



Quarter 4 2008
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VALUATION IN FINANCIAL MARKETS

This course focuses on how financial assets and firms are valued in financial markets. We broaden the portfolio of valuation techniques developed in the required curriculum (specifically in the Financial Management and Policies course) and apply these methods to a range of financial data and assets. The course serves as background for other finance elective courses and builds skills in key valuation principles such as options pricing. We emphasize the economic underpinning and application of valuation techniques.

The course is organized in two modules. The first concentrates on valuing traded financial assets in the fixed income and options markets. These assets have precisely defined payoffs and often involve fairly complicated structures. The second module focuses on valuing entire companies and the implication for stock prices. We pay particular attention to different ways to deal with the impacts of both operating results and financial structure on market prices.

Requirements

Students are expected to be prepared for each class. Grading will be based on class participation (25%), two problem sets (20%) and an exam (55%). For some sessions, preparation involves reading technical notes and applying techniques to specific problems. Other sessions tackle comprehensive cases. Some readings are from Brealey, Myers and Allen's *Principles of Corporate Finance* (8th edition, hereafter BMA) which the finance faculty recommend as a reference for use in finance electives and on the job. (BMA was also recommended in the Financial Management and Policies course syllabus).



Quarter 4 2008
VALUATION IN FINANCIAL MARKETS
COURSE OUTLINE

1. Tuesday, March 18 **Duration and Convexity**
Case: The Walt Disney Company: 100-Year Bonds - Sleeping Beauties?
2. Wednesday, March 19 **Term Structure of Interest Rates**
Case: Pricing Strips and the Term Structure
3. Monday, March 24 **Pricing Interest Rate Swaps**
Lecture and Problems
4. Tuesday, March 25 **Interest Rate Swaps**
Case: G & P Greetings Inc.
5. Monday, March 31 **Introduction to Options**
Lecture and Problems
6. Tuesday, April 1 **Black-Scholes Option Pricing Model**
Lecture and Problems
7. Wednesday, April 2 **Put-Call Parity**
Case: Smith Barney
8. Monday, April 7 **Option Pricing Models and Dividend Payments**
Lecture and Problems
9. Tuesday, April 8 **Convertible Bonds**
Case: Flowers Industries
10. Monday, April 14 **Valuing a Company**
Case: Carrier and Tyler Refrigeration

11. Tuesday, April 15 **Methods for Valuing Companies**
Lecture and Problems
12. Monday, April 21 **Adjusted Present Value**
Case: *Benninger Packaging, Inc.*
13. Tuesday, April 22 **TBD**
14. Monday, April 28 **TBD**
15. Tuesday, April 29 **Valuation Overview**



VALUATION IN FINANCIAL MARKETS

Session #1: Duration and Convexity

Date Tuesday, March 18

Case: *The Walt Disney Company: 100-Year Bonds - Sleeping Beauties?* [UVA-F-1063]

Read: *Valuing Assets in Financial Markets* [UVA-F-1518]
Duration and Convexity [UVA-F-1238]

Network

File: None.

Class Objective: Cover and understand basic ways to measure a bond's price sensitivity to interest rate changes.

Assignment:

1. How risky are the Disney Bonds?
2. What types of risk are relevant to your assessment?
3. In terms of risk, how do these bonds compare with a comparable 30-year issue?
4. What is your recommendation?



VALUATION IN FINANCIAL MARKETS

Session #2: Term Structure of Interest Rates

Date Wednesday, March 19

Case: *Pricing Strips and the Term Structure* [UVA-F-0925]

Read: *Interest Rates, Market Pricing, and Compounding* [UVA-F-1517]
Spot and Forward Interest Rates (UVA-F-1520)

Supplemental reading: *Brealey, Myers and Allen, Principles of Corporate Finance, 8th edition, Chapter 23 through page 641.*

Network

File: Strip.xls

Class Objective: Cover the basics of the term structure of interest rates, including the relationships among yields to maturity, spot interest rates and forward interest rates.

