$ROE = \frac{352{,}875}{1{,}932{,}603}$ = 0.1826

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

$b = \frac{352{,}875-45{,}317}{352{,}875} = \frac{307{,}558}{352{,}875}$ = 0.8716 - *b* is also referred to as the retention or plow-back rate

$SGR = \frac{ROE\ x\ b}{1-ROE\ x\ b}$ (5)

$SGR = \frac{0.1826\ x\ 0.8716}{1\ -0.1826\ x\ .08716} = \frac{0.1592}{.84303}$ = 0.1893

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.

National Media Management
Balance Sheet
as of December 31

	2013	2014
Current Assets		
Cash	213,960	263,850
Accounts Receivable	651,552	768,318
Inventory	621,807	662,296
Total	1,487,319	1,694,464
Fixed Assets		
Buildings	722,862	757,328
Equipment	378,522	448,021
Technology	250,000	300,000
Total	1,351,384	1,505,349
Total Assets	2,838,703	3,199,813
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	2013	2014
Liabilitites		
Accounts Payable	214,414	232,480
Total	214,414	232,480
Long Term Debt		
Mortgages (interest only)	271,700	271,700
Credit Line	99,022	134,508
Bonds	628,522	628,522
Total	999,244	1,034,730
Owner's Equity		
Common Stock	292,564	292,564
Preferred Stock	200,000	200,000
Accumulated Retained Earnings	1,132,481	1,440,039
Total	1,625,045	1,932,603
Total Liabilities and Owner's Equity	2,838,703	3,199,813

National Media Management
Income Statement
January 1 - December 31, 2014

Sales	
Products	7,535,221
Services	2,152,025
Total Sales	9,687,246
Expenses - COGS	
Admin and Mgt	852,873
Production	1,529,884
Materials	6,524,879
Depreciation	145,734
Total Expenses - COGS	9,053,370
EBIT (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 (35%)	190,009
Net Income	352,875
Distribution of Earnings	
Dividends (Common)	25,317
Dividends (preferred)	20,000
Addition to Retained Earnings	307,558