FUNDAMENTAL EQUITY ANALYSIS

A PRIMER

WRITTEN BY:
DAVID NINCIC

ADVANCED STUDY PROJECT IN FINANCE (FNCE 890)
THE WHARTON SCHOOL
PROFESSOR DONALD KEIM
SPRING 1999

THE WHARTON FELLOWS FUND
(http://wh-fellows.wharton.upenn.edu)

FUNDAMENTAL EQUITY ANALYSIS

A PRIMER

Fundamental Equity Analysis: A Primer provides Wharton students with a guide to the craft of stock picking. It presents an overview of qualitative and quantitative fundamental research methods, with a comprehensive survey of valuation techniques. The framework provided in the *Primer* should prove useful to those who wish to present stock recommendations, either verbally or in written form. We urge those with an interest in stock picking to present their investment ideas to the Wharton Fellows Fund. We hope that the *Primer* will be a valuable resource in this regard.

David Nincic
MBA, Class of 1999

Fundamental Analysis

- Stocks that comprise the Wharton Fellows Fund are selected using fundamental equity analysis
- Fundamental analysis is premised on the belief that markets are not efficient and that superior research can uncover stocks whose intrinsic values differ from their market values
- Technical analysis, in contrast, is premised on the belief that by recognizing recurrent and predictable stock price patterns, one can identify and profitably trade mispriced stocks
- In this report, we will provide:
  - a broad introduction to fundamental equity research
  - direction for those who wish to write a stock research report to be presented to the Wharton Fellows Fund

Investment Philosophy

- The Wharton Fellows Fund invests only in small-cap value stocks
  - Academic research suggests that small companies with low price-to-book ratios outperform the market over time[1,2]

- While small-cap value is a category with no precise definition, the Wharton Fellows Fund defines small-cap value stocks as having:
  - Equity market capitalization of less than $1 billion
  - Financial ratios and price multiples in the top tercile-to-quintile of publicly-traded companies (e.g., low P/E companies are in a top segment, high ROA companies are in a top segment)

Choosing a Stock to Research

- Fellows Fund Screen
  - Screen identifies stocks that meet the characteristics described above
  - Several hundred stocks have been identified
  - The Fellows Fund prefers that its portfolio consist of stocks from the screen, but exceptions are commonly made
  - Ask any Fellow for a copy of the screen

- Focus on companies within industries in which the Fund is underweighted
  - The Fellows Fund should be industry neutral
  - Industry weightings of Fund should mimic those of the Russell 2000
  - In each weekly Fellows Fund meeting, a sheet is distributed that outlines the Fund's holdings, including industry weightings

- Ask for ideas from the Analysts of the industry that you are interested in
  - Each industry has two Fellows that are Analysts for the industry

- Leverage personal work experience and interests
  - Many of the Fund's best stocks are recommended by students who have worked with or analyzed the company and/or related industry in their prior work

- Many stocks may have to be analyzed before finding a true compelling value
  - The stock that you ultimately present to the Fellows Fund may not be the first stock you chose to research

[1] Fama, Eugene F., and Kenneth R. French. "The Cross-Section of Expected Stock Returns," *Journal of Finance*, Vol. 47, No. 2, June 1992, pp. 427-465.
[2] Fama, Eugene F., and Kenneth R. French. "Size and Book-to-Market Factors in Earnings and Returns," *Journal of Finance*, Vol. 50, No. 1, March 1995, pp. 131-155.

Conducting Research

- Review the information in a company's "investor packet"
  - An investor packet can be obtained through the Investor Relations Department of the company you are interested in
  - The investor packet should contain the company's latest annual report, 10-K, 10-Q, recent press releases, and, possibly, sell-side analyst reports

- Use First Call Research Direct, available at Lippincott Library[3]
  - Get sell-side (investment bank) company and industry research reports
  - Get earnings estimates updated in real-time
  - Get sell-side analyst morning notes
    - Morning notes (referred to as *US* or *International Notes* by First Call) are short commentaries on stocks that sell-side analysts publish, usually for discussion at the morning equity department meeting of the analyst's firm
    - Sell-side analysts write morning notes on companies more frequently than they do research reports

- Talk to company management
  - After conducting research on a stock, questions arise that can be answered only by company management
  - The appropriate contact is usually the Director of Investor Relations or CFO
    - They are often unresponsive to phone calls from the Wharton Fellows Fund because the Fund is an unknown, small investor to them
    - Stating that you are with the "Endowment Fund of the University of Pennsylvania" typically generates a better response than stating that you are with the "Wharton Fellows Fund" (and is truthful, we contend!)

Useful Resources

- Yahoo Finance (http://finance.yahoo.com)
  - Current and historical stock prices
  - Historical stock price graphs
  - Government bond yields
  - Stock index values
  - Insider buying and selling
  - Recent press releases
  - Message board with lively discussions on most stocks

- Bloomberg
  - Excellent source for news reports and press releases on companies
  - Two terminals on the second floor of Vance Hall and one terminal in Lippincott

- Global Access (http://www.library.upenn.edu/resources/databases/databases.html)
  - Excellent source of SEC documents (10-Ks, 10-Qs, 8-Ks)
  - Only Web site of which we are aware that prints EDGAR filings correctly
  - Capable of downloading financial statements directly into Excel
  - Somewhat slow to download

- SEC Archive of EDGAR filings (http://www.sec.gov/cgi-bin/srch-edgar)
  - Fastest download time of all web-based EDGAR databases
  - Cumbersome to read through a downloaded document. Prints poorly

[3] First Call Research Direct may not be available in Lippincott Library beginning Fall 1999. It may be replaced with another Web-based database of Wall Street research reports. Morning meeting notes and earnings estimates (but not research reports) are also available using the First Call terminal in the Fellows Fund office (435A Vance Hall). You can get a key to the office from the WGA office (216 Vance Hall) or by asking a Fellow.

Useful Resources (continued)

- LEXIS/NEXIS (http://www.library.upenn.edu/resources/databases/databases.html)
  - Full text of articles available from virtually every newspaper, magazine and newsletter that exists (Notable exception: *Wall Street Journal*)
  - Use Telnet version rather than the Web version. The Telnet version has a better search engine and indexes more periodicals

- Datastream
  - A very useful but user-unfriendly database of financial information updated in real-time
  - Only resource at Penn that can calculate betas using total returns[4]
  - Two terminals in Lippincott Library

Stock Picking Principles

- Changes in perceptions of company and industry fundamentals are the catalyst for a stock's movement
- Anticipate these changes before others do
- The most important factor in anticipating change is to understand the competitive position of a company and its industry
- The qualitative is more important than the quantitative
- Decisions must be made using limited and conflicting information. Do not wait until you have all the facts to buy a stock. It will then be too late
- The more complex the reasoning, the more likely it is to be wrong. The basis for buying a stock should be simple and explainable in less than a minute
- Know the sign (+ or -) of both the first and second derivative of a company or industry's key operating indicators. Use the second derivative to anticipate changes in a company's fundamentals
- The best investments are anti-consensus. If consensus is correct on a stock, abnormal returns cannot be achieved
- Earnings disappointments and positive surprises are usually multiple quarter events

Understanding a Company's Business

- Without a thorough understanding of a company's precise business, one cannot analyze the competitive position of a company
- A company's annual report and 10-K are the best documents to understand the exact nature of a company's business
- Never lose sight of the fact that you are betting on a business when buying a stock
  - Thoroughly understand the bet that is being made
  - The business comes first, the financials come (a distant) second

[4] In Appendix II, we provide an example of calculating betas using Datastream.

Competitive Analysis[5]

- Porter's Five Forces is a highly useful framework for analyzing the attractiveness of an industry
  - A company analysis is valid only within the context of an industry analysis
- The underlying assumption of the Porter framework is that industry profitability is a function of industry structure and not a function of the product that the industry sells
- In analyzing a company as an investment, one should be able to:
  - Evaluate the attractiveness of the company's industry within a Porter Framework
  - Identify the company's competitive strategy
  - Identify the company's ability to achieve and/or sustain a competitive advantage within its industry

Industry Analysis

- The Porter Framework states that there are five basic competitive forces that affect industry profitability
- The first three determine industry profitability
  - Rivalry among firms
  - Ease of entry and exit
  - Pressure from substitute products
- The last two determine who in the industry retains the profits
  - Bargaining power of buyers
  - Bargaining power of suppliers

Competitive Strategies

- Within all industries, companies have three generic strategies that they can pursue
  - Cost leadership
  - Product differentiation within main industry segments
  - Niche specialization

Sustainable Competitive Advantage

- Choice of a generic competitive strategy does not necessarily lead to superior profitability
- The competitive strategy must be sustainable. Understand the factors that lead to or prevent erosion of a company's competitive advantage
  - Cost leadership requires low overhead, standardization of processes, leverage with suppliers, and learning curve effects
  - Product differentiation requires innovation, customer loyalty and strong marketing skills

Earnings Projections

- All stock research reports presented to the Wharton Fellows Fund must include a detailed model that projects earnings per share (EPS) for at least two fiscal years
  - On the following page, we describe the major line items of an earnings model and how to project them[6]

[5] To maintain the focus of this report, only a brief review of competitive analysis is included. Nevertheless, this is probably the most important section of the report. In the author's opinion, two of the best stock-picking books are written by Michael Porter, a recognized expert in competitive strategy theory rather than stock-picking:

Porter, Michael E. *Competitive Strategy: Techniques for Analyzing Industries and Competitors.* New York: The Free Press, 1980.

Porter, Michael E. *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: The Free Press, 1985.

If pressed for time, a very worthwhile read is the chapter: "Competitive Strategy: The Core Concepts" in *Competitive Advantage*.

[6] This approach takes several shortcuts allowing an analyst to project earnings without simultaneously projecting the balance sheet and cash flow statement. These conceptual weaknesses do not typically result in material differences in near-term earnings projections.

Earnings Projections (continued)

- When you have completed your earnings model, compare it to the earnings models of sell-side analysts
  - Understand (and possibly correct) discrepancies between the two models
  - Do not necessarily assume that the sell-side analyst's model is more accurate

Revenues

- Revenue = volume x price
  - Earnings models are highly sensitive to small adjustments in volume and pricing estimates. Use great care and thought in making these estimates
  - If specific volume and pricing data is not given by a company, have a mental model of how volumes and pricing will change going forward
  - Understand cyclical sales pattern of a company and/or industry
  - Distinguish between inflation and non-inflation increases in pricing. Price increases in excess of inflation typically lead to increases in operating margins

Operating Expenses

- Revenues – operating expenses = EBITDA

- Factors that affect total operating expenses include:
  - Inventory costs
  - Unit labor costs
  - Selling, general and administrative costs
  - Capacity utilization rates
  - Inflation

- Inventory costs
  - Understand the direction and magnitude of the change in input prices
  - Understand the pricing power of a company relative to its suppliers
  - Determine whether increases in inventory costs can be passed on to the customer

- Unit labor costs
  - Unit labor costs depend upon wage levels and productivity
  - An increase in the wage level does not necessarily increase unit labor costs if the wage increase reflects productivity gains

- Selling, general and administrative costs
  - Determine to what extent SG&A costs are correlated with revenues
  - Weak correlation may imply that operating margins are sensitive to small percentage changes in revenue

- Capacity utilization rates
  - Important for companies with high operating leverage.[7] For such companies, small increases in volumes can have a magnified effect on operating margins
  - Airlines are an example in which capacity utilization rates are very important. An additional passenger on a flight is almost pure profit

- Inflation
  - In the short-run, inflation often raises operating margins because product prices usually increase more rapidly than labor and raw material costs
  - In the long run, raw material and labor costs will usually rise to a similar level to that of product prices, if not surpass them

[7] Operating leverage = Fixed costs as a % of total costs.

