Forecasting Value: DCF, APV and Econ Profit Models[1]
In-Class Problem[2]

The subject firm for the problems represented in this case is The Farm Hill Group, Ltd., a fictional firm for which hypothetical values have been presented. The Income Statement, Balance Sheet, and Other Financial Information used herein are also used in support of building a body of Corporate Finance In-Class Problems and Case Studies.

You've been assigned to review the financial statements of The Farm Hill Group, Ltd. preparatory to making a recommendation to your client regarding a possible investment in the firm. Farm Hill is a legacy manufacturer of a line of residential and commercial overhead doors and has historically generated strong profits for its stakeholders. Its current rate of growth (Δ NOPLAT) is equal to its historical and expected future rate of growth. Your client considers all of Farm Hill's assets and revenues to be pertinent to the firm's operations. You've been given the firm's abbreviated financial statement (attached) and the following forecasted values:

Common Stock: R_F = 0.04, R_M =0.07, β = 0.96

WACC = k_u = k_{tax}

Year	Debt	EBIT	Dep	Int Exp	IC	NOPLAT	Δ NWC	Δ FA	FCF	ROIC
2014	31.544	8.65	3.890	4.360	109.842	5.882	2.472	4.04	-.630	0.0535
2015	31.544	9.394	4.225	5.161	116.914	6.388	2.685	4.387	-0.684	0.0546
2016	31.544	10.202	4.588	5.493	124.594	6.937	2.915	4.765	-0.743	0.0557
2017	31.544	11.079	4.982	5.854	132.935	7.534	3.166	5.175	-0.807	0.0567
2018	31.544	12.032	5.411	6.246	141.993	8.182	3.438	5.620	-0.876	0.0576
2019	31.544	13.067	5.876	6.671	151.830	8.885	3.734	6.103	-0.952	0.0585
2020	31.544	14.190	6.382	7.133	162.513	9.649	4.055	6.628	-1.034	0.0594

[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).

1. **Calculate Farm Hill's NOPLAT, Invested Capital , ROIC, FCF, and WACC (both book and market based) for 2014.**

Note that I'm including values with respect to Private Equity since the client appears to value it as an important part of a potential investments

NOPLAT = (Operating Rev – Operating Exp) + Dep – Adjusted Tax
= (253.64 – 244.99)(1-.32) = 5.882
= EBIT (1-T_M)
= 8.65 8 (1-.32) = 5.882

Invested Capital = NWC + FA
= (93.483 – 30. 571) + (32.17 + 14.76) = 109.842

ROIC = $\frac{NOPLAT}{IC}$ = $\frac{5.882}{109.842}$ = .0535 or 5.35%

FCF = NOPLAT + Dep - Δ NWC – (Δ FA + Dep)
= 5.882 + 3.890 - 2.472 – (4.04 + 3.89) = -.0630
= NOPLAT + Depreciation - Net Investment
= 5.882 + 3.89 - (109.84 – 103.33 + Dep) = -.0630

WACC from a book value approach

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

V = E + P + D = 5.570 + 0.090 + 31.544 = 37.204
$R_D = \frac{Interest\ Paid_{2014}}{Interest\ Bearing\ Debt_{2013}} = \frac{4.36}{26.65} = .1636$ or 16.36%
$R_P = \frac{Preferred\ Dividends}{Preferred\ Stock} = \frac{0.025}{0.090}$ = .2778 or 27.78%
$R_{E(CAPM)} = R_F + (R_M - R_F)\beta$
= .04 + (.07 - .04)(0.96) = .0688 or 6.88%

$= \left(\frac{5.570}{37.204}\ x\ 0.0688\right) + \left(\frac{0.090}{37.204}\ x\ 0.2778\right) + \left(\frac{31.544}{37.204}\ x\ .1636\right)(1 - 0.32)$
= 0.0103 + 0.000672 + (0.1387)(0.68)
= .1053 or 10.53%

WACC from a quasi-market value approach (*quasi because we don't have the market value of the debt available to us***)**