Assignment:

1. What is the yield to maturity on the 2-year and 5-year bonds quoted in Exhibit 1?
2. What are the spot rates for the first 2-years implied by the zero coupon bonds in Exhibit 2?
3. What are the spot rates for the first 2-years implied in the coupon bond prices shown in Exhibit 1? (Use bootstrap approach to estimate the spot rates). How do these spot rates compare to those in question 2?
4. What is the relationship between the yield to maturity on the 2-year bond and the spot rates for the first two years?
5. What is the forward interest rate from month 18 through month 24?
6. Plot the yield curve and the term structure of interest rates implied in Exhibits 1 and 2. What does the term structure tell you about future interest rates?



VALUATION IN FINANCIAL MARKETS

Session #3: Pricing Interest Rate Swaps

Date Monday, March 24

Read: *Valuation of "Plain Vanilla" Interest Rate Swaps* [UVA-F-1121]

Network

File: None.

Class Objective: Understanding interest rate swaps and how they are priced.

Assignment:

Estimate a swap rate for a 3-year (last payment June 2009) interest rate swap (expressed as a fixed annual interest rate that could be swapped for 3-month LIBOR). Estimate a 5-year swap rate (last payment June 2011). Base the pricing on the attached sheet of Eurodollar Futures contract prices (from June 2006) and assume that it is exactly 3 months to the first payment on September 12. Assume the current (as of June 12, 2006) 3-month LIBOR rate is 3.21%.

If you are particularly interested in these markets, try out the Bloomberg System in the library to look at current swap quotes and information on Eurodollar Futures. You can print these out using the instructions listed below.

Swap Quotes:

Hit **M-Mkt** key, then type **IRSB** and hit **Go**

Select *18 United States* by entering **18** and hitting **Go**

This is the swap quote page. To print a copy hit the **print** key.

Eurodollar Futures Analysis:

Hit **Cmdty** and enter **EDS** and hit **Go**

This will get you to the IMM Eurodollar Futures Analysis page.

To print a copy hit the **print** key.

EURODOLLAR (CME) - \$1 million: pts of 100%

	Open	High	Low	Settle	Chg.	Yield		Open
						Settle	Chg.	Interest
6-Jul	96.76	96.76	96.76	96.76	-	3.24	-	116,620
6-Aug	96.71	96.71	96.71	96.71	-	3.29	-	17,794
6-Sep	96.71	96.71	96.71	96.71	-	3.29	-	813,919
6-Oct	96.76	96.76	96.76	96.76	-	3.24	-	230
6-Dec	96.66	96.66	96.66	96.66	-	3.34	-	752,837
7-Mar	96.62	96.62	96.62	96.62	-	3.38	-	660,259
7-Jun	96.30	96.40	96.26	96.32	0.01	3.68	(0.01)	490,780
7-Sep	96.08	96.18	96.04	96.10	0.02	3.90	(0.02)	424,856
7-Dec	95.78	95.88	95.74	95.80	0.04	4.20	(0.04)	449,413
8-Mar	95.69	95.79	95.65	95.71	0.04	4.29	(0.04)	242,773
8-Jun	95.18	95.28	95.14	95.20	0.03	4.80	(0.03)	183,517
8-Sep	94.90	95.00	94.86	94.92	0.02	5.08	(0.02)	173,389
8-Dec	94.62	94.72	94.58	94.64	0.02	5.36	(0.02)	141,627
9-Mar	94.37	94.47	94.33	94.39	0.03	5.61	(0.03)	150,124
9-Jun	94.14	94.24	94.10	94.16	0.03	5.84	(0.03)	117,292
9-Sep	94.12	94.22	94.08	94.14	0.03	5.86	(0.03)	81,626
9-Dec	93.71	93.81	93.67	93.73	0.03	6.27	(0.03)	66,604
10-Mar	93.52	93.62	93.48	93.54	0.04	6.46	(0.04)	73,873
10-Jun	93.34	93.44	93.30	93.36	0.04	6.64	(0.04)	50,968
10-Sep	93.18	93.28	93.14	93.20	0.04	6.80	(0.04)	39,005
10-Dec	93.04	93.14	93.00	93.06	0.04	6.94	(0.04)	31,822
11-Mar	92.91	93.01	92.87	92.93	0.04	7.07	(0.04)	30,792
11-Jun	92.78	92.88	92.74	92.80	0.04	7.20	(0.04)	17,891
11-Sep	92.36	92.46	92.32	92.38	0.05	7.62	(0.05)	7,123
11-Dec	92.25	92.35	92.21	92.27	0.05	7.73	(0.05)	7,504
12-Mar	92.16	92.26	92.12	92.18	0.05	7.82	(0.05)	2,922
12-Jun	92.08	92.18	92.04	92.10	0.05	7.90	(0.05)	6,039
12-Sep	91.86	91.96	91.82	91.88	0.05	8.12	(0.05)	1,930
12-Dec	91.54	91.64	91.50	91.56	0.05	8.44	(0.05)	603
13-Mar	91.50	91.60	91.46	91.52	0.05	8.48	(0.05)	305