EXAMPLE: EARNINGS PROJECTIONS

TENET HEALTHCARE CORPORATION
Fiscal 2000 Quarterly Income Statement Projections

($000,000s)	FY1999E	1Q00E 8/31/99	2Q00E 11/30/99	3Q00E 2/28/00	4Q00E 5/31/00	FY2000E	% Change 2000 vs. 1999
Net Operating Revenues	$11,004	$2,756	$2,673	$2,762	$2,794	$10,985	(0%)
Operating Expenses							
Salaries and benefits	4,476	1,120	1,084	1,117	1,128	4,449	(1%)
Supplies	1,553	395	382	394	397	1,568	1%
Provision for doubtful accounts	731	173	168	173	175	689	(6%)
Other operating expenses	2,375	593	574	592	597	2,356	(1%)
Operating Income (EBITDA)	$1,871	$474	$465	$486	$497	$1,922	3%
EBITDA percentage	17.0%	17.2%	17.4%	17.6%	17.8%	17.5%	
Depreciation	423	103	91	87	87	368	(13%)
Amortization	132	34	34	35	35	138	5%
Interest expense	485	118	110	103	100	431	(11%)
Interest income	(29)	(6)	(6)	(6)	(6)	(25)	(15%)
Minority interest expense	5	1	2	2	2	7	40%
Pretax Income	$855	$ 224	$ 234	$ 265	$ 279	$ 1,003	17%
Income taxes	330	87	91	103	109	391	19%
Tax rate	38.6%	39.0%	39.0%	39.0%	39.0%	39.0%	
Net Income	$525	$137	$143	$162	$170	$612	17%
Diluted EPS	***$1.67***	**$0.44**	**$0.46**	**$0.51**	**$0.54**	***$1.95***	16%
Diluted Shares Outstanding (000s)	313,570	313,800	314,000	314,500	315,500	314,450	0%

	FY1999E	1Q00E 8/31/99	2Q00E 11/30/99	3Q00E 2/28/00	4Q00E 5/31/00	FY2000E	% Change 2000 vs. 1999
Domestic hospitals	131	121	111	111	111	111	(15%)
Average licensed beds	29,490	28,900	26,900	26,900	26,900	27,400	(7%)
Admissions	942,980	230,040	212,700	225,400	227,860	896,000	(5%)
Average length of stay	5.3	5.2	5.2	5.1	5.1	5.2	(2%)
Inpatient days	4,950,645	1,203,109	1,112,421	1,149,540	1,162,086	4,627,156	(7%)
Revenue per admission	$ 7,035	$ 6,966	$ 7,034	$ 6,936	$ 6,936	$ 6,967	(1%)
Revenue per inpatient day	$ 1,340	$ 1,332	$ 1,345	$ 1,360	$ 1,360	$ 1,349	1%
Inpatient revenues (MM)	$ 6,634	$ 1,603	$ 1,496	$ 1,563	$ 1,580	$ 6,243	(6%)
Outpatient visits	9,487,000	2,450,000	2,495,000	2,532,000	2,575,000	10,052,000	6%
Revenue per outpatient visit	$ 340	$ 343	$ 345	$ 347	$ 350	$ 346	2%
Outpatient revenues (MM)	$ 3,226	$ 840	$ 861	$ 879	$ 901	$ 3,481	8%
Other operations (MM)	$ 1,145	$ 313	$ 316	$ 320	$ 312	$ 1,261	10%

Depreciation and Amortization

- Depreciation is a non-cash cost that is based primarily on past capital expenditures
  - It can usually be forecasted by extrapolating the past 3-7 year trend into the future
- Amortization typically refers to the amortization of goodwill
  - It is probably safe to assume that this expense stays flat over the near future

Interest Expense

- Interest expense is primarily a function of previously borrowed funds whose interest rates were fixed in the past
  - Interest expense can usually be projected by extrapolating from historical trends
  - If debt will increase significantly, future interest expense can be estimated as: past interest expense + (current interest rates x estimated increase in debt)

Income Tax Rate

- It is usually appropriate to assume that future tax rates approximate current tax rates

Diluted Shares Outstanding

- Extrapolate growth in diluted shares outstanding from past trends
  - Diluted shares outstanding usually increase by about 1-3% each year to account for an increase in the number of options granted and exercised[8]
  - Exclude any past share offerings when determining a normalized growth rate for diluted shares outstanding

Balance Sheet: Introduction

- The balance sheet is too often overlooked when analyzing a company's financials. Yet it provides two main pieces of information that are critical in valuing a company
  - A company's quality of earnings
  - A company's financial risk
- We will discuss these two topics in detail in the following two sections

Balance Sheet: Indicator of Earnings Quality

- Quality of earnings is the relationship between a company's operating cash flow (a fact) with reported earnings (an accounting estimate)
- Generally, the higher the operating cash flow, the higher the quality of earnings
- Four major indicators of earnings quality are presented below. Deterioration of the first two indicators can be a predictor of future earnings disappointments
  - Days of sales outstanding (DSOs)
  - Days inventory held
  - Capitalized costs
  - Reserves related to one-time charges

Days of Sales Outstanding (DSOs)

- DSO = Average net accounts receivable / (Sales / # of days in period)
  - The lower the DSO, the higher the quality of earnings
  - An increase in DSO indicates that a company is having more difficulty converting its sales into cash
    - Possible indicator of a more liberal customer credit policy
    - Possible indicator of more aggressive revenue recognition accounting

[8] In addition, an increase in stock price may increase diluted shares outstanding under the treasury stock method of accounting for the assumed exercise of in-the-money employee stock options.

Days Inventory Held

- Days inventory held = Ave. inventory / (Cost of goods sold / # of days in period)
  - The lower the days inventory held, the higher the quality of earnings
  - Inventory ties up capital, which results in a higher cost of capital (in $ terms rather than in % terms)
  - An increase in days inventory held indicates that a company is building up inventory at a rate greater than it is selling product
    - Possible indicator of sales difficulties
    - Possible indicator that a company has obsolete inventory

Capitalized Costs

- Capitalized costs are costs that are capitalized (debited) to the balance sheet rather than expensed (debited) on the income statement
  - Capitalized costs reduce cash flow but do not reduce earnings (until they are later amortized). They therefore tend to inflate reported net income
  - Examples of capitalized costs include:
    - Interest expense related to construction activities
    - Software development costs
    - Certain marketing costs (e.g., AOL's accounting method prior to October 1996 for direct response advertising costs)

Reserves Related to One-time Charges

- Firms often incur large one-time/special/non-recurring expenses related to acquisitions, restructurings and other events
  - Firms often overestimate these expenses in order to create a reserve (a credit to a liability)
  - If it appears in the future that a company will not meet Wall Street earnings estimates, it can reduce (credit) its income statement expenses by reducing (debiting) the reserve
  - Be wary of companies with a history of recurring "non-recurring" charges. The earnings quality of such companies is suspect

Balance Sheet: Financial Risk

- Systematic risk has two components[9]
  - Operating risk
  - Financial risk

- Financial risk is associated with the level of debt in a company's capital structure
  - Debt increases a company's financial risk and, hence, its cost of equity[9]

- There are three questions that you should be able to answer with regard to a company's capital structure:

Operating Risk and Financial Leverage

- *Is the financial leverage employed by a company appropriate for its operating risk?*
  - The more volatile a company's cash flows, the less leverage it should employ, and vice versa
  - Utilities, with predictable cash flows, have high debt levels
  - Technology companies, with unpredictable cash flows, have low debt levels
  - Be careful of companies that diversify their business mix and increase their operating risk, but maintain the same financial risk (e.g., nursing home companies)

[9] We discuss systematic risk and its relationship to the cost of equity on page 20.

Operating Leases

- *How would the capitalization of operating leases affect the capital structure?*
  - Companies minimize apparent debt levels by entering into leases that GAAP allows to be classified as operating leases rather than capitalized leases
  - The rent on these leases represents a fixed charge equivalent to the interest payments and debt repayments the company would make were it to buy the PP&E using mortgage financing
  - One should capitalize operating leases (when material) to get a better representation of the level of debt
  - There are two main methods used to capitalize operating leases
    - (Conceptually correct method) Calculate the present value of future required operating lease payments. Future operating lease payments are provided in a company's annual report/10-K. Discount at the cost of debt
    - (Shortcut used by practitioners) Take the most recent quarter's rent expense, annualize it by multiplying by 4, and then multiply the result by 8, which assumes a cap rate of 12.5%

Distortion of P/E and ROE by Debt[10]

- *How does a company's capital structure distort its P/E and return on equity (ROE)?*
  - Value stocks: leverage tends to <u>understate</u> P/E and <u>overstate</u> ROE
  - Growth stocks: leverage tends to <u>overstate</u> P/E and <u>understate</u> ROE
    - Value stocks tend to have EBIT/EV > cost of debt
    - Growth stocks tend to have EBIT/EV < cost of debt
  - The following rules of thumb are useful:

Rules of Thumb: Leverage and P/Es

If EBIT/EV > cost of debt, then leverage understates P/E
If EBIT/EV = cost of debt, then leverage does not disort P/E
If EBIT/EV < cost of debt, then leverage overstates P/E

Rules of Thumb: Leverage and Returns on Equity

If EBIT / invested capital > cost of debt, then leverage overstates ROE
If EBIT / invested capital = cost of debt, then leverage does not disort ROE
If EBIT / invested capital < cost of debt, then leverage understates ROE

where invested capital = book value of debt and equity

  - On the following page, we demonstrate the distorting effect that leverage has on P/E

[10] A return on (market) equity (ROE) is simply the reciprocal of a P/E. Since ROE is usually based on the book value of equity, we calculate ROE on a book basis.

EFFECT OF CAPITAL STRUCTURE ON P/E

Low Multiple Stocks (Value Stocks)

($000,000s)	Company A	Company B	Company C	Company D
Market value of debt	$ -	$ 10.0	$ 25.0	$ 35.0
Market value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
Enterprise value of firm	$ 50.0	$ 50.0	$ 50.0	$ 50.0
EBIT	$ 10.0	$ 10.0	$ 10.0	$ 10.0
Interest expense @ 10%	-	1.0	2.5	3.5
Pre-tax income	10.0	9.0	7.5	6.5
Income taxes @ 40%	4.0	3.6	3.0	2.6
Net income	$ 6.0	$ 5.4	$ 4.5	$ 3.9
Enterprise value / EBIT	**5.0**	**5.0**	**5.0**	**5.0**
P/E	***8.3***	***7.4***	***5.6***	***3.8***

EBIT / Enterprise value of 20% > Interest expense of 10%, therefore debt distorts P/Es downward.
Typically, leveraged value stocks have understated P/Es.

