

You will take the perspective of a potential investor in Kellco, a high-value manufacturing firm. Your primary objective is to value Kellco using methods from the course. **Problem 1** focuses on a multiples valuation of Kellco using information from peer firms. **Problem 2** reconciles differences in multiples-implied valuations using a discounted cash flow (DCF) approach. **Problem 3** enhances the DCF by deriving the CAPM-implied discount rate. **Problem 4** considers a potential acquisition by Kellco of a differentiated firm and its effect on Kellco's cost of capital. **Problem 5** considers the optimization of a smart investor who likes high average returns and dislikes risk.

As a valuation, the exam proceeds logically from problems 1-5, and I recommend you take it linearly if time allows. However, results from later parts are largely independent from previous problems if you decide otherwise. In either case the exam involves interim calculations and data entry you will want to **store in Excel**.

This exam is intended to allow you to demonstrate your mastery of the material. Correct quantities are important, but intuition on concepts and formulas central to valuation is critical. To this end, be sure to show a representative formula or calculation when possible, but do not reproduce extended description when a quantity or method is used several times in the same question.

Problem 1. Multiples Valuation of Kellco (35 points)

Kellco is a market leader in a competitive sector. You are contemplating investing in Kellco on January 1, 2014, and seek to obtain an estimate of the **intrinsic value** (as may be distinct from the market value) of the firm. In this problem, you will assess the value of Kellco by comparing with peer firms in the same business, Boothink, Draftson, Hibbis, and Horton. Some essential accounting data follows below.

Boothink	2011	2012	2013
Sales	6,063.7	6,366.9	6,621.6
NOPAT	2,100.0	2,200.0	2,310.0
Free Cash Flows	1,575.0	1,650.0	1,732.5
Asset Value	18,900.0	19,800.0	20,790.0
Discount rate	8.0%	8.0%	8.0%

Draftson	2011	2012	2013
Sales	9,430.5	9,807.7	10,200.0
NOPAT	1,808.0	1,870.0	1,942.0
Free Cash Flows	1,265.6	1,309.0	1,359.4
Asset Value	13,921.6	14,399.0	14,953.4
Discount rate	7.0%	7.0%	7.0%

Hibbis	2011	2012	2013
Sales	2,163.0	2,379.3	2,617.2
NOPAT	1,810.8	1,908.4	2,003.4
Free Cash Flows	1,448.6	1,526.7	1,602.7
Asset Value	20,281.0	21,373.6	22,438.1
Discount rate	7.5%	7.5%	7.5%

Horton	2011	2012	2013
Sales	19,104.0	18,148.8	17,241.4
NOPAT	4,320.0	4,210.0	4,050.0
Free Cash Flows	2,592.0	2,526.0	2,430.0
Asset Value	18,144.0	17,682.0	17,010.0
Discount rate	12.0%	12.0%	12.0%

Kellco	2011	2012	2013
Sales	6,020.8	6,081.0	6,263.4
NOPAT	2,456.5	2,481.1	2,555.5
Free Cash Flows	1,584.2	1,607.3	1,649.1
Asset Value	19,802.5	20,573.1	21,438.1 (market value)
Discount Rate			(see part (d))

Problem 1. (continued)

- (a) **[10 points]**. Estimate Kellco's end-of-2013 value using the asset value to free cash flow (A/FCF) multiple. Be sure to include only peer firms that are comparable to each other on the necessary metrics to use the relevant multiple. Assume that peer firms' cash flows grow forever at the most recent growth rate.
- (b) **[7 points]**. Estimate the capital efficiency and profit margins for Kellco's peer firms for 2013.
- (c) **[10 points]**. Estimate Kellco's value using asset value to NOPAT and asset value to sales multiples for comparable firms. As before, be sure to exclude firms that do not satisfy the required economic assumptions and justify your choices of peers.

Problem 1. (continued)

- (d) [8 points]. Solve for the implied growth rate for Kellco using the A/FCF multiple you used above to value Kellco. To estimate the discount rate for Kellco, use the average discount rates for firms you retained for the A/FCF multiple. In light of historical growth rates, does the implied future growth rate seem reasonable? Why or why not?

Problem 2. DCF Valuation for Kellco (35 points)

You regard the multiples valuations of **Problem 1** with skepticism. In this problem, you will supplement your multiples valuation of Kellco with a discounted cash flow (DCF) approach. The DCF provides a useful estimate of value in its own right, and it also helps to identify assumptions embedded in the multiples valuation that may not be applicable.