Est. vol. 606,932; vol. Tue 682,932; open int. 5,204,390, +21,147.



VALUATION IN FINANCIAL MARKETS

Session #4: Swaps, Caps and Swaptions

Date Tuesday, March 25

Case: *G&P Greetings Inc.* [UVA-F-1122]

Network

File: G&P.xls

Class Objective: Understanding the valuation and use of interest rate swaps, introducing interest rate caps and swaptions.

Assignment:

1. How does the 6.10% swap rate compare with the market rate implied by the Eurodollar Futures prices? Note that the first fixed rate payment for the swap will be in December 1995 and it will be for 3 months of interest. Subsequent fixed payments will be for six months of interest and are scheduled to fall on the dates shown in Exhibit 3 (i.e., every 6 months through June 1998). Is this a competitive rate? Price the swap assuming that the swap will be signed on or about September 12th 1995, the same date as the maturity of the Eurodollar futures contract.
2. Please only skim the discussion on the interest rate caps and the swaption. We will address these briefly in class.



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Session #5: Introduction to Options

Date Monday, March 31

Read: *Option Contracts and Their Valuation* [UVA-F-1519]

Stock Options and Compensation [UVA-F-1521]

Supplemental reading: Brealey, Myers and Allen, Principles of Corporate Finance, 8th edition, Chapter 20.

Glance over the internet material on the CBOT and CBOE.

Network

File: None.

Interesting information on the Chicago Board of Trade (CBOT) can be found at <http://www.cbot.com> where you can navigate to information about the exchange and pricing for a wide array of products. For information on The Chicago Board Options Exchange (CBOE) see <http://www.cboe.com> which has lots of data and a helpful glossary on terms in the options markets (see the learning center tab).

Class Objective: Introduce the basics of options and their valuation.

Assignment:

1. What is a call option? What is a put option? Based on the Black-Scholes valuation exhibit in the note (including Appendix 2) please consider the following questions:
 - a. How does the value of a call option change as the time to maturity increases? What is the explanation?
 - b. How does the value of a call option change as the volatility increases? Why?
 - c. How does the value of a call option change as the stock price increases relative to the strike price? Why?

2. Using the Black-Scholes Model tables in the reading, what volatility is implied in the current call option prices on Apple Computer stock? How does this compare with the historic volatility of .4963?
3. What is your estimate of the value of the stock options awarded to the executives of Apple Computer in March 1999? What would have been the impact if the managers had received the same value of the option grants but in shares of Apple Computer?
4. Using the Black-Scholes tables in the reading, what would the value of the option grants be if the volatility of Apple stock was estimated to be .20?

Note: When dealing with derivative contracts such as options, the general convention is to express interest rates using continuous compounding.



