

Using CAPM and WACC¹
In-Class Problem²

You'll recall recently recommending your client take a position in Pasquinel Enterprises³ after completing an exhaustive analysis of the firm's financial statements and future prospects. The investment recommendation is based on a \$20,000,000 valuation using 2015 as the base year (year 0) that included a plan for the firm to fund year 1-3 operating deficits (2016-2018) through raising debt capital at a 7.2% interest rate in the bond markets. In the interim the firm has sold some of its common stock such that the market cap of the common stock is assessable at \$25,000,000. You're now assisting the firm's management in identifying the return the firm will need to realize to justify the investment. After your client makes their investment and the firm secures the \$15,000,000 in debt capital, the firm will have the following capital components and market metrics:

	Book Value	Market Value			
Bonds⁴	15,000,000	<i>calculate</i>	<i>See foot notes for details</i>		
Preferred Stock⁵	1,250,000	1,450,000			
			R_F	R_M	Beta
Common Stock	3,750,000	25,000,000	.02	.09	1.4

Pasquinel's average federal corporate tax rate is estimated at 28%, and its return on invested capital (ROIC) is estimated at 13%. In addition to the information initially available, you've prepared the following valuation with explicit forecast periods and rates as indicated and included a continuing value calculation based on a Free Cash Flow DCF model – this uses the investor's r as the discount rate.

		Yr	FCF	PV _{DCF}	ΣPV _{DCF}
r	20%	2015	0	(20,000,000.00)	(20,000,000.00)
g ₁₋₃	0%	2016	1	(5,000,000.00)	(24,166,666.67)
g ₄₋₈	35%	2017	2	(5,000,000.00)	(27,638,888.89)
g ₉₋₁₃	10%	2018	3	(5,000,000.00)	(30,532,407.41)
g ₁₄₊	4%	2019	4	3,500,000.00	(28,844,521.60)
		2020	5	4,725,000.00	(26,945,650.08)
		2021	6	6,378,750.00	(24,809,419.61)
		2022	7	8,611,312.50	(22,406,160.33)
		2023	8	11,625,271.88	(19,702,493.64)
<i>PV_{DCF}, CV_{DG}, PV_{CV} values do not include CF₀</i>		2024	9	12,787,799.06	(17,224,132.51)
PV_{DCF}	10,789,067.81	2025	10	14,066,578.97	(14,952,301.48)
CV_{DG}	121,697,007.95	2026	11	15,473,236.87	(12,869,789.70)
PV_{CV}	11,374,274.42	2027	12	17,020,560.55	(10,960,820.56)
Value	22,163,342.23	2028	13	18,722,616.61	(9,210,932.19)

¹ This problem 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 was developed by Richard Haskell, PhD (rhaskell@westminstercollege.edu), Gore School of Business, Westminster College, SLC, Utah (2015).

³ Pasquinel Enterprises is a fictitious firm; any resemblance to any firm, real or imagined, is purely coincidental.

⁴ Bonds issued in 2015 at par (\$1,000 each) for 15 years (callable after 10 years), and semi-annual interest payments to fund 2015-2018 operating deficits of \$5,000,000 each year. There have been no interest payments made on the bonds to date and the bonds are not in default.

⁵ The preferred stock holders will receive an aggregate annual of \$168,200

1. At the rate you've calculated for the bonds, what market value would you expect the bonds to hold? (Use the bond valuation formula to check your figures).

If the bonds were issued at par (\$1,000 each) with a coupon rate of 7.2%, interest rates have not changed, and the bonds have yet to make their first interest payment, we would expect the bond value to remain unchanged. The bond value in the aggregate would continue to be \$15,000,000.

$$\text{Bond Value} = C \frac{\left[1 - \frac{1}{(1+YTM)^N}\right]}{YTM} + \frac{F}{(1+YTM)^N}$$

$$= 36 \times \frac{\left[1 - \frac{1}{(1.036)^{30}}\right]}{.036} + \frac{1000}{(1.036)^{30}} = 1000$$

2. Given that we have both the coupon rate and current YTM for the firm's debt, which value should we use when thinking about the most accurate measure as the cost of the firm's debt?

In this case it doesn't matter as the two variations of the rate are the same. The use of the coupon rate would best support the firm's fiscal experience. The use of YTM would give us an understanding of the market's perspective.

In this case we're going to use $R_D = YTM$, but what is the YTM? Since the bonds were just barely issued at face value, we can suppose the YTM is the same as the coupon rate. So R_D is 7.2%

We don't have enough information to consider R_D as $\frac{\text{Interest paid}_1}{\text{Long-Term Debt}_0}$

3. Calculate the firm's R_P

$$R_P = \frac{\text{Preferred Dividends paid}_1}{\text{Market Cap of Preferred}_1} = \frac{168,200}{1,450,000} = .1160$$

4. Calculate R_E

$R_E = R_F + \beta(R_M - R_F)$ this is the CAPM equation for Common

$$R_E = .02 + (1.4)(.09 - .02) = .118 \text{ or } 11.8\%$$

5. What are the proportional weights each of the firm's capital components considering both book and market value perspectives?