Medium Multiple Stocks

($000,000s)	Company A	Company B	Company C	Company D
Market value of debt	$ -	$ 10.0	$ 25.0	$ 35.0
Market value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
Enterprise value of firm	$ 50.0	$ 50.0	$ 50.0	$ 50.0
EBIT	$ 5.0	$ 5.0	$ 5.0	$ 5.0
Interest expense @ 10%	-	1.0	2.5	3.5
Pre-tax income	5.0	4.0	2.5	1.5
Income taxes @ 40%	2.0	1.6	1.0	0.6
Net income	$ 3.0	$ 2.4	$ 1.5	$ 0.9
Enterprise value / EBIT	**10.0**	**10.0**	**10.0**	**10.0**
P/E	***16.7***	***16.7***	***16.7***	***16.7***

EBIT / Enterprise value of 10% = Interest expense of 10%, therefore debt does not distort P/Es.

High Multiple Stocks (Growth Stocks)

($000,000s)	Company A	Company B	Company C	Company D
Market value of debt	$ -	$ 10.0	$ 25.0	$ 35.0
Market value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
Enterprise value of firm	$ 50.0	$ 50.0	$ 50.0	$ 50.0
EBIT	$ 4.0	$ 4.0	$ 4.0	$ 4.0
Interest expense @ 10%	-	1.0	2.5	3.5
Pre-tax income	4.0	3.0	1.5	0.5
Income taxes @ 40%	1.6	1.2	0.6	0.2
Net income	$ 2.4	$ 1.8	$ 0.9	$ 0.3
Enterprise value / EBIT	**12.5**	**12.5**	**12.5**	**12.5**
P/E	***20.8***	***22.2***	***27.8***	***50.0***

EBIT / Enterprise value of 8% < Interest expense of 10%, therefore debt distorts P/Es upward.
Typically, leveraged growth stocks have overstated P/Es.

Notes:

- Each firm is worth the same.
- Each firm is valued correctly on a relative basis as shown by the equal EV/EBIT multiples.
- The variation in P/E incorrectly implies that some stocks are being valued more cheaply than others.

- EV/EBIT multiples are more appropriate than P/Es when comparing firms with different capital structures.
- Similarly, return on invested capital (ROIC) is a more valid measurement than return on equity (ROE) when comparing firms with different capital structures.

- This analysis is premised on Miller Modigliani's Propositions I and II (no taxes) that firm value is unaffected by capital structure.
- Most academics argue that there is a tax benefit to debt (with the value of the benefit debated), and therefore capital structure does matter.
- It remains true that leverage distorts P/Es and ROEs, with the exact magnitude debatable.

Valuation Introduction

- There are two main types of valuations:
  - Price multiple[11]
  - Discounted cash flow (DCF)
- Price multiples are useful measures of relative values
- Discounted cash flows are the only true measure of absolute values
  - EVA and CFROI are DCF-based valuation methodologies [12]

Price Multiples

- Advantages of price multiples
  - Easy to calculate
  - Provides a means to compare the relative values of companies
  - Provides useful crosschecks to the values derived from DCF models
- Limitations of price multiples
  - Does not capture the absolute and true value of a company, which is the present value of its future cash flows
  - The value of a company is <u>not</u> an assumed price multiple
  - An average industry or market price multiple is a weak predictor of a company's future price multiple
  - Denominator of price multiple is typically an accounting figure. Accounting numbers are estimates while cash flows are fact
  - Denominator of price multiple incorporates only one year of historical or projected results and, thus, does not incorporate growth rates
- Maintain consistency between the claimholders (debtholders and shareholders) in the numerator and denominator. For a levered firm, use of the following multiples is:

– <u>Correct</u>	– <u>Incorrect</u>
P/E	EV/Earnings
EV/EBIT	Price/EBIT
EV/EBITDA	Price/EBITDA
EV/Sales	Price/Sales[13]
EV/Invested capital	
Price/Book	

- On the following page, we provide an example of inconsistency between claimholders and its effect on the price multiple

P/E

- Calculation of P/E
  - For P, use current price of stock
  - For E, use projected diluted EPS for the next four quarters (forward P/E)[14]
  - Stock prices incorporate expectations of the future more than they do results of the past. Therefore, forward P/Es tend to be more useful than trailing P/Es
  - It is still worthwhile to calculate trailing P/Es. The four quarter trailing P/E is the P/E that is typically reported by the media

[11] "Price" multiples are not limited to multiples in which "price" (of a stock) is in the numerator. It also includes multiples in which Enterprise value or other measures of firm value are in the numerator.
[12] Economic Value Added (EVA) is promoted by Stern Stewart & Co. Cash Flow Return on Investment (CFROI) is promoted by HOLT Value Associates. We discuss EVA in detail beginning on page 27.
[13] Companies that are valued as a multiple of sales are typically early stage companies that are not profitable. These companies rarely have debt. Therefore, a Price/Sales calculation is equivalent to an EV/Sales calculation.
[14] Quarterly EPS estimates can be obtained from the First Call Research Direct terminal in Lippincott Library or the Fellows Fund office.

Example: Mixing Claimholders in the Numerator and Denominator of a Price Multiple

Maintaining Consistency Between Claimholders in the Numerator and Denominator of Price Multiples:

An Example using EV/EBIT and Price/EBIT

Market Values and Price Multiples		Abbreviated Income Statement	
Market (book) value of debt	$ 1,000	EBIT	$ 100
Market value of equity	100	Interest @ 9%	(90)
Enterprise value	$ 1,100	Pretax Income	10
		Taxes @ 40%	(4)
EV/EBIT	***11.0***		
Price/EBIT	***1.0***	Net Income	$ 6

EV/EBIT

- *Numerator:* Both debtholders and equityholders comprise EV
- *Denominator:* Both debtholders and equityholders have a claim on EBIT
- The use of EV/EBIT is correct

Price/EBIT

- *Numerator:* Only equityholders comprise Price (Price = market value of equity)
- *Denominator:* Both debtholders and equityholders have a claim on EBIT
- The result is a Price/EBIT ratio of 1.0 which is implausibly cheap
- Equityholders do not have a claim on the 90% of EBIT used to pay interest
- A more appropriate price multiple that includes only the equityholders in the numerator is P/E.
- The P/E for this company is 16.7 (100 ÷ 6), which is a much better indicator of the relative value of the company

P/E (continued)

- Measure a company's forward P/E relative to its peer group
  - Understand why the company trades at a discount/premium to its peers
  - Company P/Es do not necessarily mean revert to an industry average
  - Be cognizant of whether one is equal-weighting or market-cap weighting the industry average P/E, and the significance of the choice

- Be aware that industry P/Es tend to be upwardly biased
  - Upward bias primarily caused by skewed distribution of P/Es. P/Es have lots of extreme points on the high end, but are limited to zero on the low end. (Negative P/Es are not meaningful and are always excluded from average P/E calculations)
  - *Inverse average E/P* (1/average E/P for the industry) is probably a better estimate of the industry P/E. This measure helps correct for the upward bias

- Measure a company's forward P/E relative to that of the market[15]
  - For P, use the current value of the index[16]
  - For E, use forward EPS of the index[17]

[15] The market is either the S&P500 or Russell 2000. Other indices such as the NYSE Composite, Nasdaq Composite, Russell 2000 Value, or Wilshire 5000 may also be appropriate benchmarks for a stock, but we are unaware of resources that provide earnings estimates for these indices.
[16] On Yahoo Finance, the ticker symbol for the S&P500 is ^SPX. For the Russell 2000, it is ^RUX.

P/E (continued)

- Examine historical relationship between a company's forward P/E and the market's forward P/E[18]
  - Understand reasoning for changes in relative P/Es over time (e.g., why does a company now trade at a discount to the market when it has historically traded at a premium to the market?)

- Be aware of how leverage distorts P/E
  - See *Distortion of P/E and ROE by Debt* on page 9

EV/EBIT(DA)

- Calculation of EV/EBIT(DA)
  - The calculation of EV is shown on page 14
  - On page 15, we provide a fairly complicated, real-world example of calculating enterprise value for Chock Full O'Nuts Corporation
  - When calculating EBIT(DA) for purpose of an enterprise multiple, use the four most recent historical quarters (i.e., trailing EBIT(DA))
  - While enterprise multiples on forward EBIT or EBITDA would be useful, it is very difficult to get consensus EBIT or EBITDA estimates

EBIT
=
Net income
+
Interest expense
+
Income taxes
+
Extraordinary items (net of tax)

EBITDA
=
Net income
+
Interest expense
+
Income taxes
+
Extraordinary items (net of tax)
+
Depreciation and amortization

- The primary benefit of enterprise multiples is that they are not distorted by leverage

- EBIT vs. EBITDA
  - EBIT is usually more appropriate then EBITDA
  - Use EBIT when analyzing a company whose annual capital expenditures approximate or exceed the company's annual depreciation expense
  - Use EBITDA when analyzing a company whose capital expenditures tend be front-end loaded. In such cases:
    - The depreciation expense usually exceeds ongoing capital expenditures
    - EBITDA may be a better approximation of cash flow than EBIT

- Limitations of EV/EBIT(DA)
  - Using EBIT and EBITDA is <u>not</u> cash flow analysis
  - Both measures ignore taxes, capital expenditures and changes in working capital

[17] On First Call, the S&P500's symbol is SPX (before one-time charges) and SPXR (after one-time charges). The Russell 2000's symbol is RUSAO.
[18] Conceptually, the correct way to do this is to compare historical stock and index values with historical *projected* EPS. We are not aware of a database accessible to University of Pennsylvania students that provides historical projected EPS. FactSet is a database used by most investment banks and investment management firms that contains this information. An alternative approach is to calculate historical forward P/Es using actual results. One could also simply compare historical trailing P/Es.

Calculating Enterprise Value

Enterprise Value	***Calculation***	***Where to find it***
Market value of common equity	(No. of shares outstanding) x (current stock price)	*Shares outstanding:* front page of most recent 10-Q or 10-K *Current stock price:* Yahoo Finance
+		
Market value of preferred stock	(No. of preferred shares outstanding) x (current preferred stock price)	*Shares outstanding:* balance sheet of most recent 10-Q or 10-K *Current preferred stock price:* Yahoo Finance
+		
Market value of employee stock options	(Diluted shares outstanding - basic shares outstanding) x (current stock price) (1) (2) (3)	*Diluted and basic shares outstanding:* Most recent 10-Q or quarterly earnings press release. *Current stock price:* Yahoo Finance
+		
Market value of debt	Book value of total debt on balance sheet (Exception: Convertible debt--one needs to calculate market value) (4)	*Book value of debt:* Most recent 10-Q or 10-K. Include both short-term and long-term debt. *Convertible debt price:* Yahoo Finance (usually); otherwise Bloomberg
=		
Enterprise Value (5) (6)		

Notes:

(1) Because employee stock options do not trade, one cannot directly observe the value of these options. The technique presented understates the value of the options because it assumes that the options must be immediately exercised. (For instance, the technique wrongly assumes that out-of-the money options have no value.) In some cases, an annual report/10-K will give enough information to calculate the market value of outstanding options using the Black-Scholes formula.