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

V = E + P + D = 62.663 + 0.125 + 31.544 = 94.332

$R_D = \frac{Interest\ Paid_{2014}}{Interest\ Bearing\ Debt_{2013}} = \frac{4.36}{26.65} = .1636$ or 16.36%

$R_P = \frac{Preferred\ Dividends}{Preferred\ Stock} = \frac{0.025}{0.125} = .20$ or 20%

$R_{E(CAPM)} = R_F + (R_M - R_F)\beta$

= .04 + (.07 - .04)(0.96) = .0688 or 6.88%

$= \left(\frac{62.663}{94.332}\ x\ 0.0688\right) + \left(\frac{0.125}{94.332}\ x\ 0.20\right) + \left(\frac{31.544}{94.332}\ x\ .1636\right)(1 - 0.32)$

= 0.0457 + 0.000265 + (0.05471)(0.68)

= .0832 or 8.32%

2. Calculate the firm's value based on a Discounted Cash Flow model using NOPLAT as the cash flow and a NOPLAT augmented form of the Dividend Growth (DG) model for the continuing value. Use a book based WACC as your discounting factor.

DCF/DG

In order to assign value based on a DCF model, we'll use the NOPLAT values from our table of values for the explicit period; and ***in this case I'll use the book value based WACC identified above***. This is a model in two parts in which Part One is a simple Discounted Cash Flow Models assigning a value for the explicit forecast period, and Part Two uses a modified version of the Dividend Growth Model and assigns a continuing value beyond the explicit period. We need to recall that the valuation assigned in Part Two is a future value and must be time discounted back to a present value – we'll use WACC for this discounting.

$Value_{DCF/DG} = \sum \frac{NOPLAT_t}{(1+WACC)^t} + PV_{CV}$

$CV = \frac{NOPLAT_{2020}}{WACC - g} = \frac{9.64948}{0.1053 - 0.086} = 499.9731$

$PV_{CV} = \frac{499.9731}{1.1053^5} = 303.072$ This is the present value of PV_{CV}

Now you can think about the DCF equation as follows:

$Value_{DCF} = \sum \frac{NOPLAT_t}{(1+WACC)^t}$

$= \frac{6.388}{1.1053^1} + \frac{6.937}{1.1053^2} + \frac{7.534}{1.1053^3} + \frac{8.182}{1.1053^4} + \frac{8.885}{1.1053^5}$

= 5.7793 + 5.6784 + 5.5792 + 5.4818 + 5.3859

= 27.905

$Value_{DCF/DG}$ = 27.905 + 303.1225 = 331.027

3. Calculate the firm's value based on a Discounted Cash Flow model using NOPLAT as the cash flow and the Key Value Drive model for the continuing value. Use a book based WACC as your discounting factor.

DCF/KVD

This breaks into two parts: the use of a DCF Model to assign value during the explicit period and a KVD Model to assign value beyond that point. In order to assign value based on a DCF model, we'll use the NOPLAT values from our table of values for the explicit period, but we need to think about what we'll use for the *r* in this model, and based on the values available to us I think we need to use WACC. It's high, but it's the only credible proxy we have barring making some assumptions for which we have little or no foundation.

The DCF/KVD Models is calculated in two parts: Part One is a simple DCF Model based on projected NOPLAT and assigns value during the explicit forecast period; Part Two is the Key Driver Model and assigns a continuing value before the explicit period. Part Two creates a future value and needs to be discounted back to a present value to be relevant to us – we most often see this discounting value as WACC, which is some opportunity cost of capital, so we'll use WACC for this value throughout this entire problem set.