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Session #6: Black-Scholes Option Pricing Model

Date Tuesday, April 1

Read: The Black-Scholes Option Pricing Model [UVA-F-1522]

Supplemental reading: Brealey, Myers and Allen, *Principles of Corporate Finance*, 8th edition, Chapter 21.

Network

Files: **Boeing Dell Danaher 2006.xls, bscholes.xls** Note that the bscholes.xls file is an Excel-based version of the Black-Scholes model.

Class Objective: Cover the logic and the application of the Black-Scholes Model.

Assignment: For purposes of this assignment assume that today's date is August 15, 2006. At that time, the U.S. Treasury yield curve was approximately flat at 5% for all maturities. Please assume an annual interest rate (continuously compounded) of 5% in your analysis. The network file has historic stock prices and current options prices for Boeing, Dell and Danaher. These companies pay no or small dividends. For purposes of this assignment assume they are non-dividend paying stocks.

Value the following European call options using the bscholes.xls file.

1. Call on Boeing stock; exercise price of \$77.50 and 9 months maturity
2. Call on Boeing stock: exercise price of \$80.00 and 24 months maturity
3. Call on Dell stock: exercise price of \$25.00 and 9 months maturity
4. Call on Dell stock: exercise price of \$22.50 and 24 months maturity
5. Call on Danaher stock: exercise price of \$67.50 and 9 months maturity



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Session #7: Valuation using Put-Call Parity

Date Wednesday, April 2

Case: *Smith Barney, Harris Upham and Co., Inc.* [UVA-F-0946]

Network

File: None.

Class Objective: Review arbitrage pricing and how it enforces pricing relationships among different financial assets, specifically among calls, puts, stocks and bonds.

Assignment:

1. What is Put-Call parity? How does it depend on arbitrage in markets?
2. Using the following information, devise arbitrage strategies for trading. How would you go about instituting these trading rules for **European** options on **non-dividend** paying stocks? Can you make money?
 - a. Current XYZ stock price is \$73
 - b. Current risk-free rate (continuous compounding) is 6%
 - c. Call option on XYZ with maturity of 6 months and an exercise price of \$78 is trading for \$ 6.30.
 - d. Put option on XYZ with maturity of 6 months and an exercise price of \$78 is trading for \$9.00.
 - e. What would be the case if the call price had been \$6.94? What would you do if the stock price had been \$73.25?
3. How would you go about instituting these trading rules for **American** options on **non-dividend** paying stocks?

4. What is the impact of dividends on Put-Call parity? How do you have to change the Put-Call parity formula to account for dividends? What alterations in your strategies would you have to make for **European** options on dividend paying stocks? What would be the concerns for **American** options on dividend paying stocks?

5. Smith Barney has a large inventory of stocks, which it holds in “street name”. These are stocks owned by customers but are held in Smith Barney’s name. Assuming that Smith Barney has an inventory of stocks on which puts and calls are traded, can Put-Call parity be used to lower Smith Barney’s cost of borrowing? If so, how?



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Session #8: Option Pricing Models and Dividend Payments

Date Monday, April 7

Read: *Option Valuation and Dividend Payments* [UVA-F-1523]

Network

File: **bscholes.xls**

Class Objective: Build a Black-Scholes model in excel and make extensions that account for dividend payments. Understand differences between European and American call options in terms of early exercise.

Assignment: Your assignment is to use Excel to construct the Black-Scholes model and then use that to price options.

The basic Black-Scholes model is:

$$\text{Call option Value} = P \cdot N(d_1) - X \cdot e^{-r_f t} \cdot N(d_2)$$

$$\text{where } d_1 = \frac{\ln(P/X) + (r_f + \sigma^2 / 2) \cdot t}{\sigma \cdot \sqrt{t}}$$

$$d_2 = d_1 - \sigma \cdot \sqrt{t},$$

P = underlying asset value,

X = exercise price,

t = time to maturity,

σ = Volatility,

and r_f = risk-free rate.