(2) Ignore shares that represent the assumed conversion of convertible debt. See Chock Full O'Nuts EV calculation for an example.

(3) Be aware that if a company had negative net income in the most recent quarter, the company will have calculated basic and diluted EPS using the same number of shares outstanding. The diluted shares outstanding will exclude the assumed exercise of options because such an exercise will be antidilutive to EPS.

(4) The book value of debt generally approximates the market value of debt. It is therefore usually acceptable to simply substitute the book value for market value of debt. The most common exceptions are distressed debt and convertible debt.

(5) Often, analysts will add minority interest (as shown on the balance sheet) when calculating enterprise value. This is valid when calculating enterprise multiples as long as the numerator (e.g., EBIT, EBITDA) is not reduced by minority interest expense.

(6) Very often, analysts will subtract cash when calculating enterprise values. Avoid doing this unless there is a significant excess amount of cash on the balance sheet. EV is not meant to be the liquidation value of company. All companies must maintain a certain required cash balance to run the business on an ongoing basis. This "required cash" cannot be used to pay down debt. *If one chooses to subtract cash from the enterprise value, one must exclude interest income from EBIT or EBITDA when calculating enterprise multiples.*

ENTERPRISE VALUE CALCULATION
Chock Full O' Nuts (NYSE: CHF)

		Sources:
Common shares outstanding	10,830,922	*Front page of 1/31/99 10-Q*
Price of CHF as of 4/30/99	9 7/16	*Yahoo Finance*
Market value of common equity	$ 102,216,826	
Book value of 7% convertible debt due 2012	51,693,000	*10-K: 7/31/98*
Price of CHF7D12 as of 4/30/99	118 3/8	*Yahoo Finance*
Market value of 7% convertible debt due 2012	$ 61,191,589	
Book value of 8% convertible debt due 2006	37,240,000	*10-K: 7/31/98*
Less: 8% CV debt that was redeemed on 12/4/98	(5,000,000)	*10-Q: 1/31/99*
Book value of 8% CV debt as of 1/31/99	32,240,000	
Price of CHF8I06 as of 4/30/99	121 1/2	*Yahoo Finance*
Market value of 8% convertible debt due 2006	$ 39,171,600	
Total book value of debt	90,355,437	*10-Q: 1/31/99*
Less: Book value of convertible debt	(83,933,000)	
Book value of non-convertible debt	$ 6,422,437	
Diluted shares outstanding	21,181,000	*10-Q: 1/31/99*
Less: Basic shares outstanding	(10,521,000)	
Shares representing options or conversion of CV debt	10,660,000	
Less: Shares representing conversion of CV debt	(10,408,000)	*10-K: 7/31/98*
Increase in # shares by assuming options are exercised (treasury stock method)	252,000	
Price of CHF as of 4/30/99	9 7/16	*Yahoo Finance*
Value of options using treasury stock method [(1)]	$ 2,378,250	
ENTERPRISE VALUE	**$ 211,380,702**	

Notes:

(1) The treasury stock method understates the value of employee stock options because it assumes that the options must be immediately exercised. CHF, in its 7/31/98 10-K disclosed that there were 401,000 unexercised employee stock options at an average exercise price of $6.52. If CHF had also disclosed information on the term-to-maturity of the options, one could calculate a more accurate (and higher) value of the options using the Black-Scholes formula.

EV/Sales

- Calculate sales based on trailing four-quarter revenue
  - While EV/Sales on forward sales would be useful, it is difficult to get consensus sales estimates

- Useful when the company being analyzed is unprofitable and when:
  - Most companies in the industry are similarly unprofitable, or
  - Most companies in the industry are profitable and the company being analyzed is expected to become equally profitable

- Not useful for an unprofitable company that will forever languish behind its industry peers

Price/Book

- Calculation of Price/Book and Price/Tangible book

$$\text{Price / Book} = \text{Current stock price} \div \left(\text{Book value of common stockholders' equity} \div \text{\# of common shares outstanding at balance sheet date} \right)$$

$$\text{Price / Tangible book} = \text{Current stock price} \div \left(\left(\text{Book value of common stockholders' equity} - \text{Intangible assets} \right) \div \text{\# of common shares outstanding at balance sheet date} \right)$$

- Book value can be based on either the net worth or tangible net worth of the firm
  - Conceptually, tangible net worth is a better measure of book value since intangible assets are less likely to be convertible into cash
  - Tangible book value can give an approximate liquidation value of a company

- Significant evidence that low Price/Book stocks outperform the market.[19] Two main explanations offered are:
  - Low Price/Book companies have a low Price/Book ratio because they are riskier
    - There is a positive relationship between stock returns and risk
    - Therefore, it is natural that low Price/Book stocks outperform high Price/Book stocks[20]

  - Price/Book ratios (and implicitly stock returns) mean revert[21]
    - Investment returns mean revert because the dynamics of the marketplace always trend towards perfect competition
    - Competitive advantage of high Price/Book companies erodes
    - Poor stock performance of low Price/Book companies forces management to improve operating performance and, consequently, stock performance

[19] Many papers have been written about the Price/Book effect on stock returns including:
Rosenberg, Barr, Kenneth Reid and Ronald Lanstein. "Persuasive Evidence of Market Inefficiency," *Journal of Portfolio Management*, Vol. 11, No. 3, Spring 1985, pp. 9-17.
Keim, Donald B. "Stock market regularities: A synthesis of the evidence and explanations," in: E. Dimson (ed.) *Stock Market Anomalies*. Cambridge: Cambridge University Press, 1988, pp. 16-39.
Fama, Eugene F., and Kenneth R. French. "The Cross-Section of Expected Stock Returns," *Journal of Finance*, Vol. 47, No. 2, June 1992, pp. 427-465.

[20] Fama and French (1992) found that low Price/Book stocks outperformed on both an absolute and risk-adjusted basis. They measured risk using beta, which is not the appropriate measure of risk if you believe this first explanation for the Price/Book effect.

[21] A discussion of this phenomenon can be found in: Haugen, Robert A. *The New Finance: The Case Against Efficient Markets*. 2nd ed. Englewood Cliffs: Prentice Hall, 1999.

Price/Book (continued)

- Price/Book ratios, like P/Es, can be distorted by debt
  - High Price/Book stocks (Price/Book > 1) may appropriately reflect compensation to shareholders for financial risk caused by leverage
  - Very low Price/Book stocks (Price/Book < 1) may properly reflect magnification of negative returns caused by leverage
    - High Price/Book stocks are not necessarily overpriced
    - Low Price/Book stocks are not necessarily underpriced

Rules of Thumb: Leverage and Price/Book Ratios

If Price/Book > 1, then leverage overstated the Price/Book ratio
If Price/Book = 1, then leverage did not affect the Price/Book ratio
If Price/Book < 1, then leverage understated the Price/Book ratio

  - See the following page for an illustration of the distorting effect of leverage on Price/Book ratios

EV/Invested Capital

- EV/Invested capital ratio adjusts for the debt distortion of Price/Book ratio
  - Invested capital = (book value of debt + book value of preferred stock + book value of common stock)
  - Like Price/Book, EV/Invested capital can be calculated on a tangible book basis. Simply subtract intangible assets from invested capital

MVA/Capitalized EVA

- Calculation of MVA/Capitalized EVA[22,23]

Market Value Added = Enterprise value – Invested capital
Economic Value Added = (EBIT x (1-T)) – (k_{WACC} x Invested capital)
Capitalized EVA = EVA / k_{WACC}

Where: k_{WACC} = Weighted average cost of capital measured as a percentage
Capitalized EVA = (EVA of last four reported quarters) / k_{WACC}

- Conceptually, MVA = Capitalized EVA + PV of projected growth in EVA
- MVA/Capitalized EVA is an indicator of the growth in EVA that is incorporated into a company's stock price[24]
  - Ratio > 1 indicates that the market is projecting EVA to grow
  - Ratio = 1 indicates that the market is assuming no growth in EVA
  - Ratio < 1 and > 0 indicates that the market is projecting EVA to decline
  - Ratio < 0 indicates that the market projects future EVA to be negative
- Compare one's expectations of EVA growth to that incorporated in the stock price. If different, the stock may be mispriced

[22] MVA and EVA incorporate several accounting adjustments to Invested capital and tax-affected EBIT. We discuss these adjustments further in the EVA section of the report (pp. 27-29).
[23] See Appendix III for an excerpt from the Firearms Training Systems, Inc. (FATS) stock research report written by Kenneth Ruskin. In the report, Mr. Ruskin values FATS shares by measuring MVA relative to capitalized EVA.
[24] The interpretations given to the following MVA/Capitalized EVA ratios assume that Capitalized EVA is a positive number.

EFFECT OF CAPITAL STRUCTURE ON PRICE/BOOK RATIO

Price/Book Below 1

($000,000s)	Company A	B	C	D
Book value of debt	$ -	$ 15.0	$ 25.0	$ 35.0
Book value of equity	$ 50.0	$ 35.0	$ 25.0	$ 15.0
Invested capital	$ 50.0	$ 50.0	$ 50.0	$ 50.0
Enterprise value of firm	$ 45.0	$ 45.0	$ 45.0	$ 45.0
Market value of equity	$ 45.0	$ 30.0	$ 20.0	$ 10.0
EV/Invested capital	**0.90**	**0.90**	**0.90**	**0.90**
Price/Book	***0.90***	***0.86***	***0.80***	***0.67***

When Price/Book < 1, then leverage caused Price/Book ratio to be deflated.

Price/Book of 1

($000,000s)	Company A	B	C	D
Book value of debt	$ -	$ 10.0	$ 25.0	$ 35.0
Book value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
Invested capital	$ 50.0	$ 50.0	$ 50.0	$ 50.0
Enterprise value of firm	$ 50.0	$ 50.0	$ 50.0	$ 50.0
Market value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
EV/Invested capital	**1.00**	**1.00**	**1.00**	**1.00**
Price/Book	***1.00***	***1.00***	***1.00***	***1.00***

When Price/Book = 1, then leverage did not affect the Price/Book ratio.

Price/Book Above 1

($000,000s)	Company A	B	C	D
Book value of debt	$ -	$ 10.0	$ 25.0	$ 35.0
Book value of equity	$ 50.0	$ 40.0	$ 25.0	$ 15.0
Invested capital	$ 50.0	$ 50.0	$ 50.0	$ 50.0
Enterprise value of firm	$ 70.0	$ 70.0	$ 70.0	$ 70.0
Market value of equity	$ 70.0	$ 60.0	$ 45.0	$ 35.0
EV/Invested capital	**1.40**	**1.40**	**1.40**	**1.40**
Price/Book	***1.40***	***1.50***	***1.80***	***2.33***

When Price Book > 1, then leverage caused Price/Book ratio to be inflated.

Notes:

- Assumption is that all changes in the market value of the firm accrue to equityholders.
- Reality is that part of the changes in market value accrue to the bondholders.
- The amount that accrues to bondholders is not material for these calculations.
- The amount would be material if the firm were perceived to be financially distressed.