From your analysis of the Kellco and industry and economic environments, you develop a top-down pro forma for Kellco for 2014 – 2016. The historical (left) and predicted (right) cash flow statement is as follows:

	2011	2012	2013	2014	2015	2016
NOPAT [=EBIT(1-t)]	2,456.5	2,481.1	2,555.5	2,606.6	2,658.7	2,711.9
+DEPR	361.2	364.9	375.8	383.3	391.0	398.8
-CAPEX	1,204.2	1,216.2	1,252.7	1,277.7	1,303.3	1,329.4
-ΔNWC	29.4	22.4	29.5	24.0	24.5	25.0
FCF	1584.2	1607.3	1649.1	1688.1	1721.9	1756.3

You project that Kellco will be a mature firm after 2016 and grow at a long-term rate of $g = 2\%$.

For parts (a) – (d), assume that the cost of capital for Kellco is $r = 7.5\%$.

(a) [10 points]. What is your estimated present value of Kellco using growing perpetuity terminal values as of the end of 2013 [the first payment comes in 2014]? With a stable (non-growing) perpetuity terminal value?

(b) [6 points]. We can use multiples as a check for the DCF calculation. Complete the following table by solving for the implied multiples for Kellco from the DCF using growing perpetuity terminal values. In light of this comparison, do you trust your DCF valuation?

[Note: You may leave the Problem 1 column blank if you have not completed it. It serves only to guide your intuition and will not be scored.]

Problem 2. (continued)

	DCF	Market	Problem 1
A/Sales		3.4	
A/NOPAT		8.4	
A/FCF		13.0	

- (c) **[9 points]**. The terminal value component of Kellco is a large fraction of its present value. You believe untenable terminal value assumptions may drive the differences you document in part (b). What are two important assumptions for using DCF-based terminal values? What is our key assumption for using multiples-based terminal values?

- (d) **[9 points]**. You decide to replace the terminal value of part (b) with a price/earnings ratio-implied terminal value. What is the present value of Kellco under this assumption?

[Note: The market price of Kellco at the end of 2013 is 21438.1.]

Problem 3. Correcting the Denominator: Kelco's Discount Rate (35 points)

The discounted cash flow valuation relies on accurate discount rates and cash flow forecasts. As you observed in **Problem 2**, the DCF valuation is highly sensitive to uncertainty in the discount rate. In this question, you will apply the Capital Asset Pricing Model (CAPM) to obtain a more precise estimate for the discount rate.

You observe the following data series: S&P 500, short-term Treasury bill, and Kelco historical returns; current zero-coupon yields on U.S. Treasuries; and historical average returns for the S&P 500 and three-month Treasury bill. These data are:

	Market	Rf	Kelco		Yields
2004	10.7%	1.4%	14.3%	3-month	0.05%
2005	4.8%	3.2%	4.4%	1-year	0.14%
2006	15.8%	4.8%	17.8%	5-year	1.59%
2007	5.2%	4.4%	7.0%	10-year	2.38%
2008	-36.8%	1.4%	-55.4%	30-year	3.16%
2009	26.3%	0.2%	39.1%		
2010	15.1%	0.1%	20.3%		
2011	1.9%	0.1%	5.3%	(1964-2013) Average returns	
2012	16.0%	0.1%	24.7%	S&P 500	11.3%
2013	32.3%	0.1%	47.4%	3-Month T-bill	5.1%

These data will also be useful for **Problem 5**, so remember to store them in Excel!

(a) [7 points]. Derive the (backward-looking) confidence interval for average Kelco returns. Why can't we use the average historical return for the Kelco's cost of capital?

(b) [5 points]. Estimate the CAPM beta for Kelco.

Problem 3. (continued)

- (c) **[5 points]**. Suppose Kelco's cash flows have an average maturity of 10 years. What risk-free rate should you use to compute its cost of capital? Defend your choice in no more than 1-2 sentences.

- (d) **[10 points]**. Kelco is not an all-equity firm. It has a debt-to-equity ratio (D/E) of 25%. Based on its credit rating, you assume Kelco's debt beta is 0.05.

Using the CAPM and your responses to (b) and (c), what is Kelco's cost of capital?

[Hint: We should use as much data as possible for computing the market risk premium]

- (e) **[8 points]**. We can improve our DCF valuation using the market-implied discount rate calculated in part (d). Supposing (as in **Problem 2**) that Kelco reaches maturity in 2016 and grows at 2% thereafter, what is the present value of Kelco? Assume a growing perpetuity terminal value.

For your convenience, I reproduce Kelco's projected cash flows for 2014–2016 below:

	2014	2015	2016
FCF	1688.1	1721.9	1756.3

Problem 4. Kellco's Acquisition and the Cost of Capital (35 points)

Kellco is contemplating an acquisition of Blogg, a long-form internet news company primarily covering innovations in the high-value manufacturing space. In addition to its internet operations, Blogg recently launched a printed trade publication to help match suppliers and customers, taking advantage of its position as a tastemaker in high-value manufacturing. Kellco believes that the Blogg acquisition will augment its marketing arm and reduce favorable reporting on rival firms.