Volatility, σ , is defined as annual volatility (e.g. .25 means 25% per year). Time, t, is defined in years. If there are 122 days to maturity, then $t = 122/365$ or .33425 years. N(d) is the value of the cumulative normal distribution for a value of d. The Excel function NORMSDIST(d) returns the cumulative normal distribution value for a particular calculated value of d. In excel the natural log function is LN(.), and the exponential is EXP(.).

Use the following information to answer the questions.

Assume today's date is September 1, 2006. The market information on XYZ stock is as follows:

Firm: XYZ

Current stock price	=	\$47.50
Volatility	=	.25
Risk-free rate of interest	=	5.0% (continuous compounding)

Expected Dividend payments in 2006-2007:

<u>Dividend</u>	<u>Ex-date</u>	<u>Payable Date</u>
\$0.50	Dec. 1, 2006	Dec. 15, 2006
\$0.50	Mar. 1, 2007	Mar. 15, 2007
\$0.75	Jun. 1, 2007	Jun. 15, 2007
\$1.00	Sep. 1, 2007	Sep. 15, 2007

1. Build an Excel based Black-Scholes model and price a **European** call option with a maturity of 61 days, Nov. 1, 2006. Assume an exercise price of \$45. Using the same inputs, how does the value compare with the value from the BSCHOLES.xls value?
2. Using your excel model, what is your estimate of the price of a **European** call option with a maturity date of December 15, 2006 and an exercise price of \$45?
3. Using your excel model, what is the value of a **European** call option with a maturity date of September 2, 2007 and an exercise price of \$45? How does this compare with the known dividend model in BSCHOLES.xls?
4. Using your excel model, how would you price a **European** call option with a maturity date of September 2, 2008 and an exercise price of \$45?
5. Compare the values of a European call option with a maturity of May 31, 2007 and an exercise price of \$45 using a known dividend approach and a constant dividend yield approach. Are the values different? If so, why? Which approach is the better representation of reality?
6. Based on the technical note discussion (*Option Valuation and Dividend Payments*), how would you adapt your excel model to value the option in question 2 if it were an **American** option? What would you have to do if the option in question 3 were an **American** option?
7. Would an **American** call option with maturity of 120 days and an exercise price of \$45 ever be exercised early? If so, what would be your decision rule to decide when and at what stock price you'd want to exercise early?



VALUATION IN FINANCIAL MARKETS

Session #9: Valuation of Convertible Bonds

Date Tuesday, April 8

Case: Flowers Industries, Inc. (Abridged), UVA-F-0812

Read: *BM & A: 8th Edition, Chapter 25, pages 680-686.*

Network

File: Spot rates.xls

Assignment:

1. Using option pricing theory as a basis for your calculations, what is the value of the convertible subordinated debenture? [The standard practice is to view a convertible as having two components (a bond and an option), to value each component separately, and then to add the components. From the issuer's standpoint, a convert would be costly if its true value were above par value, and cheap if its true value were below par value.]

Note: For the sake of simplicity, ignore the impact of dilution and the sinking fund provision. In addition, to value the straight bond, I have attached the spot rates for US Government zero coupon bonds with different maturity dates. (Spot rates file). These are annual rates based on semi-annual compounding. You can assume that Flowers would command a 250 basis point premium over the default free spot rate.

2. When will the holder of the convertible bond convert?
3. Should Marty Wood go forward with the convertible issue?
4. Ignore the sinking fund provision in your analysis, but how would it impact your estimate of the value of the convertible bond?



VALUATION IN FINANCIAL MARKETS

Session #10: Valuing a Company

Date Monday, April 14

Case: *Carrier and Tyler Refrigeration* [UVA-F-1312]

Read: *Methods of Valuation for Mergers and Acquisitions* [UVA-F-1274 - review from first year finance]

Spreadsheet: Tyler spreadsheet 9-12-00.xls

Assignment:

1. What is Tyler's value as a stand-alone entity?
2. What is Tyler's value with synergies (but excluding any potential effects on Ardco)?
3. What is Tyler's value to Carrier?