Discounted Cash Flow (DCF) Introduction

- The value of a firm is its discounted future free cash flows
- Therefore, two items are needed to do a DCF:
  - A discount rate (the cost of capital)
  - Free cash flow projections
- The following is a summary of the three types of DCF analysis and the appropriate discount rate and FCF to be used in each case

THE THREE TYPES OF DISCOUNTED CASH FLOW ANALYSIS

Type of DCF Analysis	*Discount Rate for FCFs*	*Discount Rate for Interest Tax Shields*	*Free Cash Flow Measure to Use*	*Comments*
Weighted Average Cost of Capital (WACC)	k_{WACC}	Does not apply	FCF_u	Best for companies with a constant debt-to-value ratio
Adjusted Present Value (APV)	k_u	Usually both k_d and k_u	FCF_u	Best for companies that do not have a constant debt-to-value ratio
Flow to Equity	k_e	Does not apply	FCF_{lev}	Best when analyzing financial service companies where it is difficult to distinguish between operating interest expense and financial interest expense

Definitions:

k_e	Cost of equity
k_u	Cost of unlevered equity (Cost of unlevered capital)
k_d	Cost of debt
k_{WACC}	Weighted average cost of capital
FCF_u	Free cash flows of the unlevered firm
FCF_{lev}	Free cash flows of the levered firm

Cost of Capital

- The discount rate used in a DCF is the firm's cost of capital
  - Problem is that there are several costs of capital
  - Cost of capital choice depends on which of the three DCF methods is used
  - In this report, we will discuss only the WACC method
  - WACC incorporates both the cost of debt and the cost of equity

Cost of Debt (k_d)

- The cost of debt is the average yield on the company's debt
  - Conceptually correct method
    - Calculate the yield-to-maturity of the company's publicly-traded bonds based on current prices
    - Use the debt footnote in 10-K to calculate the interest rate on all other debt
    - Calculate the weighted average cost of debt
  - Shortcut used by practitioners
    - Use the debt footnote of the 10-K to calculate the interest rate for all debt
    - Calculate the weighted average cost of debt

Cost of Equity (k_e)

- The cost of equity is an investor's required rate of return for holding equity in a firm
- Unlike the cost of debt which is directly observable, the cost of equity is unobservable
- Several methods exist to calculate the cost of equity, with the Capital Asset Pricing Model (CAPM) the most popular

Capital Asset Pricing Model (CAPM)

- CAPM states that investors face two types of risks:
  - Systematic risk
  - Unsystematic risk
- Systematic risk
  - Systematic risk consists of macroeconomic variables such as commodity price and industrial production levels that affect all firms (though in varying degrees)
  - Systematic risk is unavoidable and affects all (risky) assets
  - Systematic risk cannot be diversified away, and therefore:
    - Investors are rewarded for assuming systematic risk
- Unsystematic risk
  - Unsystematic risk is firm-specific or specific to a small group of companies
  - Examples include the risk of a labor strike, the risk of market share loss, or the risk of an inept company management
  - Unsystematic risk can be diversified away, and therefore:
    - Investors are not rewarded for assuming unsystematic risk
- Because there is only one risk for which investors are rewarded (systematic risk), the CAPM is a one-factor model
  - The one factor is the return on the market portfolio
  - Beta (β) measures the responsiveness of a stock's return to the return on the market portfolio
  - The relationship between beta and expected return on equity can be expressed mathematically:

CAPM: $k_e = r_f + (\beta \times ERP)$

where:
- k_e = the cost of equity
- r_f = the expected return on the riskless asset, or risk-free rate
- β = the beta of the stock
- ERP = the expected equity risk premium, or the amount by which investors expect the future return on equities to exceed that on the riskless asset

Calculating Cost of Equity using CAPM

- Several methods are used to calculate k_e using CAPM. The variation in approaches is due to different:
  - Definitions of the risk-free rate
  - Estimates of the equity risk premium
- We believe that the method advocated by Robert Holthausen[25] is the conceptually correct approach for calculating k_e, and we present his method on the following three pages

Risk-Free Rate (r_f)

- r_f = (long-term T-bond yield) – (maturity premium of 1.38%)
  - We recommend using the 20-year T-bond yield as the long-term yield
  - Conceptually, the duration of the risk-free asset should equal the duration of the cash flows being discounted. Because companies are long-lived assets, 30-year T-bond yields would be the conceptually correct yield
  - Nevertheless, we recommend using 20-year bond yields because we have a much longer history, and presumably more accurate estimate, of the 20-year maturity premium than we do the 30-year maturity premium[26]
  - 20-year bonds are essentially as effective as 30-year bonds in capturing the long-term expectation of inflation. The difference in yields between the two bonds is primarily due to non-inflation related factors[27]
  - 20-year T-bond yields can be found in the middle of the *C* section of the *WSJ*
  - We define maturity premium in the figure below

THE RISK-FREE RATE (r_f)

30-Day T-bill yield	=	Short-term expectation of inflation	+	Expected real rate of return		
20-Year T-bond yield	=	Long-term expectation of inflation	+	Expected real rate of return	+	Maturity premium
Appropriate r_f	=	20-Year T-bond yield	-	Maturity premium		

- The T-bill yield would not be an appropriate choice for r_f.
  -- It incorporates only the short-term expectation of inflation
- The T-bond yield would not be an appropriate choice for r_f.
  -- It incorporates a maturity premium that rewards bondholders for a risk not faced by equity holders.
  -- The risk that bondholders face is of an unexpected rise in inflation that will reduce their real rates of return.
  -- Equity holders do not face this same risk because their nominal returns are not fixed. Companies have the ability to raise prices in response to unexpected rises in inflation.
- The maturity premium is measured as the historical difference between income returns on 20-year Treasury bonds and total returns on 30-day T-bills. (Income returns and total returns are equivalent for T-bills.)
- Over 73 years (January 1926 - December 1998), the average maturity premium has been ***1.38%***.

[25] Robert Holthausen, Nomura Securities Co. Professor of Accounting and Finance, teaches Security Analysis at the Wharton School. Professor Holthausen's course, as well as his work-in-progress textbook, *Security Analysis: How to Analyze Accounting and Market Data to Value Securities* (written with Mark Zmijewski), are very useful resources for understanding DCF valuation techniques.

[26] We have a 73-year history of 20-year bond yields versus a 22-year history of 30-year bond yields. 30-year Treasury bonds were only issued beginning in February 1977.

[27] The primary factor is the different maturity premia between the two securities. Other factors include the coupon rates of the two bonds and the higher liquidity of 30-year T-bonds.

Beta (β)

- Beta measures the responsiveness of a stock's return to that of the market
  - $\beta > 1$ implies that a stock's price movements are usually in the same direction as those of the market, but of a greater magnitude
  - $\beta > 0$ and < 1 implies that a stock's price movements are usually in the same direction as those of the market, but of a lesser magnitude
  - $\beta < 0$ implies that a stock's returns are negatively correlated with returns of the market
    - Stock betas < 0 are very unusual. Gold stocks are a rare example

- Calculation of beta
  - Beta can be calculated two ways, which generate equivalent values
    - Ordinary least squared (OLS) regression
    - Using the equation below

$$\beta = \frac{\text{Cov}(r_s, r_m)}{\sigma(r_m)}$$

r_s = historical returns of a stock
r_m = historical returns of the market
$\sigma(r_m)$ = variance of the historical market returns

  - When calculating beta, use total returns (with dividends) rather than price returns
  - Bloomberg calculates beta using price returns
  - Datastream allows one to calculate beta using total returns[28]
  - Conceptually, the returns being measured should be returns *in excess* of the risk-free rate (30-day T-bills) during the period, rather than absolute returns
    - This adjustment rarely results in a material difference

- Time period and frequency of returns when calculating beta
  - Generally, the longer the history of returns the better, <u>but</u>
  - Avoid using returns over time periods when a company's operations or capital structure were significantly different than they are now
  - Generally, little accuracy is gained by having more than five years of monthly data or two years of weekly data
  - Use weekly or monthly returns, rather than daily returns
    - Daily returns show evidence of statistical noise and autocorrelation

- Adjusted betas
  - Stock beta estimates are riddled with imprecision
  - High standard error on most individual company betas
  - Using industry betas removes much of the standard error problem[29]
  - Mean reversion of betas[30]
    - Evidence that betas revert to a mean value of one
    - We recommend using the Bloomberg adjustment of: $\beta_{adj} = 0.33 + 0.67 \times \beta_{hist}$

[28] Datastream is located in Lippincott Library. In Appendix II, we provide an example of calculating betas using Datastream.
[29] In order to calculate an industry beta, one must calculate the historical beta for each industry participant and unlever each beta to get an industry unlevered beta. The industry unlevered beta can then be levered to reflect the financial risk of the firm being analyzed. The correct techniques to unlever beta are quite complicated, and we recommend Wharton's Security Analysis course and R. Holthausen's textbook to learn these techniques.
[30] Marshall Blume, Howard Butcher III Professor of Financial Management at the Wharton School, was one the first academics to study this phenomenon. *See:* Blume, Marshall E. "On the Assessment of Risk," *Journal of Finance*, Vol. 26, No. 2, March 1971, pp. 1-10, and "Betas and their Regression Tendencies," *Journal of Finance*, Vol. 30, No. 3, June 1973, pp. 785-795.

Equity Risk Premium

- The equity risk premium measures the additional return investors require to compensate themselves for the risk of investing in equities rather than the risk-free asset

- Calculation of the ERP
  - Use the historical arithmetic mean difference between total returns on the S&P 500 and total returns on 30-day T-bills[31]
  - Over 73 years (January 1926 – December 1998), the arithmetic mean difference has been ***9.35%***

- Some argue that the prolonged bull market of the 1990s is evidence that the expected ERP has declined to a range of 5-7% (3-5% measured against long-term T-bonds)
  - We believe that there is inadequate evidence of a decline in the ERP
  - Over the past 73 years, there has been no meaningful correlation between the P/E of the market and the subsequent year's realized equity risk premium[32]
  - We recommend using the historical arithmetic mean ERP of ***9.35%***

Example of Calculating k_e

Example: **Calculation of k_e for Thorley, Inc.**

20-year Treasury bond yield is currently 5.93%.
Thorley's historical beta (based on two years of weekly returns) is 1.43.

$\beta_{hist} = 1.43$	$k_e = (r_{20yr} - MP) + (\beta_{adj} \times ERP)$
$\beta_{adj} = 0.33 + (0.67 \times 1.43)$	$k_e = (5.93\% - 1.38\%) + (1.288 \times 9.35\%)$
$\beta_{adj} = 1.288$	$k_e =$ ***16.6%***

Steps in Performing a DCF Valuation

- Below we outline a five-step procedure to value a firm using a discounted cash flow model (WACC method)

Step 1: Calculate WACC

- WACC is the average cost of capital for a firm weighted by the amount of debt and equity in the firm's capital structure

$$WACC = [k_e \times E/V] + [k_d \times (1-T) \times D/V]$$

where: D = Market value of debt
E = Market value of equity
V = Market value of firm
T = Marginal tax rate

- The market value of debt typically approximates its book value and therefore it is acceptable to use the book value of debt as D

[31] Conceptually, income returns on T-bills should be used. Total returns and income returns are the same for 30-day T-bills.
[32] Ibbotson Associates. *Stocks, Bonds, Bills and Inflation: Valuation Edition, 1999 Yearbook.* Chicago: Ibbotson Associates, 1999.