$\text{Value}_{\text{DCF/KVD}} = \sum \frac{NOPLAT_t}{(1+WACC)^t} + PV_{CV}$

$CV = \frac{NOPLAT_{2020}\left(1-\frac{g}{ROIC_{2020}}\right)}{WACC-g} = \frac{9.64948\left(1-\frac{0.086}{0,0594}\right)}{0.1053-0.086} = -224.213$

$PV_0 = \frac{PV_{CV}}{(1+WACC)^t} = \frac{-224.213}{1.1053^5} = -135.914$ This is the present value of PV_{CV}

Now you can think about the DCF equation as follows:

$\text{Value}_{\text{DCF}} = \sum \frac{NOPLAT_t}{(1+WACC)^t}$

$= \frac{6.388}{1.1053^1} + \frac{6.937}{1.1053^2} + \frac{7.534}{1.1053^3} + \frac{8.182}{1.1053^4} + \frac{8.885}{1.1053^5}$

= 5.7793 + 5.6784 + 5.5792 + 5.4818 + 5.3859

= 27.905

$\text{Value}_{\text{DCF/KVD}}$ = 27.905 -135.914 = -108.009

4. Calculate the firm's value using an Economic Profit model (Econ π) with the following form with a book based WACC as the discounting factor:

The Economic Profit model is driven by the use of Invested Capital, ROIC and WACC through which we can think of economic profit as = invested capital x (ROIC-WACC). In this formation we can see that *ROIC > WACC* drives value while *ROIC < WACC* destroys value. The model captures both the explicit and continuing periods Economic Profit Model in its complete form can be thought of as:

Value$_{ECON\pi}$ = Invested Capital $_0$ + Present Value of Forecast Economic Profit During Explicit Period + Present Value of Forecast Economic Profit After Explicit Period (CV period)

We'll think of these as **Value$_{ECON\pi}$** = IC_0 + $PV_{DCF(Econ\ \pi)}$ + $PV_{CV(Econ\ \pi)}$, where in **IC_t** is simply obtained through our table of values. We understand economic profit to me that profit realized after all real and opportunity costs have been included, in this case with specific focus on operational values. As such, the firm's invested capital must be included in the equation to allow a total value to be assigned. Were this not the case, the resultant value would simply note the value calculated in excess of the firm's invested capital and would not be comparable to values calculated by other model types (DCF/DG, DCF/KVD and APV). The following equations help define the economic profit model:

Value$_{ECON\pi}$ = IC_0 + $PV_{DCF(Econ\ \pi)}$ + $PV_{CV(Econ\ \pi)}$

$PV_{DCF(Econ\ \pi)}$ = $\sum \frac{IC_{t-1}(ROIC_t - WACC_t)}{(1+WACC_t)^t}$

PV Econ π_{CV} = $\frac{CV_{ECON\pi}}{(1+WACC)^t}$

$CV_{ECON\pi} = \frac{IC_0\ x\ (ROIC_1 - WACC_1)}{WACC_1 - g}$

The following values provide us with the value of Economic Profit:

	Year	IC	ROIC	WACC	Econ Profit	$PV_{ECON\pi}$	Total $PV_{ECON\pi}$			
	2014	109.842	0.0535	0.1053	-5.684					
1	2015	116.914	0.0546	0.1053	-5.5646	-5.03	-5.03		**IC_0**	109.84
2	2016	124.594	0.0557	0.1053	-5.8011	-4.75	-9.78		**$PV_{EXPLICIT}$**	-22.54
3	2017	132.935	0.0567	0.1053	-6.0583	-4.49	-14.27		**$CV_{E\ \pi}$**	- 361.30
4	2018	141.993	0.0576	0.1053	-6.3379	-4.25	-18.52		**PV_{CV}**	-219.02
5	2019	151.830	0.0585	0.1053	-6.6418	-4.03	-22.54		**$VALUE_{E\ \pi}$**	-131.72
	2020	162.513	0.0594	0.1053	-6.9721					

5. Calculate the firm's value based on a Free Cash Flow model.

To do this we'll simply use FCF rather than NOPLAT as was used in question #3 above.

FCF with CV = KVD

	Year	FCF	$PV_{DCF(FCF)}$	Total $PV_{DCF(FCF)}$		
	2014	-0.630				
1	2015	-0.684	-0.619	-0.619	$PV_{DCF(FCF)}$	-2.99
2	2016	-0.743	-0.608	-1.227	CV_{FCF}	-53.56
3	2017	-0.807	-0.598	-1.825	$PV_{CV(FCF)}$	-32.47
4	2018	-0.876	-0.587	-2.412	$VALUE_{FCF}$	-35.46
5	2019	-0.952	-0.577	-2.989		
6	2020	-1.034				

6. Calculate the firm's Adjusted Present Value using the DCF/APV model form using a book based WACC as the discounting factor.