Setting aside ethical concerns, as a potential investor in Kellco, you are concerned about the acquisition and seek to evaluate it yourself. In particular, you are concerned whether the acquisition will increase Kellco's riskiness relative to its historical levels.

You estimate the risk of the project to assess its effect on Kellco's cost of capital. Unlike Kellco, Blogg is not publicly traded and has no equity data, so instead you rely on a comparables analysis to evaluate its risk characteristics.

Potential comparable firms and their salient financial information is below:

High-Value Manufacturing				
	Boothink	Draftson	Hibbis	Horton
Debt	3950.1	7476.7	1795.0	5103.0
Equity	16839.9	7476.7	20643.0	11907.0
β_E	1.1	1.3	0.9	2.1
β_D	0.1	0.2	0.0	0.3

Internet News			
	Puffco	Wroteit	Shale
Debt	86.0	0	265.5
Equity	344.0	221	619.5
β_E	2.0	1.6	1.9
β_D	0.2	0.2	0.2

Print (Textbook) Publishing			
	Flamingo	McGrawTim	Elementary
Debt	4655	8480	5118
Equity	8645	12720	3412
β_E	0.8	0.7	0.8
β_D	0.1	0.2	0.3

(a) [7 points]. Select comparable companies for Blogg and justify your choices.

Problem 4. (continued)

- (b) [8 points]. Estimate beta on assets for Blogg given your choice of comparables.
- (c) [8 points]. Kellco is contemplating financing the Blogg acquisition with debt, equity, or a mix of both securities. In the absence of frictions, why does the cost of capital not depend on the method of financing? What is one friction that causes the cost of capital to depend on the debt/equity mix?
- (d) [12 points]. The market values Blogg at 1641.3. What is the cost of capital for Kellco after the Blogg acquisition? How much does Kellco's cost of capital increase? Suppose that Kellco's pre-acquisition cost of capital is 9.5% [to eliminate dependence on the previous problem]. Assume also that the excess return on the market is 6.2% and the relevant risk-free rate is 1.6%.

Problem 5. Investing in Kellco: The Portfolio Choice Problem (40 points)

You convinced your investment committee to allocate funds for investment in Kellco. Another investment committee member suggests you pair Kellco investments (ticker: KC) with investments in the Coca-Cola Company (ticker: KO). In this problem you will analyze a portfolio problem consisting of investments in KC, KO, the market, and the risk-free asset.

You observe the following historical return information on these four assets:

	Market	Rf	Kellco	KO
2004	10.7%	1.4%	14.3%	-16.1%
2005	4.8%	3.2%	4.4%	-0.7%
2006	15.8%	4.8%	17.8%	23.1%
2007	5.2%	4.4%	7.0%	30.4%
2008	-36.8%	1.4%	-55.4%	-24.1%
2009	26.3%	0.2%	39.1%	30.3%
2010	15.1%	0.1%	20.3%	19.0%
2011	1.9%	0.1%	5.3%	9.4%
2012	16.0%	0.1%	24.7%	6.5%
2013	32.3%	0.1%	47.4%	17.2%
	Average S&P 500	Average 3-Month T-bill	Std. Dev. S&P 500	
(1964-2013)	11.3%	5.1%	17.10%	

A subset of these data will also be useful for **Problem 3**, so remember to store them in Excel if you have not yet completed that problem.

- (a) [5 points]. What is the realized return of a portfolio consisting of 75% Kellco and 25% Coca-Cola from January 2013 – December 2013?

Problem 5. (continued)

- (b) **[5 points]**. What would have been the portfolio average (arithmetic) return and standard deviation over the 2004 – 2013 period?
- (c) **[8 points]**. Calculate the correlation between returns on KC and KO. Suppose expected returns of the portfolio were the same, but the correlation is zero. What happens to the Sharpe ratio under this assumption? **[no numbers needed]** Why does the Sharpe ratio improve or worsen with zero correlation?
- (d) **[8 points]**. Suppose the betas on Kelco and Coca-Cola are 1.5 and 0.56, respectively. What is your estimate of alpha for the portfolio? **[Hint: To obtain alpha for a stock, subtract the expected return by the CAPM from the average realized return.]**

Problem 5. (continued)

- (e) **[8 points]**. Interpreting your answer to part (d), is Kelco “underpriced,” “overpriced,” or neither? What do you expect to happen to Kelco's stock price in the near-term? How will expected returns change if the market moves toward equilibrium? What should alpha be in the long-run? Please justify each answer with **at most** a few words apiece.
- (f) **[6 points]**. Suppose alpha is zero, and we want to maintain the same market risk exposure with a better diversified portfolio (equivalently, we want higher expected returns for the same risk). What portfolio weights should we choose in the market and the risk-free asset to achieve the same beta as before?