

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	Cash Flow	PV _{DCF}	ΣPV _{DCF}
Investor Required Return (r) 20%	2015⁶	0	(20,000,000.00)	
g ₁₋₃ 0%	2016	1	(5,000,000.00)	(4,166,666.67)
g ₄₋₈ 35%	2017	2	(5,000,000.00)	(3,472,222.22)
g ₉₋₁₃ 10%	2018	3	(5,000,000.00)	(2,893,518.52)
g ₁₄₊ 4%	2019	4	3,500,000.00	1,687,885.80
	2020	5	4,725,000.00	1,898,871.53
	2021	6	6,378,750.00	6,378,750.00
	2022	7	8,611,312.50	2,403,259.28
	2023	8	11,625,271.88	2,703,666.69
	2024	9	12,787,799.06	12,787,799.06
	2025	10	14,066,578.97	2,271,831.04
	2026	11	15,473,236.87	2,082,511.78
	2027	12	17,020,560.55	1,908,969.13
	2028	13	18,722,616.61	1,749,888.38

PV_{DCF}	10,789,067.81	
CV₀⁷	121,697,007.95	<i>See footnote 7</i>
PV_{CV}	11,374,274.42	
VAL	22,163,342.23	

Important - Read Footnote #6

PV_{DCF}, CV₀, PV_{CV} values do not include CF₀

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 stockholders will receive an aggregate annual of \$168,200

⁶ Note that the "Cash Flow" in year 0 (2019) is not expressly a cash flow from the firm, but in this case is the cost of acquiring the firm – a present value (PV) calculation doesn't include year 0's cash flow as it's not part of the firm's FUTURE cash flows; a net present value (NPV) calculation DOES include the cost of the investment, which likely takes place in year 0 (now)

⁷ Note that CV₀ is calculated using CF₁₄ and not CF₁₃. CF₁₄, or CF₁ in continuation terms, is CF₁₃ x (1+g)

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.

$$\begin{aligned} \text{Bond Value} &= C \frac{\left[1 - \frac{1}{(1+YTM)^N}\right]}{YTM} + \frac{F}{(1+YTM)^N} \\ &= 36 \times \frac{\left[1 - \frac{1}{(1.036)^{30}}\right]}{.036} + \frac{1000}{(1.036)^{30}} = 1000 \end{aligned}$$

2. Given that we have both the coupon rate and current yield (annualized 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%

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 should recall that the firm's WACC, calculated from a market perspective, is a market-based opportunity cost of capital. As such it is the weighted average return a prudent investor might expect to receive given the firm's capital components assuming the investor intends to simply invest capital and not time and expertise. If the investor is prepared to commit his time and expertise to the firm, the he might be able to expect a higher return, but this should also be evidenced in improved cash flows. So, I'd say given the estimated cash flows, the investor's expected return is unrealistic.

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 a basic discounted cash flow model for this valuation.

Pasquinel Enterprises	
WACC	0.0940
g_{4-8}	0.35
g_{9-13}	0.1
g_{14+}	0.04
ROIC	0.13

	FCF	PV _{FCF}	Σ PV _{FCF}
0	(20,000,000.00)		
1	(5,000,000.00)	(4,570,434.31)	(24,570,434.31)
2	(5,000,000.00)	(4,177,773.95)	(28,748,208.26)
3	(5,000,000.00)	(3,818,848.28)	(32,567,056.54)
4	3,500,000.00	2,443,531.33	(30,123,525.21)
5	4,725,000.00	3,015,359.84	(27,108,165.37)
6	6,378,750.00	3,721,006.09	(23,387,159.28)
7	8,611,312.50	4,591,785.76	(18,795,373.52)
8	11,625,271.88	5,666,342.89	(13,129,030.63)
9	12,787,799.06	5,697,482.55	(7,431,548.08)
10	14,066,578.97	5,728,793.33	(1,702,754.75)
11	15,473,236.87	5,760,276.19	4,057,521.44
12	17,020,560.55	5,791,932.06	9,849,453.50
13	18,722,616.61	5,823,761.90	15,673,215.40
	PV _{DCF}	\$35,673,215.40	
	CV ₀	\$360,664,293.82	
	PV _{CV}	\$112,186,400.92	
	PV _{DCF} + PV _{CV}	\$147,859,616.32	

Note that CV0 relies on CF1 in the continuation period (CF14 in discrete time). This would be calculated as CF14 = CF13 x (1+g) or 19,471,521.27

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 an 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, though it does appear to be unrealistic. The investor would more reasonably expect a required rate of return more in line with the estimated WACC, in which case there would be limited difference in the outcomes of the two models. It's not unreasonable for an investor to seek a return modestly greater than WACC, hoping to receive some economic profit, but such a high NPV would be both unlikely and unwarranted given what we know at this point.

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 - assume the firm's NOPLAT13 = \$26,500,000.

PV_{DCF}	\$35,673,215.4
CV_{KVD}	\$353,412,279.92
$PV_{CV(KVD)}$	\$109,930,626.36
$PV_{DCF} + PV_{CV(KVD)}$	\$145,603,841.76

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.