Recall that $VALUE_{APV} = V_{FCF} + V_{TAX}$. You just calculated $VALUE_{FCF} = -35.46$, which is the same as V_{FCF} in this case because k_u = WACC in our assumptions, so you simply need to calculate V_{TAX}. To do this you'll use the same structure you should be getting used to by now: $V_{TAX} = PV_{DCF(TS)} + PV_{CV(TS)}$. To find the tax shield (TS) values for each year of the forecast period, multiply each year's tax by the tax rate (.32) in this case and then calculate annual and cumulative DCF values as follows:

Year	Interest Expense	Tax Shield	$PV_{DCF(TAX)}$	Total $PV_{DCF(TAX)}$		
1	5.161	1.651	1.494	1.494	$PV_{DCF(TAX)}$	6.953
2	5.493	1.758	1.439	2.933	CV_{TAX}	63.375
3	5.854	1.873	1.387	4.320	$PV_{CV(TAX)}$	38.417
4	6.246	1.999	1.339	5.659	V_{TAX}	45.370
5	6.671	2.135	1.294	6.953		
6	7.133	2.283				

With $V_{TAX} = 45.37$ and $V_{FCF} = -35.46$ we can sum the figures to $V_{FCF} + V_{TAX} = VALUE_{APV} = 9.915$

7. **Finally, discuss the relevance of the values you've calculated for each of the model forms in questions 2-6 (DCF/DG, DCF/KVD, ECON Profit, Free Cash Flow, and APV. Be sure to include a consideration of how they are different and how they are the same.**

The Farm Hill Group, Ltd.
Balance Sheet (millions)
Year Ending December 31

	2013	2014		2013	2014
Current Assets			Current Liabilitites		
Cash & Securities	9.780	7.933	Accounts Payable	13.360	6.641
Accounts Receivable	37.470	38.910	Other	21.150	23.930
Inventory	47.700	46.640	Total	34.510	30.571
Total	94.950	93.483			
			Long Term Debt		
Fixed Assets			Mortgages	0.320	0.960
PPE	28.130	32.170	Bonds	26.330	30.584
			Total	26.650	31.544
Total	28.130	32.170	Owner's Equity		
			Common Stock	5.440	5.570
Other Assets			Preferred Stock	0.080	0.090
Private Equity	14.760	14.760	Accumulated Retained Earnings	71.160	72.639
			Total	76.680	78.299
Total Assets	137.840	140.413	Total Liabilities and Owner's Equity	137.840	140.413

Additional Financial Information

Preferred Stock Value	2013	2014	Common Stock Value	2013	2014
Shares Outstanding (millions)	0.040	0.050	Shares Outstanding (millions)	5.440	5.570
12/31 Price per Share	2.500	2.500	12/31 Price per Share	12.000	11.250
Market Value (millions)	0.100	0.125	P/E Multiple	22.000	24.000
			EPS	0.998	0.524
			Market Value (millions)	65.280	62.663
			Book Value / Liabilities	26.650	31.544

The Farm Hill Group, Ltd.
Income Statement (millions)
January 1 - December 31

	2013	2014
Income		
Product Sales	234.980	252.780
Services		
Private Equity	0.550	0.860
Total Income	235.530	253.640
Expenses		
COGS	196.690	211.460
Sales & Marketing	23.500	29.640
Administration		
Depreciation	3.640	3.890
Total Expenses	223.830	244.990
Interest Paid		
General Interest	3.720	4.360
Total Interest Paid	3.720	4.360
Taxable Income	7.980	4.290
Taxes Paid	2.554	1.373
Net Income	5.426	2.917
Distribution of Earnings		
Dividends (Common)	1.360	1.413
Dividends (Preferred)	0.020	0.025
Addition to Retained Earnings	4.046	1.479