		Book Value Based		Market Value Based	
	Description	Value	Weights	Value	Weights
E	value of common stock	3,750,000	.1875	25,000,000	.6031
P	value of preferred stock	1,250,000	.0625	1,450,000	.0350
B	value of bonds	15,000,000	.75	15,000,000	.3619
V	E + P + D	20,000,000	1.00	41,450,000	1.00

6. What is the firm's weighted average cost of capital considering a strictly market value perspective?

$$\begin{aligned} \text{WACC} &= \left(\frac{E}{V} \times R_E\right) + \left(\frac{P}{V} \times R_P\right) + \left(\frac{D}{V} \times R_D\right) (1-T_C) \\ &= (.6031)(.118) + (.035)(.116) + (.3619)(.072)(.72) \\ &= .07117 + .0041 + .01876 = .0940 \text{ or } 9.40\% \end{aligned}$$

7. Given the WACC calculated above, what might you say with respect to the discount rate you and your client used in your initial analysis of the firm?

The discount rate used in the initial valuation metrics is 20%; high compared to the firm's WACC of 9.40%. So how do we reconcile this given that the two values should have some connection? First we might consider if the firm's current WACC is a result of the firm and its structure before the client made their investment, or if it's the result of the client's investment and expertise. In this case it seems clear the current WACC, heavily influenced by the low bond interest rate of 7.2%, is a function of the credit worthiness of the firm's equity capital contributors rather than the firm itself – recall that this is a relatively new firm, has yet to post a profit, and needed the equity and debt capital infusion to capitalize on the government contracts extended to it.

Also, it's unlikely that the firm's equity, preferred, and debt-based betas would be at their current levels - well above 1 but not as high as one might expect for a firm in the condition this firm was in when first analyzed – we might otherwise have reasonably expected these values to be higher were it not for the capital and managerial infusion arising from the client's investment.

Finally, the WACC vs r spread of some 10%-13%, though potentially allowing for important economic profit creation if the firm succeeds, still reflects the uncertainty for this firm's future and as such is likely warranted.

8. If you had used the newly calculated WACC (market based) as an appropriate discount rate for this firm, what value might you have placed on the firm when you performed the analysis leading to the offer your client made (reflected on the first page of this case)? *Use the DCF/DG model for this valuation.*

Pasquinel Enterprises			
	WACC	0.0940	
	g₄₋₈	0.35	
	g₉₋₁₃	0.1	
	g₁₄₊	0.04	
	ROIC	0.13	
	FCF	PV_{FCF}	ΣPV_{FCF}
0	(20,000,000.00)	(20,000,000.00)	(20,000,000.00)
1	(5,000,000.00)	(4,570,445.19)	(24,570,445.19)
2	(5,000,000.00)	(4,177,793.85)	(28,748,239.04)
3	(5,000,000.00)	(3,818,875.56)	(32,567,114.61)
4	3,500,000.00	2,443,554.61	(30,123,560.00)
5	4,725,000.00	3,015,395.75	(27,108,164.26)
6	6,378,750.00	3,721,059.27	(23,387,104.99)
7	8,611,312.50	4,591,862.31	(18,795,242.68)
8	11,625,271.88	5,666,450.86	(13,128,791.82)
9	12,787,799.06	5,697,604.68	(7,431,187.14)
10	14,066,578.97	5,728,929.78	(1,702,257.37)
11	15,473,236.87	5,760,427.10	4,058,169.74
12	17,020,560.55	5,792,097.60	9,850,267.34
13	18,722,616.61	5,823,942.22	15,674,209.56
	PV_{DCF}	\$35,674,209.56	
	CV_{DG}	\$360,681,700.93	
	PV_{CV}	\$112,195,289.23	
	PV_{DCF} + PV_{CV}	\$147,869,498.79	

9. How can you reconcile the value you assigned preparatory to making an offer to invest in the firm versus the value you might now calculate?

The valuation assigned based on the assumptions and analysis leading to the client's offer resulted in a higher NPV of \$2,163,342.23 compared to \$127,869,498.79 when using the firm's WACC of 9.4% rather than the client's r of 20%. This difference is not at all surprising. Notice that $IRR = 20.14.72\%$ has not changed, regardless of the value used for r or WACC, as IRR is the internal rate calculated based on $NPV = 0$.

It might be important to note that the DCF/DG model form produces consistently positive results only when $g < r$ or $g < WACC$.

10. Prepare a valuation for the firm based on the cash flows, WACC and g noted in (8) and include the firm's expected return on invested capital (ROIC). Use a discounted cash flow model for the forecasted explicit period and the Key Value Driver model for the continuation period (DCF/KVD model) and assume the firm's NOPLAT13 = \$26,500,000.

PV_{DCF}	\$35,674,209.56
CV_{KVD}	\$353,429,337.01
$PV_{CV(KVD)}$	\$109,939,335.95
$PV_{DCF} + PV_{CV(KVD)}$	\$145,613,545.51

11. How is it that including the firm's return on invested capital (ROIC) of 13% makes such significant difference in calculated values?

The DCF/KVD model form uses the same PV_{DCF} as the DCF/DG model, but introduces a key value (ROIC) which, along with WACC and g , drive the company's creation of value. We know that increased growth (g) creates value when $ROIC > WACC$, but in this case the DCF/KVD valuation only produces consistently positive results when $g < WACC < ROIC$. When $WACC > g$, or $ROIC < WACC$, or $ROIC < g$, sometimes even by the slightest margin(s), the valuation form creates significantly negative values. Applying sensitivity analysis to these models reveals how dramatically the values change as the relationship between the key value drives of g , ROIC and WACC change. It also stands that as the income variable changes, in this case seen through the firm's generalized cash flows, valuation changes are similarly correlated.