Step 2: Determine the Number of Years to Project

- Generally, project yearly free cash flows until the second derivative of FCF growth is zero (i.e., until free cash flow growth is zero or constant)
  - Ideally, project free cash flows for enough years so that the value of the firm is not overly dependent on the terminal value calculation
  - If the company being analyzed is in a cyclical industry, capture at least two full economic cycles in the model
  - While 10- and 15-year DCFs are common, models need not be done in multiples of five. A 6-year, 11-year, or 23-year model may be more appropriate for a firm

Step 3: Calculate the FCFs

- Calculate the unlevered free cash flows (FCF_u)
  - It is necessary to have income statements for all of the years projected
  - It is ideal to have balance sheets and cash flow statements for all of the years projected
  - The balance sheet and cash flow statement allow one to explicitly capture capital expenditures and changes in working capital

FCF_u
=
EBIT
-
Unlevered cash taxes
+
Depreciation and amortization
-
Δ in net working capital
-
Capital expenditures

Notes:

- EBIT = Earnings before interest expense and income taxes (but after interest income)
- Unlevered cash taxes
  - = income tax expense
  - + interest expense x marginal tax rate
  - + Δ in deferred tax asset
  - - Δ in deferred tax liability
  - + Δ in income taxes receivable
  - - Δ in income taxes payable

- Practitioners often approximate unlevered cash taxes by simply using EBIT x T. This may be materially incorrect if the company has significant deferred tax assets or deferred tax liabilities. Net operating losses are the most common example of a deferred tax asset. Deferred tax liabilities commonly arise from the different depreciation schedules for tax reporting and GAAP purposes.
- Net working capital should exclude all interest-bearing liabilities.
- Cash and interest income: At the valuation date, "excess" cash on the balance sheet should be subtracted from debt. The remaining "required" cash is part of the company's working capital and Δ in required cash should be included in Δ in working capital. Similarly, interest income on required cash should be included in FCF_u. "Required" cash is the cash that is necessary to keep on hand for general corporate purposes.

Step 4: Calculate a Terminal Value

- The terminal value represents the value of the firm at the end of the last period of the model
- The terminal value can be based on one of the following:
  - Free cash flow perpetuity
  - Price multiple

Step 4: Terminal Value (continued)

- Free cash flow perpetuity
  - Growing perpetuity: $(FCF_T \times (1+g)) / (k_{WACC} - g)$, where g = growth rate
  - No-growth perpetuity: FCF_T / k_{WACC}
    - No-growth perpetuities are usually inappropriate. The discount rate is a nominal rate that incorporates expected inflation. A no-growth perpetuity therefore assumes a perpetual deterioration in real FCF [33]

Calculation of terminal value using perpetuity formulas
13-year DCF model

FCF perpetuity (no-growth)	Terminal value at end of year 13	=	FCF at year 13 ÷ k_{WACC}
FCF perpetuity (5% growth)	Terminal value at end of year 13	=	(FCF at year 13 x 1.05) ÷ (k_{WACC} - 0.05)

- Price multiple
  - The most appropriate multiple is either EV/EBIT or EV/EBITDA
  - Avoid using P/Es. P/Es value only the equity portion of a firm [34]
  - A company's current price multiple is not necessarily a good proxy for its price multiple in future years
    - As earnings/cash flow growth slows or accelerates over time, price multiples may contract or expand

- The final year of FCF projections may be highly sensitive to points in a business cycle. If business cycles are incorporated into FCF projections:
  - Price multiples: Adjust multiple upward if at the cyclical bottom, and vice versa
  - Perpetuities: Normalize the FCF to a mid-cycle level when calculating the terminal value. A better solution may be to project FCFs until a mid-cycle year

Step 5: Discount the FCFs and Terminal Value at k_{WACC}

- Discounting formula:

$$\text{PV of } FCF_u \text{ at year } t = FCF_{u,t} / (1+k_{WACC})^t$$

  - V_{firm} = (PV of future FCFs) + (PV of terminal value)
  - $V_{equity} = V_{firm} - V_{debt}$
  - Assumes: *1*) FCFs occur at the end of year, and *2*) valuation date is at beginning of year 1
    - If assumption is that FCFs occur mid-year, simply take V_{firm} calculated using end-of-year discounting and multiply it by $(1+k_{WACC})^{½}$
    - If the valuation date is not exactly at the beginning of year 1, simply multiply V_{firm} by $(1+k_{WACC})^{t/365}$, where t = # of days after the beginning of year 1 (e.g., if valuation date is February 4, then t = 35)
    - Both adjustments can be made together

[33] This is not to say that all companies must have FCFs that grow into perpetuity. A no-growth, or even declining, perpetuity is appropriate when a company is expected to see deteriorating fundamentals.
[34] A P/E is the appropriate multiple for a terminal value when using the uncommon Flow to Equity DCF method.

CONTRACT MANUFACTURING COMPANY - DCF ANALYSIS

Notes: Fiscal Year: December ($000,000s)	1998A	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E	2007E	2008E	2009E
Total revenues	743	1,048	1,414	1,909	2,539	3,301	4,226	5,324	6,549	7,924	9,429	11,127
Cost of sales	(581)	(826)	(1,124)	(1,489)	(2,037)	(2,654)	(3,406)	(4,302)	(5,304)	(6,450)	(7,694)	(9,079)
Gross profit	162	222	290	420	503	647	820	1,022	1,244	1,474	1,735	2,047
Gross margin	21.8%	21.2%	20.5%	22.0%	19.8%	19.6%	19.4%	19.2%	19.0%	18.6%	18.4%	18.4%
SG&A	(45)	(63)	(85)	(113)	(147)	(188)	(241)	(303)	(367)	(444)	(519)	(611)
EBIT	117	159	205	307	356	459	579	719	878	1,030	1,216	1,436
EBIT %	15.7%	15.2%	14.5%	16.1%	14.0%	13.9%	13.7%	13.5%	13.4%	13.0%	12.9%	12.9%
Taxes	(42)	(58)	(75)	(112)	(130)	(167)	(211)	(262)	(320)	(376)	(444)	(524)
Tax rate	35.9%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%	36.5%
Tax-affected EBIT	***75***	***101***	***130***	***195***	***226***	***291***	***368***	***456***	***557***	***654***	***772***	***912***
+ Depreciation	118	131	149	174	195	213	241	266	312	377	449	506
- Δ in net working assets	(38)	(30)	(40)	(123)	(89)	(182)	(123)	(229)	(182)	(350)	(443)	(301)
- Δ in maintenance PP&E	(118)	(131)	(149)	(174)	(195)	(213)	(241)	(266)	(312)	(377)	(449)	(506)
- Δ in growth PP&E	(34)	(88)	(92)	(155)	(62)	(114)	(171)	(77)	(380)	(275)	(442)	(126)
Free cash flows (unlevered)	**3**	**(17)**	**(1)**	**(83)**	**75**	**(5)**	**74**	**151**	**(5)**	**29**	**(112)**	**486**
Revenue growth rate	30%	41%	35%	35%	33%	30%	28%	26%	23%	21%	19%	18%
SG&A as a % of revenue	6.1%	6.0%	6.0%	5.9%	5.8%	5.7%	5.7%	5.7%	5.6%	5.6%	5.5%	5.5%
(1) Net working assets	912	942	982	1,105	1,193	1,376	1,499	1,728	1,910	2,260	2,703	3,003
Change in NWA	38	30	40	123	89	182	123	229	182	350	443	301
Average annualized NWA turnover	1.0	1.1	1.5	1.8	2.2	2.6	2.9	3.3	3.6	3.8	3.8	3.9
Gross PP&E	728	946	1,187	1,516	1,774	2,101	2,513	2,856	3,547	4,200	5,090	5,722
Accumulated depreciation	(117)	(248)	(397)	(570)	(766)	(979)	(1,220)	(1,486)	(1,798)	(2,176)	(2,625)	(3,130)
Net PP&E	611	699	790	946	1,008	1,122	1,293	1,369	1,749	2,024	2,466	2,592
Average annualized net PP&E turnover	1.3	1.6	1.9	2.2	2.6	3.1	3.5	4.0	4.2	4.2	4.2	4.4
Period	-	1	2	3	4	5	6	7	8	9	10	11
Discounted free cash flows		(15)	(1)	(60)	49	(3)	39	71	(2)	11	(38)	150

SHARE PRICE CALCULATION

WACC	11.3%
Sum of discounted FCFs	200
Terminal value (assuming 6% FCF growth)	9,713
PV of terminal value	2,991
Enterprise value as of 1/1/99	3,191
Adjustment to bring value as of 5/1/99	116
Enterprise value	3,307
(5) - Debt	(513)
= Equity value	2,678
Number of shares	61.7
Stock value	**$ 43**

WACC CALCULATION

D/V on 12/31/95 (2)	6.3%
D/V on 12/31/96	17.9%
D/V on 12/31/97	21.4%
D/V on 12/31/98 (4)	17.9%
Assumed D/V for life of firm	20.0%
20-year T-bond yield as of 4/30/1999	5.93%
Less: Historical maturity premium	(1.38%)
Risk-free rate (r_f)	4.55%

(3) Historical beta	0.83
Adjusted beta ($0.33 + 0.67 \times \beta_h$)	0.89
Historical equity risk premium (ERP)	9.35%
$K_e = r_f + \beta_{adj} \times ERP$	
Cost of equity (K_e)	12.9%
Weighted average yield of debt (K_d) (using debt footnote of 12/31/98 10-K)	7.9%
Assumed marginal tax rate	36.5%
WACC $[E/V \times K_e] + [D/V \times K_d \times (1-T)]$	***11.3%***

Notes:

(1) Net working assets (NWA) = Current assets plus non-current assets (except for PP&E) minus non-interest bearing liabilities. Net deferred tax liability is included in NWA.

(2) Value (V) is the market value (rather than book value) of the firm.

(3) Historical beta is measured by regressing the weekly total returns of CMC in excess of T-bill returns against the weekly total returns of the S&P 500 in excess of T-bill returns. Weekly returns are measured for the period October 1996 through April 1999. CMC's capital structure was significantly different prior to October 1996.

(4) D/V ratio at 12/31/98 is based on a closing stock price of 38 1/8.

(5) Debt is not net of cash because we assume that the cash on the balance sheet is necessary to generate future free cash flows. The interest income from cash is included in revenues.

Nincic, David. *Fundamental Equity Analysis: A Primer*. Advanced Study Project in Finance (FNCE 890). The Wharton School. Spring 1999.