VALUATION IN FINANCIAL MARKETS

Session #11: Valuing Companies Lecture Problems

Date Tuesday, April 15

Read: *Valuing Companies—An Overview of Analytical Approaches* [UVA-F-1187]

Using APV: A Better Tool for Valuing Operations by Timothy A. Luehrman, *HBR Reprint 97306* plus *Note on Luehrman article*

Note: See Brealey, Myers and Allen, 8th edition, Chapter 19 - Supplementary and Optional.

Network

File: APV.XLS

Assignment:

Today's class provides an overview of various valuation approaches. I suggest you look over the first two readings to get the larger picture of valuation. Some of the details will be clearer as we go through the course.

Luehrman's article on APV (Adjusted Present Value) makes it sound like APV is much superior to WACC methodology. In class, we will discuss some of the factors that work in favor of WACC – in part, these have to do with difficulties in estimating unlevered discount rates and valuing interest tax shields. Both of these steps typically require some specific assumptions about capital structure theory (e.g. to unlever betas).

In preparation for the class examine the spreadsheet file (APV.XLS) which contains the base case assumptions shown on page 5 of the Luehrman article, *Using APV: A Better Tool for Valuing Operations* HBR, May/June 1997. Although the article is not specifically designed as a comparison of the WACC methodology and the APV methodology, use the data provided in the Excel file, construct valuations using each of the following approaches.

1. Weighted Average Cost of Capital
 - a. What is the cash flow in period 1?
 - b. What is the discount rate?
 - c. What is the terminal value?
 - d. What is the value of the investment?

2. Adjusted Present Value
 - a. What is the cash flow in period 1?
 - b. What is the discount rate?
 - c. What is the terminal value?
 - d. What is the value of the investment?

Assume for simplicity that the cost of unlevered equity is 13.5% and the government bond rate is 5%.



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Session #12: Adjusted Present Value

Date Monday, April 21

Case: *Benninger Packaging, Inc.* [UVA-F-Draft]

Read: (Brealey, Myers and Allen, Chapter 19 optional) or Luehrman HBR Reprint 97306

Network

File: Benninger.xls

Assignment:

1. Use the APV approach discussed in Session #11 to value the new company (*assume the specialized financing is not available*). Assume that Benninger is forecasting a long run growth rate of 4% for the business and a market risk premium of 5.0%.
2. Use the APV approach to revalue the proposal incorporating the specialized financing opportunity. What difficulties did you encounter?
3. What is the value of the special financing package?
4. Would you recommend that Benninger go ahead with the project?



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Session #13: TBD

Date Tuesday, April 22

Case:

Read:

Network

File:

Assignment:



VALUATION IN FINANCIAL MARKETS

Session #14: TBD

Date Monday, April 28

Case:

Network

File:

Assignment:



VALUATION IN FINANCIAL MARKETS

Session #15: Valuation Overview

Date Tuesday, April 29

Read: *Comments on Capital Cash Flow Valuation.*

Skim Harvard Note on Capital Cash Flow Valuation (*A Note on Capital Cash Flow Valuation*, 9-295-069) for future reference.

Network

File: None.

Assignment:

We will finish our conversation from the last class and review various approaches to valuation.

Think of a range of valuation challenges such as IPO's, capital budgeting, strategic acquisitions and highly levered transactions.

1. What do you see as the attractive features of various valuation methodologies in tackling each type of situation?
2. What are the main strengths and weaknesses of each of the following valuation approaches?
 - a. Multiples
 - b. Option Pricing
 - c. Specific Asset Values
 - d. Weighted Average Cost of Capital Approach to DCF
 - e. Adjusted Present Value Approach to DCF
 - f. Equity Residual Approach to DCF
 - g. Adjusted Present Value Approach to Capital Cash Flow Valuation