Economic Value Added (EVA)[35]

- EVA is a DCF-based performance measurement and valuation tool

- EVA = Return on capital – Cost of capital
  - Return on capital is defined as: Net operating profits after taxes (NOPAT)
  - Cost of capital is defined as: (k_{WACC} x Invested $capital_{adj}$)
  - k_{WACC} is weighted using market values of debt and equity even though it is being multiplied by invested capital, which is based on book values of debt and equity

- EVA can be approximated as (EBIT – unlevered cash taxes) – (k_{WACC} x Invested capital)

- The premise behind EVA is that for a company to create shareholder value, it must generate positive EVA
  - A company can have positive net income but negative EVA. This occurs when a company's NOPAT is not large enough to cover the company's cost of capital

- EVA and DCF valuation models are mathematically equivalent
  - EVA and DCF models generate the same value of the firm
  - EVA models discount future EVA. DCF models discount future free cash flow
  - Both models require free cash flow projections and a cost of capital estimate
  - Free cash flow projections can be converted into EVA projections fairly easily
  - Compare the EVA model on page 29 with the DCF model on page 26. Note that the DCF model's free cash flow projections and WACC calculation are also used in the EVA model

- EVA tends to provide a more useful measure of a company's performance in a particular period than does free cash flow
  - EVA tends to be more interpretable, meaningful and stable than FCF
  - High capital expenditures can cause FCF to be negative while EVA is positive. Because EVA does not immediately penalize companies for large capital expenditures, EVA may be a better indicator of a firm's economic performance in a particular period

- Several accounting adjustments are needed to arrive at NOPAT and invested $capital_{adj}$. For every NOPAT adjustment, there is a corresponding and required invested capital adjustment
  - These adjustments are unnecessary when using EVA as a valuation tool. The net present value of making a NOPAT and related invested capital adjustment is always zero
  - These adjustments may be useful when using EVA as a performance measurement tool. They may cause the calculated EVA to be a more accurate reflection of economic performance in a particular period

[35] Two good resources on EVA are:
Jackson, Al, Michael J. Mauboussin and Charles R. Wolf. *EVA Primer*. New York: CS First Boston, February 20, 1996. This report is available in the Fellows Fund office. Students may photocopy the report.
Stewart, G. Bennett. *The Quest for Value: the EVA Management Guide*. New York: HarperCollins, 1991.

Definition of NOPAT and Invested Capital$_{adj}$

EVA: DEFINITION OF NOPAT AND INVESTED CAPITAL$_{adj}$

NOPAT		Invested Capital$_{adj}$
= EBIT - Unlevered cash taxes		= Invested capital + Net deferred tax liability
+ Amortization of goodwill	→	+ Cumulative goodwill amortization
+ R&D expense (net of amortization of capitalized R&D)	→	+ Capitalized R&D (net of cumulative amortization)
+ Δ in LIFO reserve	→	+ LIFO reserve
+ Δ in bad debt reserve	→	+ Bad debt reserve
+ Unusual/nonrecurring loss (NT)	→	+ Cumulative unusual/nonrecurring losses (NT)
		+ Unrecorded goodwill
Capitalized operating lease adjustments (if material)		
+ Rent expense		+ Capitalized operating lease (COL) liability
- Amortization of capitalized operating lease asset		+ Accumulated difference in NOPAT between capitalization and expensing method for operating leases, i.e., (rent) - (amortization of COL asset) - (implied interest x T)
- Implied interest expense in rent x T		

Notes:

- NT = Net of taxes, multiply by 1 - T (assume the marginal tax rate for T)
- EBIT = Earnings before interest expense and income taxes
- Invested capital = book value of debt + book value of preferred stock + book value of common stock
- Unlevered cash taxes = income tax expense + (interest expense x marginal tax rate) + Δ in deferred tax assets - Δ in deferred tax liabilities + Δ in income taxes receivable - Δ in income taxes payable
- Net deferred tax liability = Deferred tax liability - deferred tax asset + income taxes payable - income taxes receivable
- Under U.S. GAAP, R&D is expensed as incurred. Under the EVA framework, R&D is capitalized and amortized over the anticipated payoff period for the successful projects. This adjustment decreases rates of return on capital.
- Only add back the Unusual/nonrecurring loss to EBIT if the calculated EBIT already includes the loss. Companies often have inflated returns on capital because they lowered their capital (stockholders' equity) by taking large one-time charges in the past. Adding back these one-time charges often gives a more accurate reflection of rates of return on capital.
- Unrecorded goodwill refers to the goodwill that would have been recorded if prior mergers and acquisitions that were accounted for under the pooling-of-interests method were instead accounted for under the purchase method. By adding unrecorded goodwill to capital, a more accurate (and lower) rate of return on capital is calculated.
- Rent expense incorporates an implied interest expense and an implied repayment of debt.
- One does not need to make every adjustment presented. Adjust EBIT and invested capital only when the adjustment is material.

DuPont Model

- The growing popularity of EVA and other similar new measures has caused companies and investors to increasingly focus on rates of return on capital
- The DuPont Model is a useful method of separating the return on capital into its component parts. We outline the DuPont Model below

DuPont Model

$$\text{Return on Invested Capital (\%)} = \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Invested Capital}} \times \frac{\text{Net Income}}{\text{Pretax Income}}$$

- The model demonstrates that a low margin (EBIT/Sales) company can still generate strong returns on capital if it has high asset turns (Sales/Assets) and/or is able to finance a large portion of its assets with non-interest bearing current liabilities (indicated by a high Assets/Invested capital ratio)

CONTRACT MANUFACTURING COMPANY - EVA ANALYSIS [1]

Notes:	Fiscal Year: December ($000,000s)	1999E	2000E	2001E	2002E	2003E	2004E	2005E	2006E	2007E	2008E	2009E	2010E
	NOPAT (Tax-affected EBIT)	101	130	195	226	291	368	456	557	654	772	912	
(2)	Invested Capital at BOP	1,523	1,641	1,772	2,050	2,201	2,498	2,792	3,097	3,659	4,285	5,169	5,595
(3)	Capital charge (Invested Capital x WACC)	172	185	200	232	249	282	315	350	414	484	584	
	EVA (NOPAT - capital charge)	***(71)***	***(55)***	***(5)***	***(6)***	***43***	***85***	***141***	***207***	***241***	***288***	***328***	
	Return on Beginning Invested Capital (ROBIC)	6.6%	7.9%	11.0%	11.0%	13.2%	14.7%	16.4%	18.0%	17.9%	18.0%	17.6%	
(4)	Weighted Average Cost of Capital (WACC)	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%	
	Spread (ROBIC - WACC)	(4.7%)	(3.4%)	(0.3%)	(0.3%)	1.9%	3.4%	5.0%	6.7%	6.6%	6.7%	6.3%	

(5)	Projected growth rate of EVA after 2009 (g)	3.1%
	EVA terminal value [EVA_{2009} x (1+g)]/(WACC - g)	4,118
	PV of EVA terminal value	1,268
	Cumulative PV of EVA Stream @ WACC	400
	Total PV of EVA	1,668
	+ Beginning capital	1,523
	= Corporate value as of 1/1/99	3,191
	+ Adjustment to bring value as of 5/1/99	116
	Corporate value	3,307
	- Debt	(513)
	= Equity value	2,678
	Number of shares	61.7
	Stock value	**$ 43**

Note that the EVA-derived firm value is exactly the same as the DCF-derived firm value. (3,307 = 3,307) See page 26

Also note that:
Invested capital at 1/1/10
+ EVA terminal value
= DCF terminal value
(5,595 + 4,118 = 9,713)

Notes:

(1) DCF and EVA valuation models are mathematically equivalent. Since free cash flows must be projected for both methods (FCFs reduce invested capital in an EVA model), it may seem simpler to use the DCF method. With a DCF model, one simply discounts the free cash flows to determine the value of the firm. An EVA model requires several more steps after projecting free cash flows to determine the value of the firm, which value will be the same as that given by the DCF model.

So why would anyone bother doing an EVA analysis?! Typically, it is because EVAs are a better indicator of value creation than are FCFs. For instance, CMC has volatile free cash flows (see p. 26), but with consistent and stable EVA growth. In this case, EVA is probably better than FCF in measuring value creation each year. In addition, an EVA model can serve as a useful crosscheck to the assumptions made in the DCF model. For instance, if the spread between ROBIC and WACC seems implausible as projected in the EVA model, then it would make sense to revise the DCF model.

(2) Invested capital at BOP 1999 = book value of equity + book value of debt (from CMC's 12/31/98 10-K). Invested capital in each subsequent year = Invested capital in prior year + NOPAT - unlevered free cash flow. Unlevered free cash flows are derived in the DCF model.

(3) Though invested capital is (essentially) the book value of debt and equity, we still calculate the capital charge by multiplying invested capital by WACC (which is weighted based on market values).

(4) We show how we calculated WACC of 11.3% in our DCF model.

(5) While DCF and EVA are mathematically equivalent, one often sees the same analyst derive a different value for a stock when the analyst uses a DCF approach versus an EVA approach. The primary reason for the difference is the methodology used for calculating the terminal value under each approach. For CMC, 6% perpetual FCF growth is equivalent to 3.1% perpetual EVA growth.

APPENDIX I

CHECKLIST OF DATA REQUIRED FOR A RESEARCH REPORT PRESENTED TO THE WHARTON FELLOWS FUND

- A research report presented to the Wharton Fellows Fund should contain the information below
- The checklist is simply the minimum required information for a stock research report. It is highly likely that the analyst will want to present additional information and analyses

√	**CHECKLIST**		
☐	Current price of stock	☐	Trailing P/E
☐	52-week range	☐	Forward P/E
☐	# of shares outstanding	☐	Trailing EV/EBIT(DA)
☐	Equity market capitalization	☐	Forward EV/EBITA(DA)
☐	Average daily trading volume	☐	(Tangible) Book value per share
☐	Price target (for stock)	☐	Price/(Tangible)Book
☐	Enterprise Value	☐	EV/Invested capital
☐	Debt/EV ratio	☐	LTM Return on invested capital (%)

☐ Stock price performance graph going back at least one year

☐ Qualitative discussion of the recommended stock (brevity is prized)

☐ Income statement model projecting earnings for the next two fiscal years (at least)

☐ Calculation of DSOs and days inventory held for the four most recent quarters

☐ Quarterly income statements for the current fiscal year, and last two annual income statements

☐ Quarterly balance sheets for the current fiscal year, and last two fiscal year-end balance sheets

☐ Quarterly cash flow statements for the current fiscal year, and last two annual cash flow statements

☐ Comparable company analysis comparing trailing and forward P/Es and trailing EV/EBIT(DA) multiples

APPENDIX II — ***CALCULATING BETAS USING DATASTREAM***

Example: Calculate IBM's beta using 3 years of historical monthly returns. "Returns" are <u>total</u> returns in excess of the risk-free rate.[36]

- Ask the librarian at Lippincott to log you on to one of the two Datastream terminals
- At the opening screen you will see:

PROGRAM NUMBER: 401S ← Type *401S <enter>*

- This will bring you to Datastream's simple regression graphics program (401S)
- You will now need to find the **Mnemonic** symbol for your stock
- Click on the **Code** button on the toolbar. This opens the Datastream Codes window
- Go to the drop-down list box and select **Equities**
- Within **Equities**, find your stock's **Mnemonic** symbol and write it down
- Close the Datastream Codes window to return to the 401S program
- You will now see:

We explain SERIES 1 and SERIES 2 on the following page.

CODE OR EXPRESSION

SERIES 1 PCH#(U:IBM(RI),1M) – LAG#(USTBL3M,1M)/12

SERIES 2 PCH#(S&PCOMP(RI),1M) – LAG#(USTBL3M,1M)/12

This is the historical period for which you want to measure returns. As an example, enter *–3Y*, *–3M*, or *–3D*, for 3 years prior, 3 months prior, and 3 days prior, respectively. The most current date available is *–1D*. You can also enter specific dates in *MM-DD-YY* notation.

START DATE : _ -3Y_
END DATE: _-1D_

Select *M* for monthly returns and *W* for weekly returns. We recommend not using daily (*D*) returns because of possible noise and autocorrelation in the returns.

CORRELATION FREQUENCY : __M__

LIN/LOG REGRESSION: __LIN__

Everything must be typed in upper-case letters.

Select *LIN*

VALUES MAY BE PLOTTED

1 AS ACTUAL VALUES
2 ALL VALUES IN INDEX SHOWN IN INDEX FORM STARTING AT 100
OR 3 SECOND SERIES REBASED TO THE STARTING VALUE OF THE FIRST SERIES

Select *1* → ENTER 1, 2, OR 3 __1___

- Press <enter> to get results of simple regression

[36] The risk-free rate is 3-month T-bills. Conceptually, we would prefer to use 1-month T-bills but historical 1-month T-bill rates are not available on Datastream. The difference this makes in the calculation of beta is immaterial.

APPENDIX II (continued)

- The results given to you will be:
  - REGRESSION COEFFICIENT: This is beta
  - CORRELATION COEFFICIENT: This is R (not R^2)
  - STANDARD ERROR: This is the standard error of beta
  - T-STATISTIC: This measures whether beta is statistically different than zero

- Do not be concerned if the graph title reads "Daily" when calculating beta using weekly or monthly returns
  - This simply means that the graph is plotting weekly or monthly returns on a rolling daily basis
  - The actual beta calculation, however, is not being performed on a rolling daily basis. Rather, returns are being calculated on a rolling basis based on your selection (M, W or D) in the CORRELATION FREQUENCY prompt
  - Similarly, do not be concerned if the graph title reads "Weekly" when you are calculating monthly returns

- At the graph screen, press the **Enter** button on the toolbar to return to the 401S CODE OR EXPRESSION screen

Explanation of Inputs in SERIES 1 and SERIES 2

SERIES 1 PCH#(U:IBM(RI),1M) – LAG#(USTBL3M,1M)/12

SERIES 2 PCH#(S&PCOMP(RI),1M) – LAG#(USTBL3M,1M)/12

- SERIES 1 refers to the dependent (Y) variable in the regression. The Y variable is the return on IBM

- SERIES 2 refers to the independent (X) variable in the regression. The X variable is the return on the S&P500

- PCH# = percentage change

- U:IBM = Mnemonic symbol for IBM

- RI = Total return indexed price

- 1M (after RI) = Monthly returns. Change to 1W for weekly returns

- LAG#(USTBL3M,1M)/12 = The interest rate on 3-month T-bills at the beginning of the month divided by 12
  - This represents the return investors would have received for the month had they invested in T-bills
  - If you are measuring weekly returns then 1M changes to 1W and 12 changes to 52

- S&PCOMP = Mnemonic symbol for S&P500

APPENDIX III

The following is an extract (pages 1 and 10) from a research report written by Kenneth J. Ruskin, an MBA student at the Wharton School, Class of 1999. The report, dated December 4, 1997, is on Firearms Training Systems, Inc. (Nasdaq: FATS)

Mr. Ruskin determined that the current stock price of FATS implied a 10-year EVA growth rate of 6.5%. He felt that the true future EVA growth rate was closer to 15% and recommended that the Fellows Fund purchase the stock.

FATS Research Report (page 1)

Date: December 4, 1997

Analyst: Ken Ruskin
Phone: (215) 587-7116

FIREARMS TRAINING SYSTEMS, INC. (FATS)

FATS is the undisputed worldwide leader in firearm simulation systems. The shares are significantly undervalued due to a market overreaction to a delayed order announced in July 1997.

Market Data			
Price	$6.00	Total Assets $MM	45.51
12 Month Range:	$5.00-$16.25	Book Value (per share)	1.89
Market Cap. $MM	$188.02	Price to Book	3.18
Shares Out. MM	20.40	ROA	33%
Daily Volume	98,272	Cash $MM	3.60
Beta	-	Debt/MV	35%
Price Target	$12	EVA	12.48
Fiscal Year End	31-Mar	EVA Imp. % of Cap.	2.2%

EPS	Analyst Estimates			My Estimates [1]	
Quarter	FY97	FY98	FY99	FY98	FY99
June	0.17A	0.11A	0.09E	0.11A	0.12E
September	0.15A	0.10A	0.09E	0.10A	0.12E
December	0.17A	0.07E	0.09E	0.10E	0.12E
Mar (FY end)	0.17A	0.08E	0.09E	0.10E	0.12E
Full-Year	0.67A	0.36E	0.37E	0.41E	0.49E
P/E Ratio [2]	9.00	16.68	16.22	14.74	12.33

(1) My estimates for rest of FY 98 are based on historical 85% recognition of $44 Million backlog @ current profit margins.
My FY99 estimates use the same 13% increase over analyst estimates.

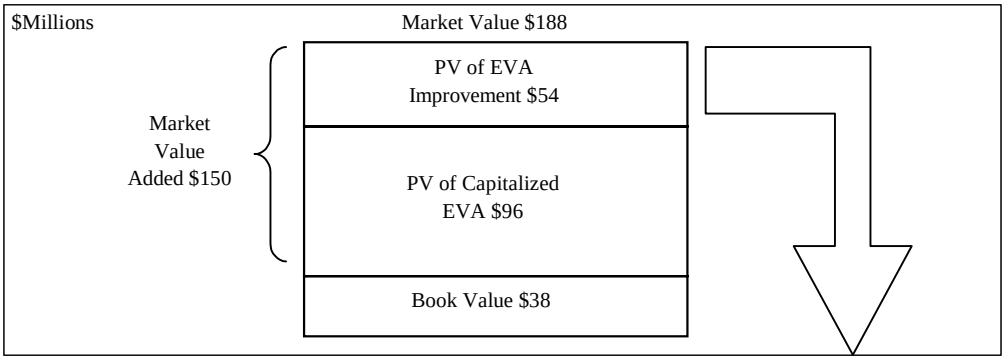
(2) Trailing 12 month P/E is 10.8

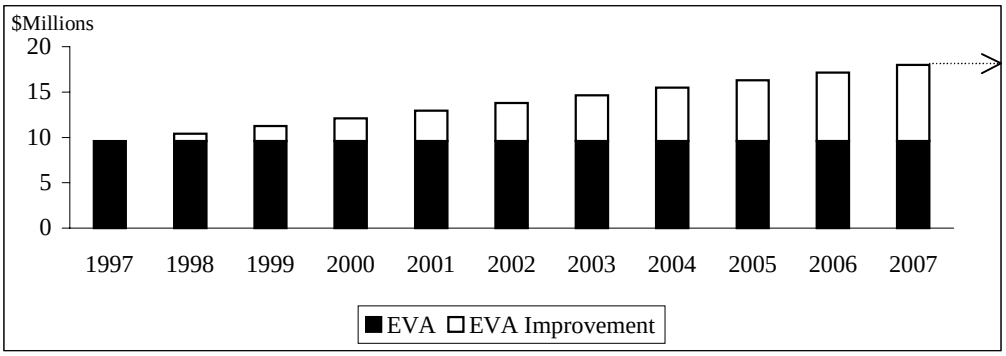
FATS Research Report (page 10)

EVA Calculation

$Millions	Sep-96	Dec-96	Mar-97	Jun-97	Sep-97	Trailing 6 Months	Annualized
NOPAT	5.10	5.19	3.80	3.10	2.98		
Capital	25.79	31.20	34.34	35.55	38.82		
Quarterly Cap. Charge		0.64	0.64	0.64	0.64		
EVA		4.54	3.15	2.46	2.33	4.79	9.58
NOPAT/Capital		20%	15%	12%	12%		
Cost of Capital		3%	3%	3%	3%		
Spread		18%	12%	10%	9%		
Capital		25.79	25.79	25.79	25.79		
EVA		4.54	3.15	2.46	2.33	4.79	9.58

Expected EVA Improvement





A quick explanation: First, annual EVA is calculated at 2x trailing six months. Then, Market Value Added (MVA) is calculated as the difference between Total Market Value and Total Book Value. This number is the Present Value of future EVA streams, which can then be split up into Capitalized Current EVA and Annual Expected EVA improvement necessary to justify the MVA. This latter number is compared against Capital and current EVA to determine feasibility of exceeding implicit market EVA improvement.
Expected Annual EVA Improvement = $840,000 or 2.2% of Capital, 6.5% of Current EVA

Bibliography

Blume, Marshall E. "On the Assessment of Risk," *Journal of Finance*, Vol. 26, No. 2, March 1971, pp. 1-10.

Blume, Marshall E. "Betas and their Regression Tendencies," *Journal of Finance*, Vol. 30, No. 3, June 1973, pp. 785-795.

Fama, Eugene F., and Kenneth R. French. "The Cross-Section of Expected Stock Returns," *Journal of Finance*, Vol. 47, No. 2, June 1992, pp.427-465.

Fama, Eugene F., and Kenneth R. French. "Size and Book-to-Market Factors in Earnings and Returns," *Journal of Finance*, Vol. 50, No. 1, March 1995, pp. 131-155.

Haugen, Robert A. *The New Finance: The Case Against Efficient Markets*. 2nd ed. Englewood Cliffs: Prentice Hall, 1999.

Hawawini, Gabriel, and Donald B. Keim. "On the Predictability of Common Stock Returns: World-Wide Evidence," in R. Jarrow et al (Eds.) *Handbooks in Operations Research and Management Science, Vol. 9*, pp. 497-544.

Holthausen, Robert W., and Mark E. Zmijewski. *Security Analysis: How to Analyze Accounting and Market Data to Value Securities.* (unpublished textbook)

Ibbotson Associates. *Stocks, Bonds, Bills and Inflation: 1999 Yearbook*. Chicago: Ibbotson Associates, 1999.

Ibbotson Associates. *Stocks, Bonds, Bills and Inflation: 1999 Yearbook, Valuation Edition*. Chicago: Ibbotson Associates, 1999.

Jackson, Al, Michael J. Mauboussin and Charles R. Wolf. *EVA Primer*. New York: CS First Boston, February 20, 1996.

Keim, Donald B. "Stock market regularities: A synthesis of the evidence and explanations," in: E. Dimson (ed.) *Stock Market Anomalies*. Cambridge: Cambridge University Press, 1988, pp. 16-39.

Porter, Michael E. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: The Free Press, 1980.

Porter, Michael E. *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: The Free Press, 1985.

Rosenberg, Barr, Kenneth Reid and Ronald Lanstein. "Persuasive Evidence of Market Inefficiency," *Journal of Portfolio Management*, Vol. 11, No. 3, Spring 1985, pp. 9-17.

Ross, Stephen A., Randolph W. Westerfield and Jeffrey Jaffe. *Corporate Finance*. (4 ed.) Chicago: Irwin, 1996.

Stewart, G. Bennett. *The Quest for Value: The EVA Management Guide*. New York: HarperCollins, 1991.